

Research and innovation in the national recovery and resilience plans

SUMMARY

The European Union's research and innovation (R&I) policy has become central in the attempt to safeguard the EU's technological sovereignty, ensure prosperity, and advance social, economic and environmental sustainability. Various challenges persist nevertheless, from ageing populations and health hazards to (economic) security and the climate crisis. In addition, underinvestment in R&I is a shared concern across Member States, although to varying degrees.

To reach the EU's spending target for R&I of 3 % of the EU's annual gross domestic product, the Next Generation EU (NGEU) recovery instrument and its main spending tool, the Recovery and Resilience Facility (RRF), could play a vital role in providing additional funding to Member States. To emerge stronger from the COVID-19 crisis and benefit from these resources (channelled partly into R&I ecosystems), countries have drawn up individual national recovery and resilience plans (NRRPs). As a funding condition, Member States needed to address at least a significant subset of the European Semester's country-specific recommendations and foster the green and digital transitions, by achieving the milestones and targets linked to the measures agreed in their NRRPs. The RRF is financing over €47 billion worth of R&I measures in the NRRPs, but the focus on R&I investment differs across the plans.

In this briefing, six case studies (either investment or reform measures) in R&I from individual recovery plans have been analysed. These measures range from investing in sustainable agriculture (Portugal), to reforming and integrating research, development and innovation organisations in the European Research Area (Romania). Each of the assessed case studies has been linked to one of the six R&I policy guidelines developed by the European Commission.

The briefing also touches on other financing opportunities for R&I under the traditional multiannual financial framework. Experts point out that NGEU might contribute to closing the innovation and underinvestment gap between Member States and the EU's 3 % target. The European Parliament supports an ambitious EU-wide R&I policy, and continues to ensure transparency and democratic scrutiny in the implementation of the NGEU recovery instrument.



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EU's research and innovation policy and challenges

With [a wide array of challenges](#) facing the European Union (EU) – from ageing populations and health hazards to (economic) security and the climate crisis – the EU's **research and innovation (R&I)** agenda has become all the more important in addressing these issues and transforming our societies. Specifically in the domain of the green and digital transitions, which are two of the [six priorities of the von der Leyen Commission](#) from 2019, R&I projects have seen substantial financial support, as they play a vital role in bringing about more inclusiveness, sustainability, competitiveness and resilience in Europe. In 2022, the European Commission identified six policy guidelines for the EU's R&I framework (see Figure 1), which is seen as a catalyst of change in making the EU future-proof and more sovereign.

Figure 1 – EU policy guidelines on R&I



Source: [Science, research and innovation performance of the EU 2022 report](#), European Commission.

The first three guidelines envisage transformative R&I policies focused on promoting sustainable development (guideline 1), bringing about prosperity in the digital age and competitive sustainability (guideline 2), and fostering resilience, preparedness and technological sovereignty (guideline 3). The other three guidelines address the question of how to make the best use of R&I. They refer to investing in and valorising R&I policies (guideline 4), diffusing them evenly to reduce gaps (guideline 5), and creating enabling conditions – regulatory and financial – underpinning R&I (guideline 6).

The six guidelines are set to further improve the EU's position in global R&I performance, currently standing at about 20 % of the world's scientific and technological output.¹ This [refers](#) to the volume of high-ranked scientific publications (21 %), patent applications (19 %) and research and development (R&D) expenditure (18 %). Specifically in terms of investment, the EU still lags behind its policy target of 3 % of the EU's annual gross domestic product (GDP) for R&D expenditure, as stipulated in the Commission's 2020 [Communication](#) on 'A new ERA for Research and Innovation'.²

According to Eurostat, EU Member States' total investment in R&D stood at [€352 billion](#) in 2022 – an overall upward trend since 2012, but with variations between countries. In 2022, Belgium and Sweden invested the most in R&D (close to 3.5 % of their GDP), with Malta and Romania investing the least (around 0.5 % of their GDP). Nevertheless, for the EU as a whole, there is an annual [gap](#) of roughly €100 billion to the EU's 3 % target.

In terms of other indicators, the EU has witnessed a growing number of researchers, exceeding [2 million](#) full-time equivalents in 2022, and the increased digitalisation of society ([56 %](#) of EU citizens had basic digital skills in 2023, up two percentage points from 2021). Despite these positive developments in R&I in recent years, the EU continues to face a number of challenges, such as investing in new technologies,³ financing opportunities for and scaling-up of businesses, skills development, interregional collaboration, and inequalities (gender gaps).

During the [2019](#) European Semester cycle, the Council issued country-specific recommendations (CSRs) on R&I to all Member States. These predominantly called for boosting R&I investment, while also addressing regional disparities and digitalisation challenges, and enhancing the efficiency of public support schemes, the productivity of (small and medium-sized) businesses and social

inclusion. Other recommendations called for supporting science–business cooperation and consolidating agencies that implement R&I (Lithuania and Poland), removing barriers hampering innovation (Czechia) and focusing on education and training systems in innovation (Estonia).

In [2020](#), R&I-related CSRs were issued to 21 countries – all Member States except Bulgaria, Croatia, Greece, Poland, Romania and Slovakia. The majority of the recommendations (16) promoted green and digital investments linked to R&I. Others called for better access to finance for innovation (Czechia and Estonia) and promoting R&I investment in the private sector (Lithuania, Luxembourg and Sweden). The [2022](#) CSRs asked for better support for science–business cooperation and the consolidation of agencies that implement R&I (Poland), and promoting R&I reform and investment (Hungary), while the [2023](#) Semester cycle did not include any CSRs on R&I.

In the [2024](#) Semester exercise, special emphasis has been put on competitiveness, including R&I. CSRs with R&I elements were thus issued to Croatia, Czechia, France, Italy, Lithuania, Luxembourg and Slovenia, covering issues such as the fragmentation of public institutions that carry out R&I activities, improving technology transfer from academia to businesses, defining industrial strategy while minimising territorial disparities, and increasing R&I spending, specifically private and green investment.

EU financing for R&I, including Next Generation EU funding

The EU budget has traditionally provided funding for research, development and innovation. The 2021–2027 multiannual financial framework ([MFF](#)) includes various programmes that address structural challenges hindering the expansion of R&I, including the current investment gap (see previous section). Some of the main budgetary programmes supporting R&I and their corresponding overall resources are explained hereafter.⁴

[Horizon Europe](#) is the EU's largest programme dedicated fully to R&I. It is treaty-based⁵ and comes with a budget of **€95.5 billion** for 2021–2027 (or roughly 8 % of the MFF). This amount includes a top-up of €5.4 billion from the Next Generation EU ([NGEU](#)) recovery instrument, which supports the EU Member States' recovery from the COVID-19 crisis while also fostering the green and digital transitions. The programme fosters collaboration and strengthens the impact of the R&I dimension of EU policies while also tackling global challenges, and supports the creation and circulation of knowledge and technologies.

Horizon Europe backs up innovations with cutting-edge potential, and allows innovators to scale up through its [European Innovation Council](#). It also requires [open access](#) rights and obligations for scientific publications financed by the programme, defines ambitious goals and deliverables ('missions') on environmental, health and social challenges, fosters more ambitious partnerships with industry, and strengthens the [European Research Area \(ERA\)](#).⁶ Moreover, Horizon Europe [work programmes](#) allocate €1.5 million to the [Horizon Policy Support Facility](#) to help Member States implement reforms relating to their R&I systems, including the measures presented in their national recovery and resilience plans⁷ (see next section). Other research-specific programmes include the [Euratom Research and Training Programme](#) (€2 billion), the [International Thermonuclear Experimental Reactor](#) (€5.6 billion) and the [Research Fund for Coal and Steel](#) (€0.1 billion).

On top of purely research-oriented programmes, there are EU financial instruments that are not research-specific, but which still support investments in R&I. The European Regional Development Fund ([ERDF](#)) and Cohesion Fund ([CF](#)) aim to strengthen the economic, social and territorial cohesion of the EU, while also fostering R&I. With a cumulative worth of €274.1 billion, the two programmes have a specific objective to develop and enhance research and innovation capacities and the uptake of advanced technologies (as stipulated in [Regulation 2021/1058](#) of 24 June 2021 on the ERDF and CF). Programmes such as [EU4Health](#) (€5.3 billion) and the [Programme for Environment and Climate Action – LIFE](#) (€5.4 billion) also contribute to the implementation of R&I policy.

The programme (not research-specific) with the most available resources is the **Recovery and Resilience Facility (RRF)**, which is the central investment tool of NGEU. To benefit from the RRF's

financial envelope of €648 billion in grants and loans,⁸ Member States needed to develop individual national recovery and resilience plans (NRRPs). The plans contain reform and investment measures that address significantly the Council's 2019 and 2020 country-specific recommendations (see previous section) under the European Semester, as well as a set of commonly identified challenges (European flagships).⁹

The disbursement of RRF resources has been made conditional upon successful fulfilment of milestones (qualitative implementation step) and targets (quantitative implementation step) for which the Member States have to present evidence in their payment requests. Through RRF, over [€47 billion](#) (an amount equivalent to roughly 50 % of Horizon Europe resources) is being directly invested in R&I projects established in the NRRPs (see next section). The remaining RRF resources used for other projects in the NRRPs may still contribute to R&I policy objectives indirectly.

R&I measures in the recovery plans and common indicators

With over [35 %](#) of the RRF resources already paid out to Member States, the implementation of the Facility is well under way. Research and development and innovation measures presented in the NRRPs predominantly feed into three RRF pillars: the green transition, digital transformation, and smart, sustainable and inclusive growth.¹⁰

According to the Commission's [mid-term evaluation](#) of the RRF, [6 %](#) of total investments under the RRF's green transition pillar finance green R&I activities. These activities cover the circular economy, the decarbonisation of industry and clean technologies, including the industrial value chain for the hydrogen transition and energy storage. R&I reforms in some NRRPs are complementary to these investment measures and envisage changes in the regulatory framework, with a focus on improving the conditions for developing hydrogen technologies and transitioning to a circular economy.

Under the digital transformation pillar, there are 42 investment and reform measures relating to R&I across the NRRPs. These [measures](#) aim to advance digital research, development and innovation, while focusing on collaboration, financial support, specific sectors, and the promotion of research infrastructure and talent development. Lastly, the RRF pillar on 'smart, sustainable and inclusive growth' supports 271 R&I measures – the most common type of measure under the pillar – which may simultaneously address challenges under the green and digital pillar.

R&I investment differs between Member States. A Commission analysis from April 2022 sampling 22 NRRPs showed that R&I investment typically ranged between [4 % and 13 %](#) of a country's RRF allocation (see also the 'Expert debate' section). In this briefing, special emphasis has been put on reform and investment examples following the major [revision](#) of the NRRPs in 2023 that contribute directly to at least one of the six R&I policy guidelines identified by the Commission. To that end, Table 1 shows six case studies (either reform or investment measures) in the field of R&I, selected on the basis of Member States' geographical location (i.e. east, west, south, north and central EU) to maintain equal representation.

Table 1 – Examples of R&I measures in the NRRPs

Build forward better in a post-pandemic world	<p>Investment (Portugal): <i>'Research and innovation agenda for sustainable agriculture, food and agro-industry'</i></p> <p>The aim of this measure, worth €93 million in grants, is to enhance research and innovation to achieve more sustainable agriculture, including the circular bio-economy and precision farming. The investment, to be completed by the end of 2025, is expected to support 100 R&I projects, and ensure the recovery and upgrading of the scientific facilities and equipment of 24 experimental farms and labs (innovation hubs). A sample milestone linked to this measure and achieved under Portugal's first payment request for RRF grants in 2022 is the launching of a tender procedure for related R&I projects. An example of a target, planned for Portugal's ninth payment request (in early 2026), envisages the completion of innovation and research projects with green aspects that are in line with the Portuguese Innovation Agenda for Agriculture 2030.</p>
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<p>(Re)gain competitiveness</p>	<p>Investment (Finland): <i>'Accelerating key technologies (microelectronics, 6G, artificial intelligence and quantum computing)'</i></p> <p>This investment amounts to €25 million in grant resources and seeks to fund applied research and deployment of new technologies, to safeguard the EU's competitiveness, information security and sovereignty. These resources are expected to be utilised for applied research and development and innovation activities and for the development of infrastructure supporting them (e.g. creating testing and experimentation environments related to microelectronics, 5G/6G technologies, artificial intelligence or quantum technology). The measure is expected to be completed by the end of 2025. A sample milestone linked to this measure is the issuing of a report on completed projects worth at least €9 million (envisaged for the fifth payment request in 2026). An illustrative target is the awarding of at least two financing decisions by Business Finland for projects in the field of micro-electronics (to be included in the second payment request that was originally planned for the end of 2023, but which has not yet been submitted to the Commission).</p>
<p>Think the 'unthinkable' (and be ready for it)</p>	<p>Investment (Czechia): <i>'Public research and development support for priority areas of medical sciences and related social sciences'</i></p> <p>Endowed with over €196 million in RRF resources, this investment aims to support at least four research consortia (of universities, public research institutions and other public and private entities) to improve expertise in research into infectious diseases, cancer research, neurosciences, metabolic disorders, research into cardiovascular diseases and research into the socio-economic impact of health risks. The work carried out by the consortia is expected to impact scientific production in these areas and improve the functioning of public administrations during health crises. A sample milestone linked to this investment is the approval of the research and development programme by the Czech Government and the launching of a tender. An example of a target is the awarding of public contracts to at least four research consortia. Both implementation steps were positively assessed by the Commission in the country's first payment request in 2022. The measure is due to be fully implemented by December 2025.</p>
<p>Leverage businesses, institutions and people</p>	<p>Reform (Cyprus): <i>'Introducing policies and incentives to facilitate and foster access to publicly funded research infrastructure and laboratories'</i></p> <p>The aim of this reform is to optimise the utilisation of publicly funded research infrastructure and laboratories by the business community. The measure is expected to develop a dynamic digital tool accessible to all stakeholders in the R&I ecosystem, which will facilitate collaboration between different entities (public and private) by providing information, tools and services. It will also introduce incentives to boost cooperation between organisations that carry out research and businesses and spin-offs. An illustrative milestone linked to this reform is the publication of measures and incentives adopted on the Research and Innovation Foundation website. No target has been envisaged for this measure. The reform does not come with a cost, and is due to be completed by the end of 2024.</p>
<p>Connect actors and address disparities</p>	<p>Reform (Romania): <i>'Support to integrate Romania's research, development and innovation organisations in the European Research Area (ERA)'</i></p> <p>The goal of this reform is to boost performance and consolidation of Romanian public research and development and innovation organisations and their integration in the ERA. The measure envisages the introduction of legislation that encourages, facilitates and regulates voluntary and functional integration and mergers of research institutions, while taking into account the 2021-2022 Horizon Europe Policy Support Facility recommendations. It also envisages external evaluations of the performance of these entities and their capacity to produce added value. A sample milestone related to this reform is the entry into force of a law addressing the high fragmentation of Romania's research system (to be included in the third payment request for RRF loan support initially envisaged for the end of 2023). An example of a target sees 25 % of Romanian research organisations sharing research infrastructure and facilities by mid-2026 (to be included in the eighth payment request for loan support). The reform does not indicate any associated costs and is expected to be completed by mid-2026.</p>

<p>Ensure R&I-friendly conditions</p>	<p>Reform (France): 'Structural aspects of the Research Programming Law' This reform sought changes to the Research Programming Law (adopted in December 2020) to strengthen the funding and organisation of research, improve the attractiveness of scientific jobs and careers, and boost interactions between research and the economy and society. A target related to this measure envisaged the tenure-track recruitment of 100 persons in 2021 and 2022 and was fulfilled under the country's second payment request for non-repayable support in 2023. Another target envisages an increase in public research funding by €1.8 billion by September 2025 (to be included in the fifth payment request for RRF grants planned for mid-2026). There are no milestones associated with this measure, and the reform does not indicate a cost.</p>
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Source: EPRS, based on European Commission [data](#).

Among the data through which the Member States report to the Commission in order to track the implementation of the NRRPs,¹¹ common indicator No 8 on 'researchers working in supported research facilities' follows implementation of the RRF in terms of R&I. It shows that, in the second half of 2023, the RRF supported over [24 860 researchers](#) working in supported research facilities (measured in annual full-time equivalents), of which 60.1 % were men and 39.9 % women.¹² Sixteen countries contributed to the reporting for the second half of 2023.¹³ This is a flow indicator that represents the current situation in the reporting period (its values can fluctuate over time).

European Parliament

The European Parliament is a strong [supporter](#) of an ambitious EU-wide research and innovation policy. In recent years, it has adopted [several resolutions](#) calling, among other things, to strengthen the EU's international competitiveness in R&I, increase research spending in the Member States, and improve the free movement of researchers and circulation of knowledge, including boosting skills. This was embedded in Parliament's resolution of [8 July 2021](#) on a new ERA for Research and Innovation, a resolution of [6 April 2022](#) on a global approach to research and innovation, and most recently in its resolution of [17 January 2024](#) with recommendations to the Commission on promotion of the freedom of scientific research in the EU. Moreover, during the negotiations on the 2021-2027 MFF, Parliament managed to obtain an increase in the budgetary allocations for the Horizon Europe research programme, which it had deemed a priority.¹⁴

Parliament's involvement is also vital for ensuring transparency and democratic scrutiny in the implementation of the NGEU recovery instrument, which provides new funding opportunities for R&I policy and tops up the Horizon Europe programme. Based on the provisions of the [RRF Regulation](#) and the [Interinstitutional Agreement](#) (IIA) on cooperation on budgetary matters, Parliament [scrutinises](#) the Commission's work, relying on the provision of information, dialogues and reviews. Its scrutiny role over NGEU spending stems from its competences as one arm of the budgetary authority, and from its involvement in the dialogue on the European Semester.

Parliament's lead committees dealing with the RRF and, more broadly, with NGEU are the Committee on Budgets ([BUDG](#)) and the Committee on Economic and Monetary Affairs ([ECON](#)). Depending on the topic, other Parliamentary committees – such as the Committees on Employment and Social Affairs ([EMPL](#)), Environment, Public Health and Food Safety ([ENVI](#)), and Transport and Tourism ([TRAN](#)) – can be involved as well. The Committee on Industry, Research and Energy ([ITRE](#)) is also involved, including when dealing with R&I policy.

Since March 2021, Parliament has had a [standing working group](#) on scrutiny of the RRF. This is the main preparatory and follow-up body for Parliament's Recovery and Resilience Dialogues with the Commission. In addition, Parliament is responsible for scrutiny of the grant expenditure under the NGEU through the [discharge procedure](#), with the relevant reports being prepared by its Committee on Budgetary Control ([CONT](#)).

Expert debate

An [analysis](#) by the Science Business Network, published in April 2023, shows that the RRF will direct a vast amount of resources to research and development in the coming years. Member States devote an average of 10 % of their allocations for research, development and innovation, and the author warns about considerable disparities among them in financing R&I ecosystems. In particular, Germany plans to invest 26 % of its allocation directly in R&I activities, while Romania plans to invest only 1 % of its RRF allocation in R&I.

In an [article](#) published in the *Journal of Liberty and International Affairs* in March 2023, the authors argue that the EU is losing its capacity for innovation and control over data and fundamental raw materials compared to the US and China. They also warn that the EU could even weaken its regulatory power in the digital realm. However, the authors find that the MFF and NGEU could have a great impact, provided that R&I policies come with clear objectives, especially for the digital transformation.

In an early [policy brief](#) from the E3G climate change think-tank, published in June 2021, the authors point out that green R&I measures enshrined in the NRRPs are central to achieving key European objectives, including the speeding up of the economic recovery and meeting the increased climate ambitions. They do, nonetheless, warn about considerable disparities in R&I performance (an 'innovation gap') between central and eastern European Member States that joined the EU after 2004 and the older Member States. While this remains true, the vast resources available for investment under NGEU may contribute to closing this gap.

EUROPEAN PARLIAMENT SUPPORTING ANALYSIS

D'Alfonso A., Dobрева A., Kowald K., Mazur S., Mileusnic M., Pari M., Peters T. and Toft S., [Budgetary Outlook for the European Union 2024](#), EPRS, European Parliament, April 2024.

Mileusnic M., [Ensuring the recovery and resilience of EU small and medium-sized enterprises](#), EPRS, European Parliament, May 2023.

[EU recovery instrument infographic](#), EPRS, European Parliament, June 2024.

European Commission, Directorate-General for Research and Innovation, [Science, research and innovation performance of the EU 2022 – Building a sustainable future in uncertain times](#), 2022.

ENDNOTES

- ¹ Despite faring relatively well, the EU faces fierce [competition](#) from the United States and China in R&I.
- ² The 3 % target for the EU was introduced in 2002 and was reaffirmed in 2020 in the Commission's communication.
- ³ Research and innovation in the areas of health, green and digital technologies, industrial transformation, natural resources, energy, mobility and security, among other things.
- ⁴ For information on other programmes providing funding for R&I, see the European Commission's [websites](#).
- ⁵ Articles 173, 182, 183 and 188 of the [Treaty on the Functioning of the European Union](#).
- ⁶ The European Research Area (ERA) is a multi-level governance initiative, launched in 2000, that aims to create a single, borderless market for research, innovation and technology across the EU, including by direct investment (not least via the RRF). The Commission's policy guidelines on R&I also aim to [revitalise](#) and strengthen the ERA. For more information, see the Commission's [2022 Science, Research and Innovation Performance of the EU report](#).
- ⁷ Croatia and Romania [have requested and benefited](#) from this support to implement key R&I reforms enshrined in their respective recovery plans.
- ⁸ The RRF Regulation initially envisaged over €723 billion in grants and loans, but some Member States decided not to utilise the loan allocation (partially or fully).
- ⁹ There are seven European flagships: 1) Power up, 2) Renovate, 3) Recharge and Refuel, 4) Connect, 5) Modernise, 6) Scale up and 7) Reskill and upskill. These were identified in the [2020 annual sustainable growth strategy](#) that launched the 2021 European Semester.

- ¹⁰ R&I measures can also be featured in the remaining RRF pillars – 'social and territorial cohesion', 'health', 'economic, social and institutional resilience', and 'policies for the next generation' – though to a lesser extent.
- ¹¹ A [Delegated Regulation 2021/2106](#), adopted on 2 December 2021 and complementing the [RRF Regulation 2021/241](#), introduced a set of 14 common indicators to track progress on the implementation of the RRF. The Member States are required to report on these indicators twice a year through the European Semester exercise.
- ¹² Less than 0.02 % of researchers receiving RRF support identified as non-binary at the end of 2023.
- ¹³ Bulgaria, Croatia, France, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Slovenia and Sweden have not reported on common indicator No 8. Greece and Lithuania did report in the past, while Sweden did not have the data ready for S2-2023 but will report in the future.
- ¹⁴ A. D'Alfonso, [Multiannual financial framework for the years 2021 to 2027: The future of EU finances](#), EPRS, European Parliament, January 2021.

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