European Commission

SCIENCE, RESEARCH AND INNOVATION PERFORMANCE OF THE EU 2024

A competitive Europe for a sustainable future

Executive summary

Research and Innovation

Science, research and innovation performance of the EU – 2024 - A competitive Europe for a sustainable future
European Commission
Directorate-General for Research and Innovation
Directorate G – Common Policy Centre
Unit G1 – Common R&I Strategy & Foresight Service

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2024 Directorate-General for Research and Innovation

EXECUTIVE SUMMARY

How to read the SRIP 2024 report?

The 2024 edition of the Science, Research and Innovation Performance of the EU (SRIP) report builds on a wide range of data sources to offer a comprehensive and detailed overview of how Europe is performing today in terms of science, research and innovation and analyses the key determinants of this performance. The report provides an extensive coverage of topics, which illustrates the horizontal nature of research and innovation (R&I) activities in the EU landscape.

Each chapter can be read independently, catering to readers with various backgrounds and interests. Whether you are a policymaker, researcher, industry professional, academic, investor, or member of civil society, you should find sections that directly relate to your field.

Chapter 0 provides the overarching view of this edition, building on all key messages from the report to stress policy insights for EU R&I, and is a good entry point to this report before exploring more specific chapters. In particular, it highlights how the need for decisive action to make Europe more competitive, green, and fair has further intensified since the 2022 edition of this report. It details three main challenges for EU R&I today: (i) an underutilised R&I ecosystem facing several obstacles, (ii) deep and persistent R&I divides showing a stratified structure of the EU landscape, and (iii) a technological gap with respect to other regions in the world.

PART I

Part I of the report presents key analytical insights for EU R&I with focus on four specific dimensions: R&I efforts in light of EU challenges (chapter 2), EU's scientific performance (chapter 3), the local EU R&I ecosystems (chapter 4) and EU's innovative landscape (chapter 5).

Chapter 1 opens Part I with a selection of key recent trends for EU R&I on various topics covered in chapters 2 to 5.

R&I, transition and geoeconomics

The EU's R&D intensity (chapter 2.1), at 2.2% of GDP, remains below that of the US, Japan, South Korea, and China, with private R&D investment playing a significant role in explaining the gap. Governments worldwide employ different funding instruments to boost R&D investments. Within the EU, government support for private R&D decreased by 3.4% in 2020 due to reduced tax incentives, despite this instrument being increasingly used for financing private investments. Europe has taken a strong interest in Government Venture Capital (GVC), which has proven effective for increasing access to finance, but contains higher risks of crowding out private investments. Instruments to support R&D are increasingly being designed in line with a transformative policy approach that aims to drive the transition of our economy and society.

Increasing R&D investments and ensuring a strategic approach to funding are important to bridge the specialisation gap between the EU and its counterparts (chapter 2.2). The EU remains strong in green technologies, but falls behind the US and China in digital domains like the Internet of Things and AI. In sectors which are strategic to the attainment of the EU policy objectives (e.g., critical raw materials), supply chain vulnerabilities highlight the need for strategic autonomy. The risk of the EU remaining technologically dependent on other global players in these sectors raises the stakes for science diplomacy and collaborations with international partners, from which the EU can gain in terms of technological complementarity.

The need for investments in defence R&D is underscored by the current geopolitical context (chapter 2.3). The EU's defence spending surpasses Russia but remains lower than the US in nominal terms. EU defence investments prioritise the acquisition of defence equipment, focusing on technology development and production rather than foundational R&D. Fostering the synergies between EU defence and civilian R&D programmes can support the development and uptake of dual-use technologies within the EU. These technologies, serving both civilian and military purposes, could contribute to shaping the future landscape of innovation and the EU's and Member States' security.

Recent crises also highlight the importance of resilience and preparedness (chapter 2.4). The EU has shown adaptability, with 70% of citizens viewing it as a stable region in uncertain times. During crises, top R&D investors maintained investment levels, suggesting that R&I is seen as a vital component for mitigating crises, ensuring economic resilience and fostering long-term competitiveness. This requires a forward-looking strategic perspective in our R&I policies and the need to further enhance global research networks.

Scientific knowledge production

The EU has a solid research base and ranks second globally in scientific output (chapter 3.1), excelling in less technological domains, while China leads in number of top-cited publications. The EU leads in open access of scientific output, with 80% of peer-reviewed publications openly available, and shows high shares of international collaborations (56% of co-publications). Despite progress, gender disparities in scientific publications persist, particularly in STEM fields. To remain competitive and address societal challenges, the EU can further improve the effectiveness and performance of its public research systems. This includes supporting the responsible use of artificial intelligence and addressing persistent knowledge gaps through targeted actions.

The EU public science system features a broad range of institutions that perform moderately in rankings, in comparison with the Anglo-Saxon model that focuses on a concentration of elite institutions (chapter 3.2). Within the EU, universities and industry partners complement each other, with universities excelling in exploration and industry in development. Skilled immigration boosts R&I, but factors such as language barriers, low salaries, and strict immigration laws contribute to the EU's brain drain in contrast to more welcoming policies in the US, Canada, and Australia. A more open stance towards skilled migration can attract talent, while internationalisation policies can contribute to reducing the EU's brain drain.

The use of AI tools can make scientists and researchers more efficient and accelerate research productivity across fields, thereby helping to push forward scientific and technological advances (chapter 3.3). The use of these tools in science is increasing at a significant pace, with China taking the lead, followed by the US and the EU. R&I policy can support AI uptake through financing and the development of the right enablers to promote multi-disciplinarity. Nevertheless, the diffusion of AI in science poses important challenges related to jobs, ethics, and privacy. R&I policies can balance these risks and opportunities of AI by promoting a human-centric approach that emphasizes creativity, supports the creation of new tasks and complements existing activities.

EU R&I ecosystems

The EU faces an R&I divide (chapter 4.1), with northern and western Europe being home to innovation leaders, while moderate and emerging innovators are mostly situated in southern and eastern Europe. At regional level, some regions managed to improve their R&I performance over the last decade while others are lagging further behind. There are notable regional disparities in R&I collaborations, spending, and employment, with the industrial structure and asymmetric developments in productive specialisation contributing to this phenomenon. European funding, particularly the actions under the Framework Programme and the European Structural and Investment Funds dedicated to supporting territory development, enhancing institutional capacity and improving public administration, have a strong potential for narrowing this divide. The Recovery and Resilience Facility funding dedicated to R&I also plays a role in supporting countries with weaker innovation performance.

R&I collaborations within the EU (chapter 4.2) have increased but are still lower compared to some of its international competitors like the US. The European regional collaboration (co-patenting) network is fragmented along national lines with strong cross-border effects. Complex technologies, such as digital ones, have the highest shares of inter-country collaborations. EU Programmes such as the EU Framework Programme for R&I and Interreg, play a vital role in enhancing and steering collaboration networks while overcoming cross-border barriers and are essential for fostering a cohesive and competitive R&I landscape across the EU.

A thriving innovative Europe

In the pursuit of economic growth and competitiveness, labour productivity is pivotal. R&I plays an instrumental role in increasing EU labour productivity growth (chapter 5.1). In the goods sector, tangible assets are key to productivity, while in the service sector, software, training, and organisational capital are more influential for labour productivity.

Technological advancements and international trade are driving job polarisation by increasing demand for high-skilled labour and reducing routine, medium-skilled roles (chapter 5.2). EU employment is concentrated in manufacturing, in contrast to the concentration of US employment in health services, IT, and finance. Across the EU, high-tech sector employment has increased, but women remain underrepresented. This underrepresentation in crucial areas such as ICT and engineering, where the number of male graduates dominates, can limit workforce diversity and size. Further promoting STEM skill development and reskilling – including of underrepresented groups - provides opportunities to spur economic growth, to advance groundbreaking technologies and to avoid further exacerbation of inequalities.

To further boost productivity and competitiveness, the EU can contribute to creating an environment conducive to innovation, attracting talent, and addressing the gender gap in venture capital (VC) funding (chapter 5.3). While business dynamism has rebounded post-COVID-19, investor confidence has decreased, thereby presenting new challenges for European tech companies. VC activity has slowed after a strong performance in 2021 and the financing gap with the US persists. Nevertheless, the EU's VC market shows resilience and untapped potential, particularly in strategic net-zero technologies. Efforts can be dedicated to ensure that investments keep flowing to EU companies at the required scale.

To maintain the EU's competitive edge and sustain its path towards the Sustainable Development Goals (SDGs), scientific findings need to be converted more rapidly into commercial and social applications. The EU's innovation performance has been improving over time, but more efforts are needed to maximise R&I returns through knowledge diffusion and valorisation. To enhance and accelerate the transformation of research into practical applications, a systemic approach to knowledge diffusion, strategic intellectual asset management, and enhanced collaboration across academia, industry, and government are essential. To foster innovation activities, an adaptable regulatory framework and a proactive standardisation strategy remain key.

PART II

Chapters in **Part II of this edition** focus on the following specific topics.

Chapter 6 explores directionality in public research, focusing on guiding innovation to meet societal and industrial challenges. It contrasts research universities and government research laboratories, advocating tailored strategies for each to achieve targeted innovation outcomes. The chapter calls for a strategic reassessment to optimize directionality in innovation policy, emphasizing the adaptability of research universities and the targeted focus of government research laboratories.

Green start-ups are vital for the transition to a more environmentally friendly economy, but face various challenges, including the triple externality problem. Green start-ups carry high costs and risks associated with their entrepreneurial activity, causing the social benefits of their innovations to often exceed private returns. Chapter 7 provides a review of key insights from the stream of research on green start-ups and discusses implications for the public support of green start-ups and policy more generally.

Technology sovereignty has emerged as a critical issue in EU science, technology, and innovation policy. The EU lags behind in several technologies and relies heavily on foreign inputs of knowledge and raw materials. The specific challenges related to technological sovereignty and its link with open strategic autonomy and economic security are discussed in chapter 8.

Chapter 9 analyses the current and future outlook of green technologies in Europe to assess the need for substantial technological transformation in the pursuit of climate neutrality. By looking through the lenses of the emerging paradigm of economic complexity, it reveals a varied landscape of specialization and diversification. The chapter highlights the importance of regional cohesion and calls for tailored regional investment strategies.

Global productivity growth has slowed. Chapter 10 focusses on its causes and consequences, with a particular focus on the growing productivity gaps between companies and the challenges posed by digitalization and the green transition. It emphasizes the positive relationship between productivity, employment, and wages, and argues for policy actions to boost digital adoption, encourage innovation, and ensure inclusive growth.

Chapter 11 focuses on corporate investment in innovation and the adoption of green and digital technologies. It highlights regional differences in innovation activities and discusses factors that can support or hamper firms' investment in digital and green technologies. It finds that the EU maintains a competitive edge in climate-related investments and that it is closing the gap with the US in advanced digital technology adoption, especially in developed regions.

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This is a flagship biennial publication by the European Commission’s Directorate-General for Research and Innovation that draws on a long tradition of indicators and economic analyses.

Research and Innovation policy

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