



PSF review of the Romanian R&I System

Background Report

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Innovation*

PSF review of the Romanian R&I System – Background report

European Commission

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Manuscript completed in November 2021

1st edition

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PDF ISBN 978-92-76-43543-3 doi: 10.2777/38334 KI-AX-21-001-EN-N

Luxembourg: Publications Office of the European Union, 2021

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EUROPEAN COMMISSION

PSF Review of the Romanian R&I system

Background report

Written by Cristina Serbanica and Mantas Pupinis

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LIST OF ABBREVIATIONS

AREI: Adjusted Research Excellence Index

ASAS: Academy of Agricultural and Forestry Sciences

BERD: Business expenditure on R&D

BES: Business enterprise sector (in R&D statistics)

CCCDI: Advisory Board for R&D&I

CCSI: Committee for Coordination of the Smart Specialisation

CEE: Central and Eastern Europe

CNECSDTI: National Council for Ethics in Scientific Research, Technological Development and Innovation

CNCS: National Council for Scientific Research

CNFIS: National Higher Education Funding Council

CNPSTI: National Council for Science, Technology and Innovation Policy

CNTTI: National Council for Technology Transfer and Innovation

CRIC: Romanian Committee for Research Infrastructures

DESI: Digital Economy and Society Index

EAFRD: European Agricultural Fund for Rural Development

ELI-NP: Extreme Light Infrastructure – Nuclear Physics

ERDF: European Regional Development Fund

ESF: European Social Fund

ESIF: European Structural and Investment Funds

IFA: Institute of Atomic Physics

INCD: National R&D Institute

GBARD: Government Budget Appropriations for R&D

GD: Government Decision

GERD: Gross Expenditure on Research and Development

GOV: Government sector (in R&D statistics)

HES: Higher education sector (in R&D statistics)

MCID: Ministry for Research, Innovation and Digitisation

MIPE: Ministry of Investments and European Projects

OP: Operational Programme

OSIM: Romanian Office for Inventions and Trademarks

PA: Priority Axis

PCT: Patent Cooperation Treaty

PNCDI: National Plan for Research, Development and Innovation

PNDR: National Rural Development Plan

PNP: Private non-profit sector (in R&D statistics)

PNRR: National Resilience and Recovery Plan

POC: Operational Programme Competitiveness (2014-2021)

POCU: Operational Programme Human Capital (2014-2020)

POR: Regional Operational Programme

POSCCE: Operational Programme "Increase of Economic Competitiveness" (2007-2013)

PPS: Purchasing Power Standard

RDA: Regional Development Agency

RIS3: Regional Strategy for Smart Specialisation

ROSA: Romanian Space Agency

RRF: Recovery and Resilience Facility

RRM: Resilience and Recovery Mechanism

SNCDI: National Strategy for Research, Development and Innovation

UEFISCDI: The Executive Agency for Higher Education and R&D&I Funding

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INTRODUCTION

This report provides background information on the Romanian research and innovation system, in the context of the Specific Support to Romania within the Horizon Policy Support Facility. The PSF review will support the Romanian authorities in designing and implementing reforms in the public science base in order to improve the quality and performance of the R&I system and its links with the private sector. This background report is mainly targeted at the external experts involved in the Horizon Europe Policy Support Facility, and aims to provide them with a comprehensive and detailed analysis of the Romanian R&I system, its needs and challenges, and recent developments.

The Romanian authorities have provided sub-topics under five topics for the PSF Panel to examine during the review, namely:

- *Governance of the Romanian R&I system and structural changes.*
- *Framework conditions for public research.*
- *Internationalisation of the Romanian R&I system in an inclusive ERA.*
- *Public-private partnerships as key drivers for better innovation.*
- *Efficiency, effectiveness and impact of European Structural and Investment Funds in connection with the National R&D&I Plan (2015-2020).*

This background report addresses the most relevant topics with regard to the objectives of the PSF Review, in detail. The report first provides a brief overview of the Romanian R&I system (Chapter 1) and an analysis of the main statistics/indicators related to Romanian R&I performance, including benchmarking (Chapter 2). This is followed by five chapters presenting relevant qualitative and quantitative aspects related to the main focus areas of the PSF review; namely R&I Governance and Policy Mix (Chapter 3), ESIF Funding for R&I (Chapter 4), Framework conditions for public research (Chapter 5), Public-private partnerships (Chapter 6) and Internationalisation of the R&I system (Chapter 7). The Conclusions summarise the key findings and discuss their implications, while the Annexes provide supplementary information to the main focus areas under review.

Study context

Romania's R&I performance has been reviewed in several recent studies that provide a comprehensive picture of the main challenges faced by the Romanian R&I system. These studies were consulted in preparing this background report and their main conclusions are summarised herein. Here are some of the most relevant recent studies reviewing the Romanian R&D&I system:

- Curaj A. and Chionel (2015) Stairway to Excellence. Country Report: Romania. Luxembourg (Luxembourg), Publications Office of the European

Union. JRC97667. Available here:
<https://publications.jrc.ec.europa.eu/repository/handle/JRC97667>

- EC (2017) PSF Specific Support to Romania - Start-ups, Scale-ups and Entrepreneurship in Romania. Available here:
<https://rio.jrc.ec.europa.eu/sites/default/files/report/KI-AX-18-008-EN-N.pdf>
- Chioncel, M. and Del Rio, J.C. (2018) RIO Country Report 2017: Romania. JRC Science for Policy. Available here:
<https://publications.jrc.ec.europa.eu/repository/handle/JRC111316>
- Chioncel, M. (2020) Analysis of the factors that obstruct the diffusion of innovation, including digitization. Available here:
<https://uefiscdi.gov.ro/resource-821136-analysis-of-the-factors-that-obstruct-the-diffusion-of-innovatio.pdf>
- EC (2013 - 2020) European Semester documents for Romania - Country reports (including a chapter of R&I). Available here:
https://ec.europa.eu/info/archive-european-semester-documents-romania_enRomania
- EC/ DG Regio/ JRC - Targeted Support to Smart Specialisation in Romania (2016 - 2020). Available here: <https://s3platform.jrc.ec.europa.eu/romania>

The Romanian authorities will also provide the expert panel with relevant reports, studies, evaluations, monitoring data and other type of information which are useful for the preparatory work. The background report and the relevant regulatory and R&I policy documents in Romania will support the research tools that will be subsequently developed in the design of the country missions, e.g. the interviews with representatives of all relevant stakeholders (R&D-performing institutions, ministries playing a role in R&D, consulting bodies, managing authorities, innovation intermediaries, etc.).

1. THE ROMANIAN R&I SYSTEM: A BRIEF OVERVIEW

Romania inherited the Soviet model of the organisation of the science system, whose main institutional bodies were (industrial) research institutes, academies and institutes of higher education. As pointed out by Radosevic and Auriol (1999), in centrally planned economies, enterprises were not businesses, but production units with dislocated R&D functions, whilst academies were part of the government structure and universities were very weak in R&D.¹ The institutional features inherited from the centrally planned period were common to all Central and Eastern European countries (CEE), despite some country-specific differences in the weights of different sectors.

Before 1990, Romania concentrated much of its R&D activities in state-owned research institutes in specific industrial branches, and in the institutes of the Romanian Academies of Sciences. The institutes were affiliated to the so-called "industrial centrals"² and had a strong bias towards applied R&D and the replication, in local industry, of technological developments in the West.³ The structure of the science system under the communist regime was heavily focussed on physical sciences and engineering rather than biomedical sciences, as opposed to Western countries, where most of the research output was in biomedical and socio-economic sciences.⁴

The Romanian Academy (founded in 1866) was restructured by the communist regime and its activity was controlled both scientifically and politically. In 1966, the Academy had 56 institutes or centres, with about 2500 employees; yet, in 1969, 12 institutes and centres of medical research were removed from the system of the Academy and placed under the direction of the Academy of Medical Sciences, while after 1970 a newly created Academy of Social and Political Sciences took over the Academy's institutes of socio-human sciences. In 1974, the remaining institutes were redistributed to the ministries of education and culture. After 1990, the scientific network of institutes was put back together again.⁵ The Academy of Agricultural and Forestry Sciences was founded in its current form in 1969, to coordinate the scientific activity in all agricultural branches.⁶

1 Radosevic, S. and Auriol, L. (1999) Patterns in restructuring in research, development and innovation activities in central and eastern European countries: an analysis based on S&T indicators. *Research Policy* 28, 351–376

2 Sandu S. (2004) The Resilience of the Romanian R&D system. *Romanian Journal of Economics*, Institute of National Economy, 43(52), 106–137

3 Guy, B. (2006) Policy Mix Peer Reviews. Country report: Romania. Report prepared for the CREST Policy Mix Working Group by Ken Guy, Wise Guys Ltd., in conjunction with IPTS

4 Corlan, D. (2015) Trends of Romanian medical research 1990–2014. *Acta Endocrinologica (Buc)*, vol. XI, no. 3, pp. 343–347

5 The Romanian Academy. A brief history. https://acad.ro/academia2002/acadeng/pag_brief.htm

6 The Academy of Agricultural and Forestry Sciences "Gheorge Ionescu- Sisesti". Short history. <http://www.asas.ro/en/academy/short+history.html>

Universities were primarily teaching institutions during communist times and scientific research was almost non-existent.

After 1990, the Romanian R&I system went through profound restructuring processes and successive reforms. The marketisation of the economy and the changes in the industrial structure resulted in significant R&D downsizing in the first decade of post-communist transition. As pointed out by Sandu (2004, p. 112), “the industrial R&D institutes underwent a brutal process of achieving autonomy, most of them being forced to become commercial companies, while others were assimilated by some industrial companies”.⁷ Table 1.1 shows the historical evolution of the financial and human resources available in the Romanian R&I system post 1993; one can observe the abrupt drop in the number of R&D employees in business enterprise and government sectors between 1993 and 2000 and the relative stabilisation only after 2007. On the contrary, the number of R&D personnel in the higher education sector had a relative growth, given that the research mission of universities has been strengthened by law.

Table 1.1 Evolution of R&D Personnel and Gross expenditure on R&D (GERD) by sectors of performance*

R&D resources	1993	2000	2007	2014	2015	2016	2017	2018	2019
R&D Personnel (FTE)	73611	33892	28977	31391	31331	32232	32586	31933	31665
GOV	16438	7571	8786	11866	12080	12663	12500	11986	12220
HES	1991	3780	6931	8966	9008	8627	8416	7695	7600
BES	55182	22541	13107	10437	10128	10785	11525	12081	11628
PNP	N/A	N/A	153	122	115	157	147	171	217
GERD (€ million)	206.7	148.6	652.8	575.1	782.1	818.4	944.9	1024.7	1067.4
GOV	N/A	27.9	221.6	247	299.2	272.2	305.7	313.8	339.3
HES	N/A	17.4	157.3	87.5	136.4	92.6	100.5	100.4	108.9
BES	N/A	103.2	271.7	238.4	344.1	451.6	535.9	608.1	616.9
PNP	N/A	N/A	2	2.1	2.3	1.8	2.7	2.2	2.2

*Note: The sectors of performance in R&D statistics are GOV (government), HES (higher education), BES (business enterprise) and PNP (private non-profit). Source: Eurostat, GERD by sector of performance[rd_e_gerdtot]; R&D personnel by sector of performance [rd_p_persocc]

Romania joined the EU in 2007 and committed itself to raising gross expenditure on R&D (GERD) to 3% of GDP by 2010 (the Lisbon target). In the light of Europe 2020 Strategy, the country has set a new ambition, namely to increase R&D intensity to 2% of the GDP (1% from public sources and 1% from business sector)

7 Sandu, S. (2004), op. cit., p. 112

by 2020. None of these targets has been attained; recent trends show a decline in R&D intensity.

As it can be observed from Table 1.1, the public science base (GOV and HES) accounts for about 61% of total R&D personnel and about 42% of gross expenditure on R&D. The R&D system consist of about 480 organisations, of which 259 are public, i.e. National Institutes for R&D (INCDs), research institutes of centres of the Romanian Academy and the branch academies (Academy of Agricultural Sciences, Academy of Medical Sciences), public higher education institutions, other institutes or R&D structures organised as public institutions/institutions of public law.

Several public institutions are involved in the governance of R&I in Romania:

- R&I policy formulation, implementation, monitoring and assessment is under the responsibility of the **Ministry of Research, Innovation and Digitisation (MCID)**. The Ministry is advised by a number of **consultative bodies**, involving representatives from the science, technology and industrial communities.
- Scientific research at the university level is under the responsibility of the **Ministry of Education**.
- **The Executive Agency for Higher Education and R&D&I Funding (UEFISCDI)**, the **Romanian Space Agency (ROSA)** and the **Institute of Atomic Physics (IFA)** coordinate (administratively) some specific programmes and sub-programmes of the National R&D&I Plan.
- **Other ministries** play a role in the Romanian R&I system. The Ministry of Economy, Entrepreneurship and Tourism is responsible for designing and implementing entrepreneurship policies. The Ministry of Agriculture and Rural Development, the Ministry of Health, the Ministry of Energy, and the Ministry of Defence manage their own R&D Plans. The Ministry of Investment and European Projects is in charge of the management of the European Structural and Investment Funds (ESIF).
- At the regional level, the **Regional Development Agencies (RDAs)** are the executive bodies that implement R&I policy, but have a limited role in policy design and elaboration (Chapter 3 provides a detailed presentation of R&I governance).

The **National R&D&I Strategy (SNCDI)** is the overarching R&I policy document setting out the vision, the priorities, the targets and the governance framework over the 2014-2020 period. SNCDI also defines the Smart Specialisation Strategy for Romania and identifies a number of smart specialisation areas: bioeconomy, ICT/space and security, energy & environment, advanced materials & eco nano-technologies and health.

SNCDI is implemented mainly via the **National Plan for R&D&I (PNCDI)** and the **Operational Programme (OP) "Competitiveness", Priority Axis (PA) 1**: "Research, Development and Innovation for supporting the business

environment and competitiveness". All Romanian regions have elaborated **Regional Strategies for Smart Specialisation (RIS3)**, whose main implementation instrument is the **Regional Operational Programme (POR)**, **Priority Axis (PA) 1**: "Promoting technological transfer". SNCDI has also synergies with the **National Competitiveness Strategy 2014-2020**, the **National Rural Development Programme** and the finances for R&I from the European Agricultural Fund for Rural Development (EAFRD), the **National Strategy for Tertiary Education** and the support measures for human capital funded from the European Social Fund (ESF), in particular for PhD and post-doctoral students.

Romania is in the process of elaborating the National R&D&I Strategy for 2021-2027, which will incorporate the Smart Specialisation Strategy and will be developed in synergy with the RIS3 Strategies elaborated at the regional level. A number of reforms and investments in R&I are also to be implemented in the forthcoming Recovery and Resilience Plan.

2. R&I PERFORMANCE

Key messages:

This chapter provides an analysis of statistics/ indicators related to Romania's R&I performance and potential contextualised within the country's socio-economic structure and specialisation patterns. The key findings are as follows:

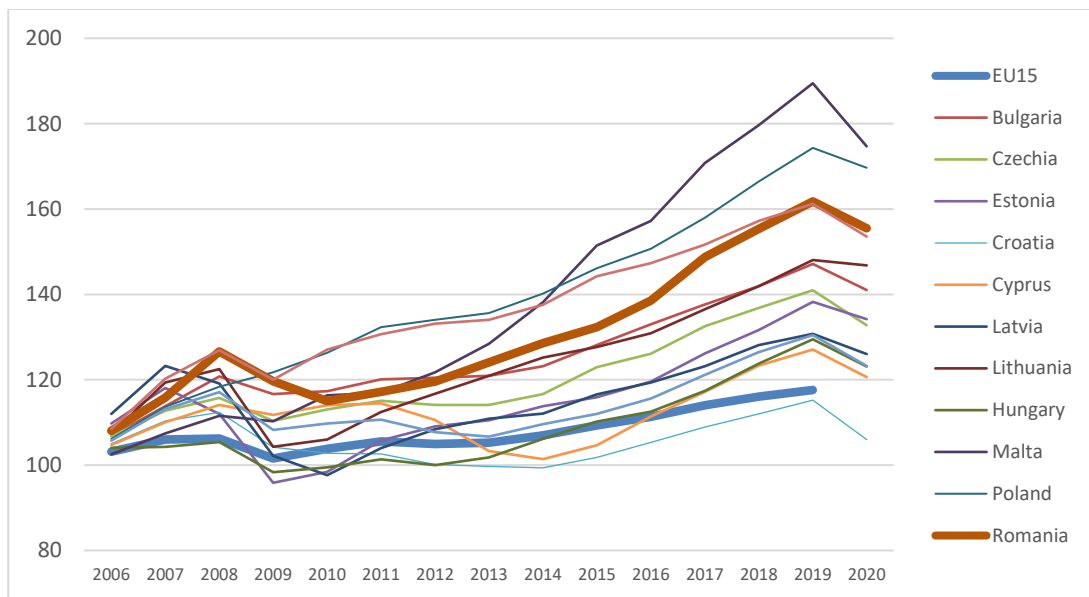
- During the decades of economic transition and integration with the EU, the country evolved from an industrial-agricultural economy to a services-based economy.
- GDP growth has advanced rapidly since 2008 and had a milder than expected decline in 2020 as a consequence of the COVID-19 pandemic.
- Economic performance and productivity are very mixed across sectors, industries and technology classes. Structural changes are still ongoing.
- Romania has the lowest R&D intensity in the EU and the 2020 2% target has not been reached.
- There is a large disparity in R&D expenditure between the capital region – Bucharest-Ilfov - and the other seven (NUTS2) regions.
- Scientific performance is poor when compared to the European standards in terms of most cited publications and PCT patent applications. Recent improvements in performance have been observed for scientific publications, but not for patent activity.
- According to the European Innovation Scoreboard (2021), Romania is an emerging innovator, whose performance relative to the EU has remained stable over time. Financial (and public) support for R&D is one of the most problematic areas for the Romanian R&I system.
- Low participation in education and training, coupled with dramatic demographic decline, threatens the country's growth prospects.

2.1. Performance and structure of the economy

30 years after the fall of communism, Romania is one of the fastest growing economies in the EU, ranked 13th by nominal GDP in 2020 (€218 billion). It is the 6th largest country in terms of population size (19.3 million). Romania had a difficult start in its adjustment to the market economy, with GDP declining dramatically in the first years of transition and recovering in the 2000s. Similarly to other countries in Central and Eastern Europe (CEE) that were part of the Eastern Bloc and are now members of the European Union (Bulgaria, the Czech Republic, Croatia, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia), Romania has undergone unprecedented political, economic, social and

cultural changes, driven mainly by restructured labour and capital markets, huge foreign direct investment, deregulation and modernisation of institutions, as well as support from ESIF.⁸ Overall, the absolute real convergence between the so-called EU13 countries or the New Member States (CEE countries plus Cyprus and Malta) and the remaining EU countries (EU15 prior to the departure of the UK) has been fast (Figure 2.1).

Figure 2.1. GDP at market prices. Chain linked volumes, index 2005=100



Eurostat: GDP and main components [nama_10_gdp]

In 2020, the World Bank classified Romania for the first time as a high-income country.⁹ That same year, Romanian GDP per capita measured in the purchasing power standard (PPS) reached 71.5% of the EU27 average, up from 44.1% in 2007. GDP per capita continues to converge with the EU average, but regional disparities persist. In 2019, the GDP per inhabitant of the capital-region, Bucharest-Ilfov, was 49700 PPS per capita; more than three times higher than that of the poorest Romanian region, North-East (13700 PPS per head).¹⁰

Despite the COVID-19 pandemic, Romania had a milder than expected economic decline in 2020 and real GDP contracted by only -3.9%, less than the EU27 average (-6.1%). Romania's economy performed strongly in the last quarter of 2020 and in the first quarter of this year; on an annual basis, real GDP is forecast

8 Balazs et al (2014) 25 years after the fall of the Iron Curtain The state of integration of East and West in the European Union. European Commission, Luxembourg: Publications Office of the European Union, p. 85

9 The World Bank in Romania. Country overview. <https://www.worldbank.org/en/country/romania/overview>

10 Eurostat: Gross domestic product (GDP) at current market prices by NUTS 3 regions, [nama_10r_3gdp]

to grow by 7.4% in 2021 and by 4.9% in 2022.¹¹ However, the COVID-19 crisis increased the risks to macroeconomic and financial stability, in particular with regard to the deficit and debt criteria.

Unlike any other Member State, Romania is subject to the Excessive Deficit Procedure from 2020, on basis of data for 2019. In this respect, the Council adopted a revised Recommendation (18 June 2021) to end the excessive deficit situation in Romania by 2024.¹² Romania’s Convergence Programme for 2021-2024 proposes a fiscal adjustment – which is mostly expenditure-based – and aims to bring the general government deficit below 3% of GDP by 2024.¹³

At present, Romania is experiencing imbalances related to the cost competitiveness losses, a deteriorating external position and a widening current account deficit.¹⁴ Under the **Recovery and Resilience Facility (RRF)**, Romania has requested €14.2 billion in grants and €14,9 billion in loans. The National RRF Plan - which is now under EC review – will play a crucial role in helping Romania to emerge strongly from the pandemic crisis (see Chapter 4 for more details).

The structural composition of the economy and the dynamism of the business sector have a strong influence on the overall capacity of an economic system to innovate and to invest in R&D. Despite Romania’s structural transformation and progress towards a knowledge-based economy, the country still has an economic structure which faces a number of structural constraints (Table 2.1).

Table 2.1 Structural differences with the EU

Indicators per category	Romania	EU
Performance and structure of the economy		
GDP per capita (PPS) (average 2017-2019)	20400	30800
Average annual GDP growth (%) (average 2018-2020)	0.44	-2.5
Employment in Manufacturing (NACE C) (%) (average 2018-2020)	18.8	16.5
Of which High and medium high-tech (%) (average 2018-2020)	33.9	37.9
Employment in Services (NACE G-N) (%) (average 2018-2020)	32.4	41.2
Of which Knowledge-intensive services (%) (average 2018-2020)	26.8	35.1

11 EC (2021) Summer 2021 Economic Forecast: Romania (7/07/2021). https://ec.europa.eu/info/business-economy-euro/economic-performance-and-forecasts/economic-performance-country/romania/economic-forecast-romania_en

12 EC (2021) Ongoing Excessive Deficit Procedure - Romania. Retrieved from: https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/stability-and-growth-pact/corrective-arm-excessive-deficit-procedure/ongoing-excessive-deficit-procedures/romania_en

13 Government of Romania (2021) Romania’s Convergence Programme 2021 - 2024 https://ec.europa.eu/info/sites/default/files/2021-romania-convergence-programme_ro_0.pdf

14 EC SWD (2021) 411 final. In-Depth Review for Romania in accordance with Article 5 of Regulation (EU) No 1176/2011 on the prevention and correction of macroeconomic imbalances. Brussels, 2.0.2021

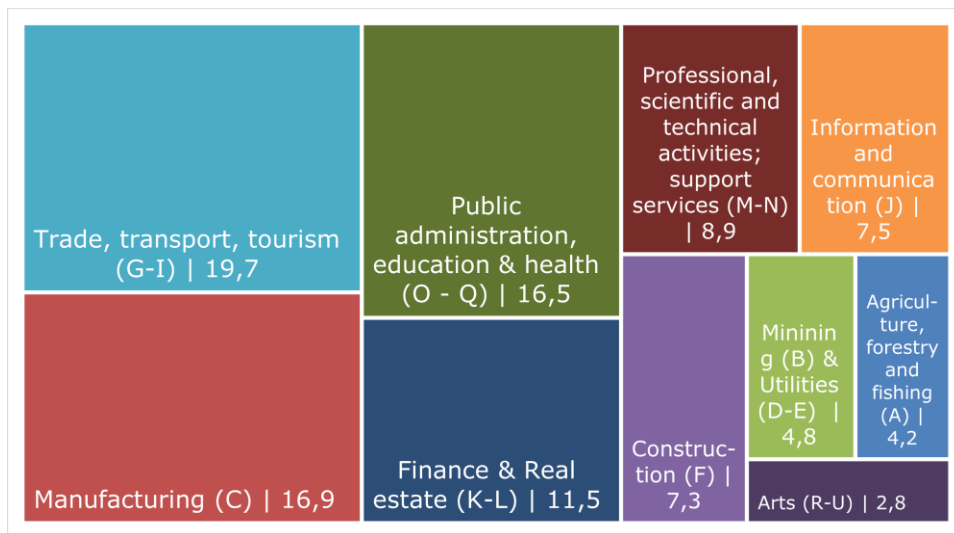
Indicators per category	Romania	EU
Performance and structure of the economy		
Turnover share of SMEs (%) (average 2016-2018)	42	36.5
Foreign controlled enterprises, % of value added (average 2016-2018)	15.9	11.8
Business and entrepreneurship		
Enterprise births (10+ employees) (%) (average 2016-2018)	2.2	1
Total early-stage Entrepreneurial Activity (TEA) (%) (average 2017-2019)	10.8	6.7
FDI net inflows (% GDP) (average 2017-2019)	2.9	2
Top R&D spending enterprises per 10 million population (average 2018-2020)	0	16.2
Innovation profiles		
In-house product innovators with market novelties, 2018	2.4	10.7
In-house product innovators without market novelties, 2018	5	12.3
In-house business process innovators, 2018	3.5	11
Innovators that do not develop innovation themselves, 2018	3.4	11.6
Other indicators		
Ease of starting a business (0 to 100 best) (average 2018-2020)	73	76.5
Rule of law (-2.5 to 2.5 best) (average 2017-2019)	0.4	1.1
Eco-innovation index (EC, DG Environment)	57	100
Average annual population growth (%) (2018-2020)	-0.5	0.1

Source: European Innovation Scoreboard (2021) Country profile: Romania. Retrieved from: <https://ec.europa.eu/docsroom/documents/45932>

As can be observed in Table 2.1, GDP per capita (which is also a proxy measure of demand for innovation) and Employment in Services are still much lower than the EU average. During the decades of economic transition and integration with the EU, the country evolved from an industrial-agricultural economy to a services-based economy, but structural changes are still ongoing. At present, despite a significant decline, the share of employment in agriculture, forestry and fishing in total employment (21.4% in 2020) is almost five times higher than the EU average (4.5% in 2020), considering that the sector contributes with only 4.2% to the total gross value added generated in the economy (Figure 2.2). This is indicative of the very large productivity gap in the agricultural sector, which is also coupled with high levels of informal employment and self-employment, reliance on outdated labour-intensive technologies, the limited education

attainment of human capital, as well as the low expenditure on research and development.¹⁵

Figure 2.2 Gross value added by industry breakdown (%) (2020)



Source: Eurostat, Gross value added and income by A*10 industry breakdowns [nama_10_a10]

The manufacturing sector employs about 19% of the population and plays a relatively strong role, compared to other EU Member States. Nevertheless, performance in the manufacturing sector is very mixed across technology classes, with the medium-high-technology sectors – in particular the automotive industry and related sectors (rubber, plastics, metals etc.) - being the largest contributors to exports and growth.¹⁶

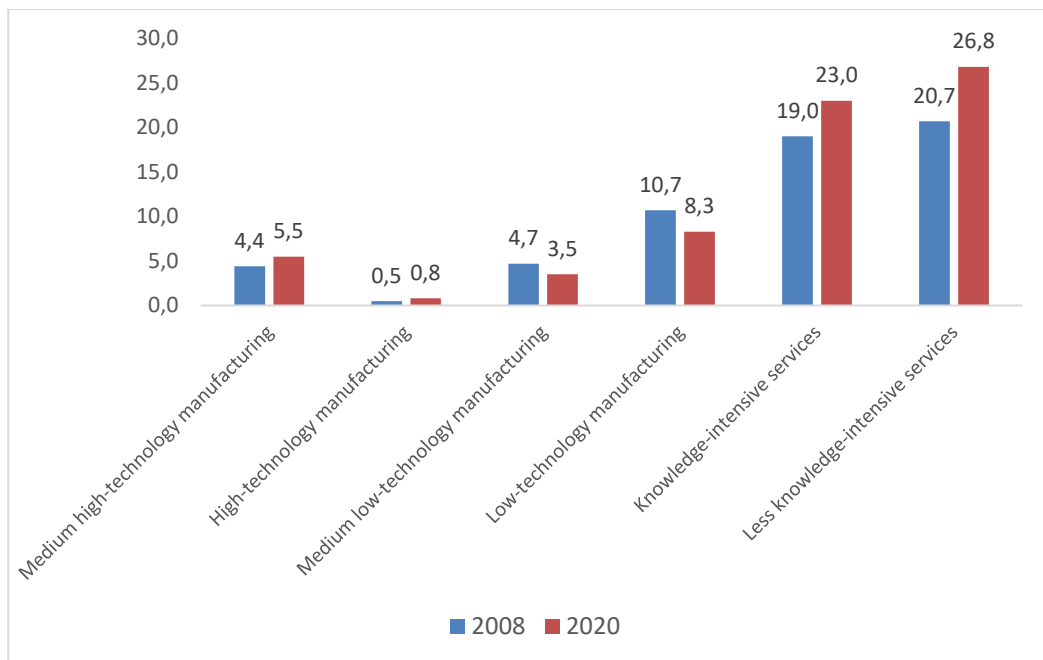
Figure 2.3 shows the decline of employment in low and medium-low technology sectors in the last decade, but also the increase of employment in knowledge intensive services, within which the ICT sector is the main driver of growth. Figure 2.3 also points to an increase in less knowledge-intensive services, which is explained by the large labour movements that occurred between the agricultural sector and the low-end services sector (such as trade).¹⁷

15 World Bank (2018) From uneven growth to inclusive development. Romania’s path to shared prosperity. Systematic Country Diagnostics. WB Group, Washington, p. 59

16 EC SWD(2020) 522 final. Country Report Romania 2020. https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

17 World Bank (2018) From uneven growth to inclusive development. Romania’s path to shared prosperity. Systematic Country Diagnostics. WB Group, Washington, p. 35

Figure 2.3 Evolution of employment in technology and knowledge-intensive sectors (% of total employment)



Eurostat: Employment in technology and knowledge-intensive sectors at the national level, by sex (from 2008 onwards, NACE Rev. 2) [htec_emp_nat2]

Labour productivity started from a very low level (44% of the EU average in 2007) but has improved in the last decade (72.8% in 2019).¹⁸ At present, labour productivity dynamics vary significantly across sectors, firms and regions.¹⁹ Foreign controlled enterprises, the firms operating in high and medium-high tech sectors and in knowledge-intensive services and the enterprises located in Bucharest-Ilfov, have higher levels of overall productivity.

The economy is predominantly based on **micro, small, and medium-sized enterprises** (99.7% of total enterprises) which account for 66.1% of employment and 55.9% of value added, which is in line with the EU average. Nevertheless, SME productivity (measured as value added per person employed) is less than half the EU average and the country has the lowest share of innovative SMEs. In general, SMEs suffer from a lack of skilled workers and from limited access to risk capital for innovative start-ups and scale-ups.²⁰

18 Eurostat: Nominal labour productivity per person, % of EU27 (from 2020) total [tesem160]

19 EC SWD(2020) 522 final. Country Report Romania 2020. https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

20 EC (2021) Romania – SME Fact Sheet 2021. <https://ec.europa.eu/docsroom/documents/46088>

Romania has been a leading destination for **foreign direct investment (FDI)**. At the end of 2019, FDI stock amounted to €88.3 billion or 39.5% of GDP. By economic activity, manufacturing (29% of total FDI stock), construction and real estate (16.9%), trade (11.6%), financial intermediation and insurance (11.5%) attracted together about $\frac{3}{4}$ of total FDI stock. More than 62% of total FDI stock is recorded in the capital region, Bucharest-Ilfov. FDI enterprises make a major contribution to Romania's foreign trade, as they account for 74.2% of exported goods and 49.9% of exported services.²¹ Foreign controlled-enterprises account for 44.7% in the value added generated in the business economy (NACE B-N, except financial and insurance activities) and 15.9% in total value added.²² There is a large competitiveness and innovation gap separating foreign-owned and domestic firms, and potential spillovers remain limited.²³

Romania shows varying degrees of performance in global and European economic and business rankings:

- Romania ranks as the 25th/133 most complex country in the world in the **Economic Complexity Index** (2018) ranking. The country is more complex than expected for its income level. Romania's largest goods exports are moderate and high complexity products, vehicles (and part of motor vehicles) and electronics, electrical machinery and equipment products, respectively; 62 new products were added in the last 15 years.²⁴
- The **WEF's Global Competitiveness Index** 2019 ranks Romania 51st out of 141 countries. The country ranks most strongly in ICT adoption (32nd) and market size (41st), and worst for financial systems (86th) health (83rd), skills (72nd) and business dynamism (72nd).²⁵
- Romania places 55th in the **World Bank's Doing Business Ranking**, which evaluates the ease of doing business in 190 countries around the world. The country has gone through many reforms to ease business operation and is now closer to other EU Member States in terms of the scores for starting a business.²⁶
- In the **EBRD Knowledge Economy Index 2019**, which measures the ability of an economy to grow through productivity enhancements and innovation, Romania is ranked at an intermediate stage, with a score of 5 (on a 1 to 10

21 National Bank of Romania (2020) Foreign Direct Investments in Romania in 2019. <https://bnro.ro/PublicationDocuments.aspx?icid=14364>

22 Eurostat: Value Added in Foreign Controlled Enterprises [egi_va1]

23 EC SWD(2020) 522 final. Country Report Romania 2020. https://ec.europa.eu/info/publications/2020-european-semester-country-reports_en

24 Harvard's Growth Lab (2018) Atlas of Economic Complexity. Country profile: Romania. <https://atlas.cid.harvard.edu/countries/185/summary>

25 World Economic Forum (2019) Global Competitiveness Report 2019. Country Profile: Romania (p. 478-481) http://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf

26 World Bank (2020) Ease of doing business in Romania. <https://www.doingbusiness.org/en/data/exploreconomies/romania>

scale). The most problematic areas are the (specialised) skills for innovation and the innovation system in all components (inputs, outputs, linkages).²⁷

- The recent **EC's Transition Performance Index 2020** - which helps monitor progress towards achieving the Sustainable Development Goals - ranks Romania the 35th/ 72. Between 2010 and 2020, the country recorded a strong transition in governance, a good transition for the social and environmental dimensions and an overall weak economic transition.²⁸
- Romania has a below average performance along all of the dimensions of the **Eco-Innovation Index**. The eco-innovative inputs and activities are at relatively half of the EU average level; the country is closer to the EU average in terms of socio-economic outcomes and resource efficiency outcome.²⁹
- Romania ranks 26th out of 28 countries in the **Digital Economy and Society Index (DESI) 2020**. The country performs best on Connectivity dimension and is well positioned as regards ICT graduates (Human Capital), but digitisation of the economy lags well behind. For digital public services and use of internet services, Romania has the lowest performance in the EU.³⁰

Apart from the various socio-economic shortcomings flagged in this section, **demographic decline** is probably one of the most pressing challenges that Romania will face in the years to come. The country's population has fallen by about four million since 1990 and is projected to continue to shrink in the next decades due to low birth rates and high out-migration, which seriously threatens the country's growth and sustainability potential.

2.2. R&D expenditure

Romania had the lowest R&D intensity in the EU in 2019. R&D expenditure accounted for 0.48% of the GDP, of which 0.2% was public R&D and 0.28% private R&D. The 2020 2% target has not been reached. Since 2000, R&D expenditure has increased by 1.4%, which is more than the EU average (1.1%), but less than in other countries in the EU13 (Cyprus, Estonia, Hungary, Poland, Czechia, etc.) (Table 2.2).

27 EBRD (2019) Knowledge Economy Index. <https://www.ebrd.com/news/publications/brochures/ebrd-knowledge-economy-index.html>

28 EC (2020) Transition Performance Index (TPI) 2020 Country profiles. Romania (p. II-49) https://ec.europa.eu/info/sites/default/files/research_and_innovation/strategy_on_research_and_innovation/documents/tpi/ec_rtd_tpi-country-profiles.pdf

29 EC (2019) Eco-innovation Index. Country profiles: Romania. https://ec.europa.eu/environment/ecoap/romania_en

30 EC (2021) Digital Economy and Society Index (DESI) 2020: Romania. <https://digital-strategy.ec.europa.eu/en/policies/desi-romania>

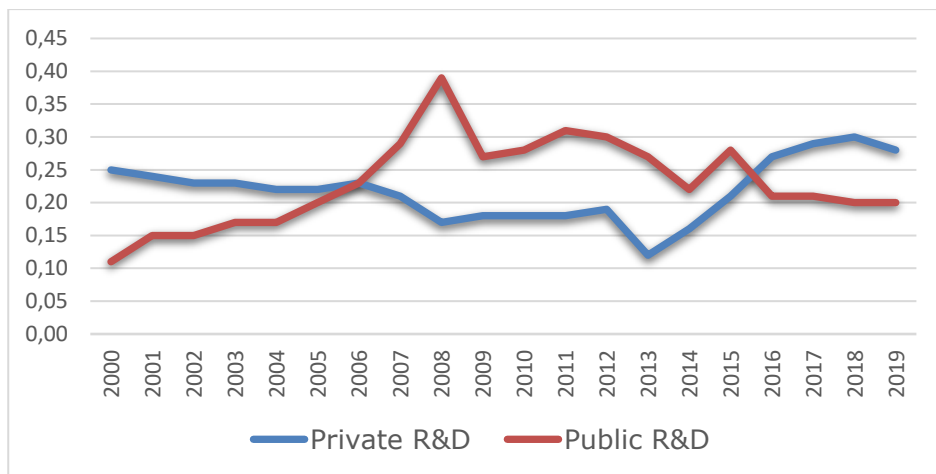
Table 2.2 Situation of EU13 Member States with regard to the R&D intensity targets

EU13	R&D intensity 2019	Public R&D intensity 2019	Private R&D intensity 2019	R&D intensity CAGR (%) 2000 -2018	R&D intensity target 2020
Bulgaria	0.84	0.27	0.57	2.4	1.50
Czechia	1.94	0.74	1.21	3.1	1.1 (public sector)
Estonia	1.61	0.74	0.87	4.8	3
Croatia	1.11	0.57	0.54	0.1	1.4
Cyprus	0.63	0.30	0.33	5	0.5 (target reached)
Latvia	0.64	0.47	0.17	2.1	1.5
Lithuania	1	0.56	0.44	2.3	1.9
Hungary	1.48	0.36	1.12	4.4	1.8
Malta	0.59	0.22	0.37	0.8	2
Poland	1.32	0.49	0.83	3.6	1.70
Romania	0.48	0.20	0.28	1.4	2
Slovenia	2.04	0.52	1.52	0.4	3
Slovakia	0.83	0.38	0.45	1.5	1.20
EU27	2.2	0.73	1.47	1.1	3

Source: Eurostat, GERD by sector of performance [rd_e_gerdtot]; data on R&D intensity CAGR extracted from: EC (2020) Science, research and innovation performance of the EU 2020. A fair, green and digital Europe. May 2020

Public R&D intensity increased from 0.11% of GDP in 2000 to 0.20% of GDP in 2019, but it is still the lowest in the EU; other EU13 countries boosted their public R&D intensity and are now above the EU average (i.e. Czechia, Estonia). Similarly, private R&D expenditure has been steadily growing in the last years (0.28% of GDP in 2019), but it is well below the EU average and the 2020 target (Figure 2.4).

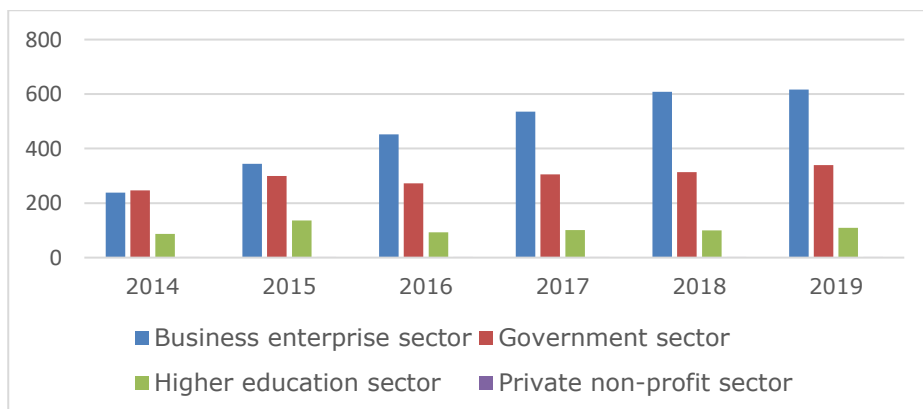
Figure 2.4 Evolution of public R&D and private R&D expenditure in Romania (2000-2019, % GDP)



Source: Eurostat, GERD by sector of performance [rd_e_gerdtot]

It should be noted that the total nominal gross expenditure in R&D (GERD, in € million) has increased in recent years, in particular in the business enterprise sector (Figure 2.5), but that relative R&D intensity has decreased due to more rapid growth in national GDP. R&D expenditure in the higher education sector remains modest when compared to the business enterprise and government sectors, while the contribution of the private non-profit sector to GERD is rather negligible.

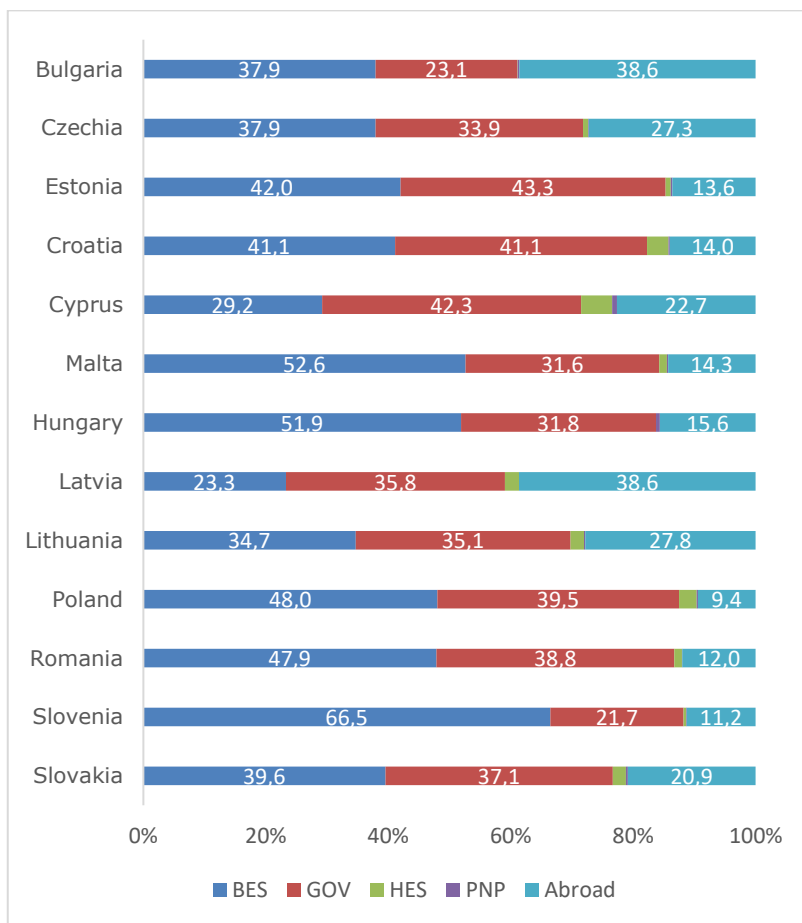
Figure 2.5 GERD by sectors of performance, Romania (€ million)



Source: Eurostat, GERD by sector of performance [rd_e_gerdtot]

Figure 2.6 shows the composition of gross domestic expenditure (GERD, average 2014-2018, %) by five main funding sources: the business sector (BES), the domestic government (GOV), the higher education sector (HES), the private non-profit sector (PNP) and the rest of the world (Abroad).

Figure 2.6 GERD by source of funds (% , average 2014-2018)



Source: Eurostat, GERD by sector of performance and source of funds (average 2014-2018) [rd_e_gerdfund]

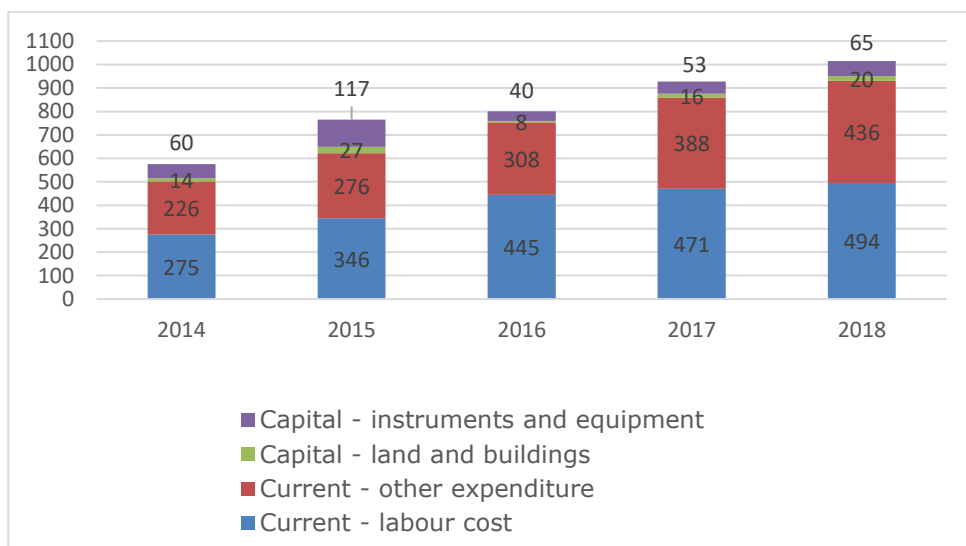
The business sector was the main source of R&D funding in Romania in the analysed period (47.95%). This is relatively close to the EU13 average, but lags behind the most research-intensive Member States, where R&I funding from the business sector is higher than 60%.³¹ The share of investments from national governments (GOV) in total R&D is much higher than the EU average in almost all EU13 countries, including Romania (38.8%). R&D expenditure financed from

31 EC (2020) Science, research and innovation performance of the EU 2020. A fair, green and digital Europe. May 2020

abroad (including from the EC) represented 12% of total GERD in Romania, which is indicative of a relatively low presence in international R&D flows.

Labour costs have constantly increased from 2014, which is consistent with the general trend in the Romanian economy; they represent about half of total R&D expenditure. The other current expenditures have also increased substantially (they doubled between 2014-2018), while capital expenditures varied between 6% to 18% of total GERD in the analysed period (Figure 2.7).

Figure 2.7 GERD by type of expenditure (€ million)



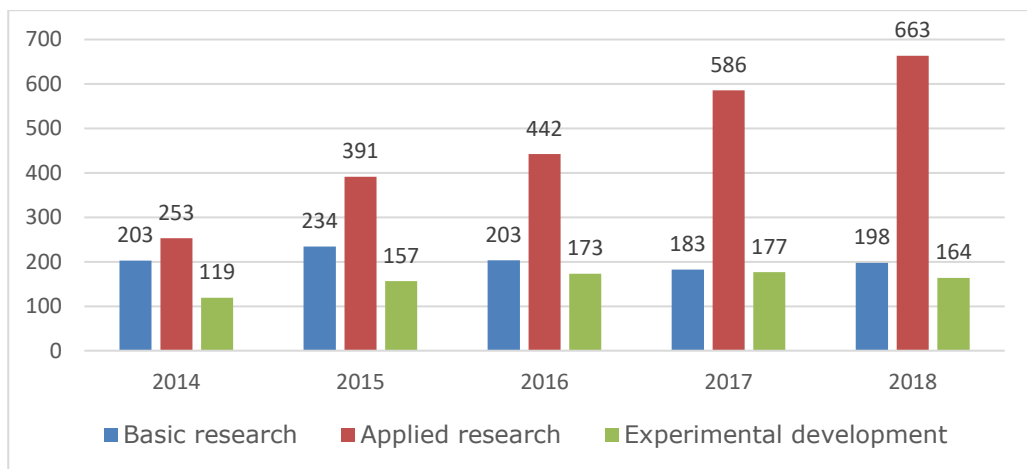
Source: GERD by sector of performance and type of expenditure [rd_e_gerdcost]

Figure 2.8 shows the distribution of GERD by type of R&D activities and highlights the significant increase of applied research in the analysed period, coupled with a decrease in basic research and a relative stagnation in experimental development. Chioncel (2020) points to the much lower shares allocated to basic research and experimental development in Romania – as compared to other EU countries.³²

Basic research remains the dominant R&D activity in the higher education sector, while applied research covers about 80% of the R&D activities in the business enterprise sector. As regards the government sector, one can observe a slight transition of focus from basic research to applied research. Experimental research remains a less exploited R&D activity in Romania (Figure 2.9).

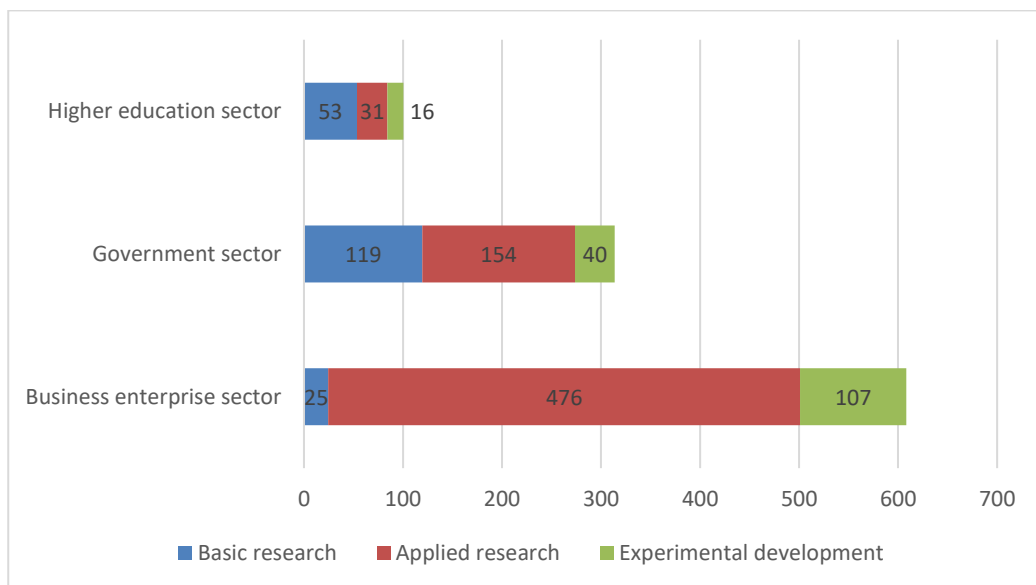
32 Chioncel (2020) Analysis of the factors that obstruct the diffusion of innovation, including digitisation. <https://uefiscdi.gov.ro/resource-821136-analysis-of-the-factors-that-obstruct-the-diffusion-of-innovatio.pdf>

Figure 2.8 GERD by type of R&D activity (€ million)



Source: Eurostat, GERD by sector of performance and type of R&D[rd_e_gerdact]

Figure 2.9 GERD by sectors of performance and type of R&D activities (2018, € million)



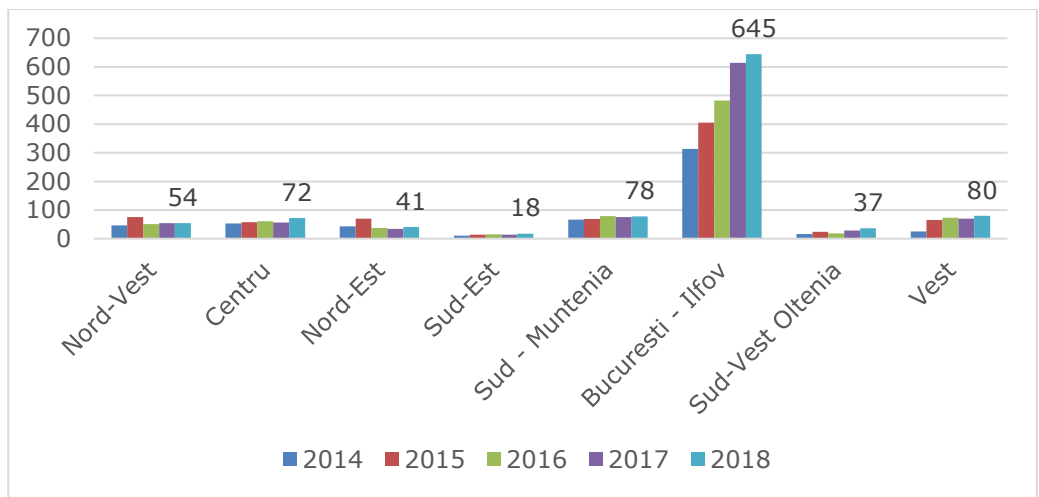
Source: Eurostat, GERD by sector of performance and type of R&D [rd_e_gerdact]

A distinctive feature of the R&D systems in EU13 is the **large disparity in R&D expenditure between the capital region and the other regions**. According to the Regional Innovation Scoreboard 2021, in terms of R&D expenditure in the public sector (as percentage of GDP), the ratio between the best performing region and the worst performing regions is exceptionally high in Bulgaria (16.5

percentage points), Czechia (20.1 percentage points) and Romania (16.3 percentage points).³³

Figure 2.10 shows the evolution of GERD (€ million) by NUTS2 regions in Romania and points to the large differences in R&D expenditure between the capital region (Bucharest Ilfov) and the other Romanian NUTS2 regions; the gap tends to widen over time.

Figure 2.10 GERD by NUTS2 regions (€ million)

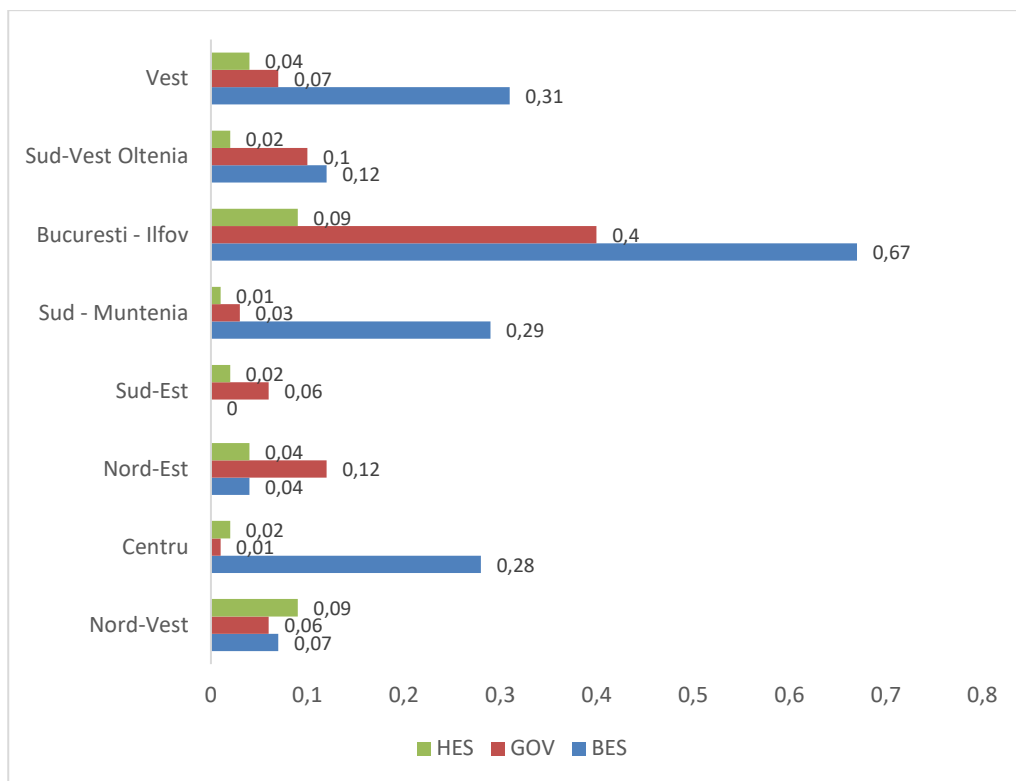


Source: Eurostat, GERD by sector of performance and NUTS 2 regions [rd_e_gerdreg]

In five of the eight NUTS2 regions (including Bucharest-Ilfov), private expenditure on R&D is dominant, while in the east of Romania (North East, South East), public expenditure on R&D is much higher. There is a single NUTS2 region in Romania, North West, where HES is the strongest sector of performance (Figure 2.11).

33 EC (2021) Regional innovation Scoreboard 2021. <https://ec.europa.eu/docsroom/documents/46032>

Figure 2.11 GERD by sectors of performance and NUTS2 regions (2018, % of GDP)



Source: Eurostat, GERD by sector of performance and NUTS 2 regions [rd_e_gerdreg]

2.3. R&I performance

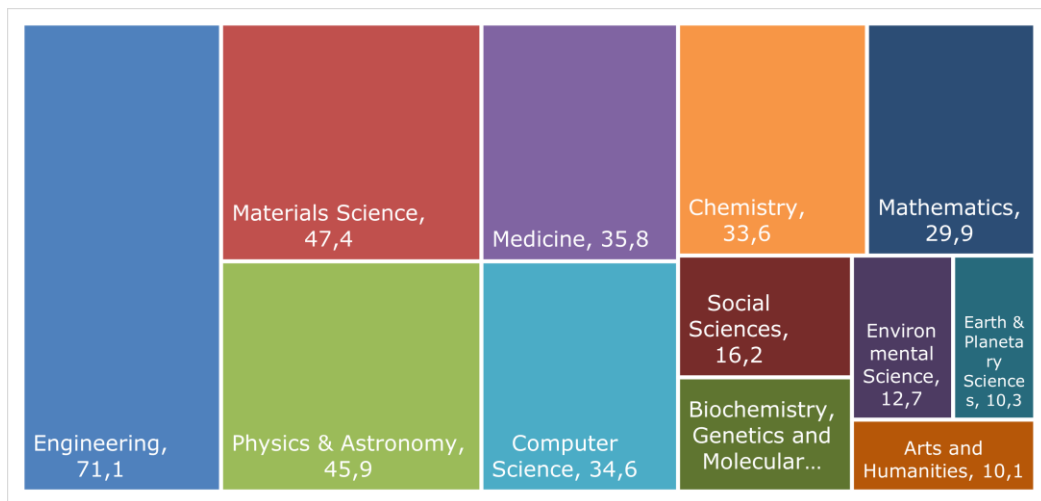
The chronic underfunding of the public science base has resulted in relatively poor scientific performance compared to European standards.

Romania ranks second-to-last in the **Adjusted Research Excellence Index 2020** (AREI), which is a composite of four components: share of top 10% most highly cities publications per total population, Patent Cooperation Treaty (PCT) patent applications per population, participation in Marie Skłodowska-Curie Actions (MSCA) and European Research Council (ERC) grants per public R&D initiative. The compound annual average growth rate 2013-2018 of the AREI score is positive and higher than the EU average, but the normalised scores per components are about three times lower than the EU average, except for the MSCA indicator, where Romania's score is of about half of the EU28 score.³⁴

34 Caperna, G., The Adjusted Research Excellence Index 2020. Methodology Report, EUR 30389 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-22745-8, doi:10.2760/352044, JRC 122029

Based on the information contained in the Scopus database (Elsevier B.V.) between 1996 and 2020, the **Scimago Journal & Country Rank** portal ranks Romania 40th out of 240 countries for the number of citable documents, and the 45th when the H-index is considered. The number of citable documents has more than doubled between 2007 and 2020 and the share in the total output produced at the EU28 level increased from 1.03% in 2007 to 1.59% in 2020.³⁵ Figure 2.12 shows the top subject areas by number of citable documents with Romanian authors.

Figure 2.12 Number of (Scopus) citable documents by subject areas (thousand, 1996-2020)

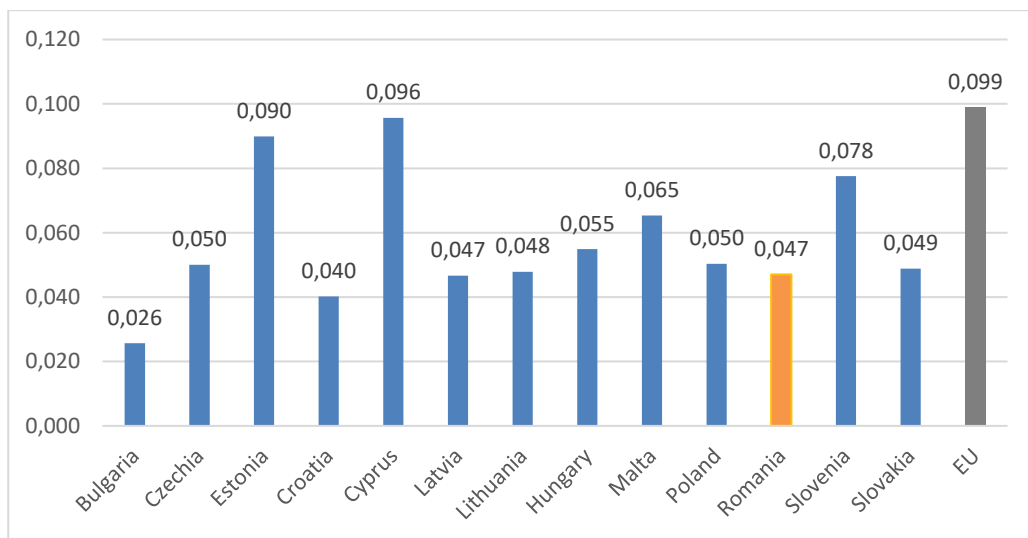


Source: Scimago Journal and Country Rank (1996-2020).
<https://www.scimagojr.com/countryrank.php?order=itp&ord=desc>

With regard to the number of scientific publications among the top-10% most cited publications worldwide, Romania’s performance is improving (Table 2.3) and is comparable to most other EU13 countries. However, it remains at some distance from EU27 average standards (Figure 2.13).

35 Scimago Journal and Country Rank (1996-2020). Country profile – Romania.
<https://www.scimagojr.com/countrysearch.php?country=R>

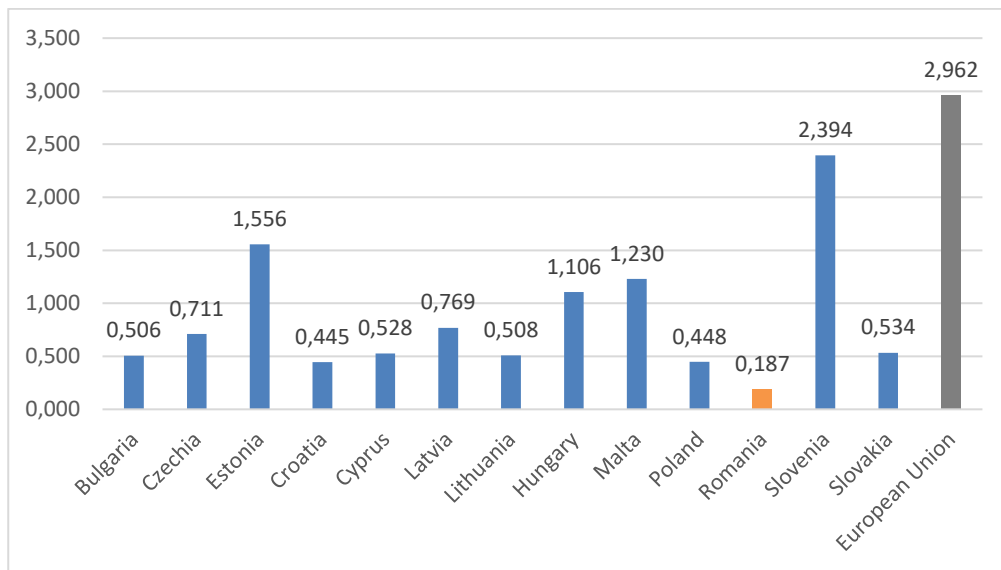
Figure 2.13 Scientific publications among the top 10% most cited (% , 2020)



Source: European Innovation Scoreboard 2021 database.
https://ec.europa.eu/growth/industry/policy/innovation/scoreboards_en

Patent activity is also modest and, similarly to scientific publications, is not demonstrably improving over time (Table 2.3). Romania ranks last in the EU in terms of PCT patent applications in relation to GDP, and its performance is much lower when compared to the EU13 countries (Figure 2.14).

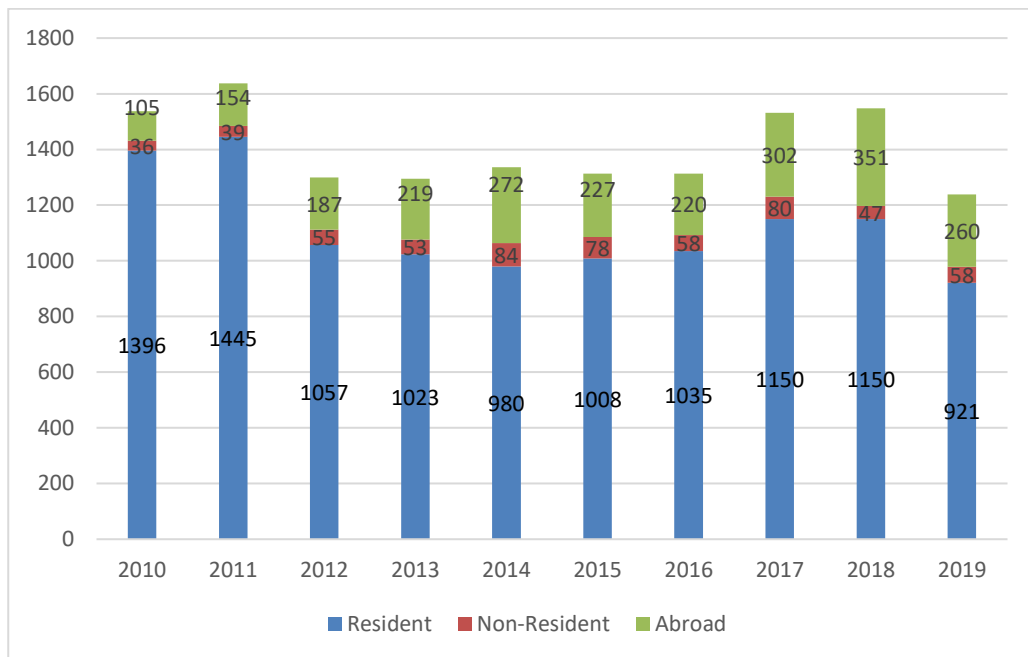
Figure 2.14 PCT patent applications per billion GDP in PPS (2020)



Source: European Innovation Scoreboard 2021 database.
https://ec.europa.eu/growth/industry/policy/innovation/scoreboards_en

It is worth mentioning with regard to patent activity that a substantial number of patents are applied at the national level and not abroad (Figure 2.15).

Figure 2.15 Number of patent applications (residents, non-residents and abroad)



Source: World Intellectual Property Office (WIPO) Statistics database. Country profile: Romania
https://www.wipo.int/ipstats/en/statistics/country_profile/profile.jsp?code=RO

There are about 1000 patents applied on an annual basis at the Romanian Office for Inventions and Trademarks (OSIM), most of which are natural persons (about 37%), research units (about 25%) and universities (about 20%); on average, there were about 400 national patents annually granted by OSIM between 2007 and 2020.³⁶ The number of trademark applications and design applications is on a positive trend (Table 2.3).

According to the European Innovation Scoreboard 2021, Romania is an **emerging innovator**, whose performance relative to the EU has remained stable over time.³⁷ Romania’s strengths are in *Broadband penetration* and *Medium and high-tech goods exports*, where performance is equal to the EU27 average. Recent performance increases are observed for *International scientific co-publications*, *Most-cited publications*, *Public-private co-publications*, *Venture capital expenditures*, *Employed ICT specialists*, *Trademark and Design*

36 Oficiul de Stat pentru Inventii si Marci (National Office for Inventions and Trademarks). Statistics (2020)
<https://osim.ro/despre-osim/statistici-publicate-in-2020/>

37 EC (2021) European Innovation Scoreboard 2021. Country profile: Romania.
<https://ec.europa.eu/docsroom/documents/45932>

Applications and Sales impacts. The most problematic areas – where performance is particularly poor and deteriorating or stable - are *Population involved in lifelong learning, Population with tertiary education, R&D expenditures in the public sector, Government support for business R&D* (Table 2.3).

Table 2.3 European Innovation Scoreboard 2021: Romania's performance relative to the EU (normalised scores)

Indicators per category	RO 2014	RO 2020	Trend	EU 2020	RO2020/ EU 2020
Human resources					
New doctorate graduates	0.427	0.109	↓	0.491	22.1%
Population with tertiary education	0.048	0.051	=	0.446	10.9%
Population involved in lifelong learning	0.018	0.014	=	0.359	4%
Attractive research systems					
International scientific co-publications	0.108	0.171	↑	0.473	36.1%
Most cited publications (among top 10%)	0.117	0.237	↑	0.584	40.5%
Foreign doctorate students	0.050	0.081	=	0.336	24%
Digitalisation					
Broadband penetration	0.518	0.749	↑	0.749	100%
People with above basic overall digital skills	N/A	0.023	N/A	0.500	4.5%
Finance and support					
R&D expenditure in the public sector	0.135	0.022	↓	0.618	3.6%
Venture capital expenditures	0.093	0.401	↑	0.553	72.6%
Government support for business R&D	0.128	0.068	↓	0.542	12.5%
Firm investments					
R&D expenditure in the business sector	0.059	0.096	=	0.590	16.3%
Non-R&D innovation expenditures	0.172	N/A	N/A	0.485	N/A
Innovation expenditures per employee	0.025	0.045	=	0.708	6.3%
Use of information technologies					
Enterprises providing ICT training	N/A	0.030	N/A	0.455	6.7%
Employed ICT specialists	0.094	0.226	↑	0.528	42.9%
Innovators					
Product innovators (SMEs)	N/A	0.046	N/A	0.591	7.8%
Business process innovators (SMEs)	0.086	N/A	N/A	0.632	N/A
Linkages					
Innovative SMEs collaborating with others	N/A	0.057	N/A	0.421	13.4%
Public-private co-publications	0.109	0.157	↑	0.341	46.2%
Job-to-job mobility of HRST	0.041	N/A	N/A	0.577	N/A
Intellectual assets					
PCT patent applications	0.021	0.024	=	0.385	6.3%
Trademark applications	0.232	0.296	↑	0.519	56.9%
Design applications	0.063	0.090	↑	0.344	26.1%
Employment impacts					
Employment in KIA	0.043	0.101	↑	0.436	23.2%

Indicators per category	RO 2014	RO 2020	Trend	EU 2020	RO2020/ EU 2020
Human resources					
Employment in innovative enterprises	N/A	N/A	N/A	N/A	N/A
Sales impacts					
Medium and high-tech goods exports	0.632	0.758	↑	0.753	100.8%
Knowledge-intensive services exports	0.290	0.403	↑	0.657	61.3%
Sales of innovative products	0.101	0.329	↑	0.454	72.4%
Environmental sustainability					
Resource productivity	0.026	0.054	=	0.510	10.6%
Air emissions by fine particulate matter	0.445	0.525	=	0.790	55.4%
Environment-related technologies	0.553	0.085	↓	0.436	19.5%

Source: European Innovation Scoreboard (2021) Country profile: Romania. Retrieved from:
<https://ec.europa.eu/docsroom/documents/45932>

3. R&I GOVERNANCE AND POLICY MIX

Key messages:

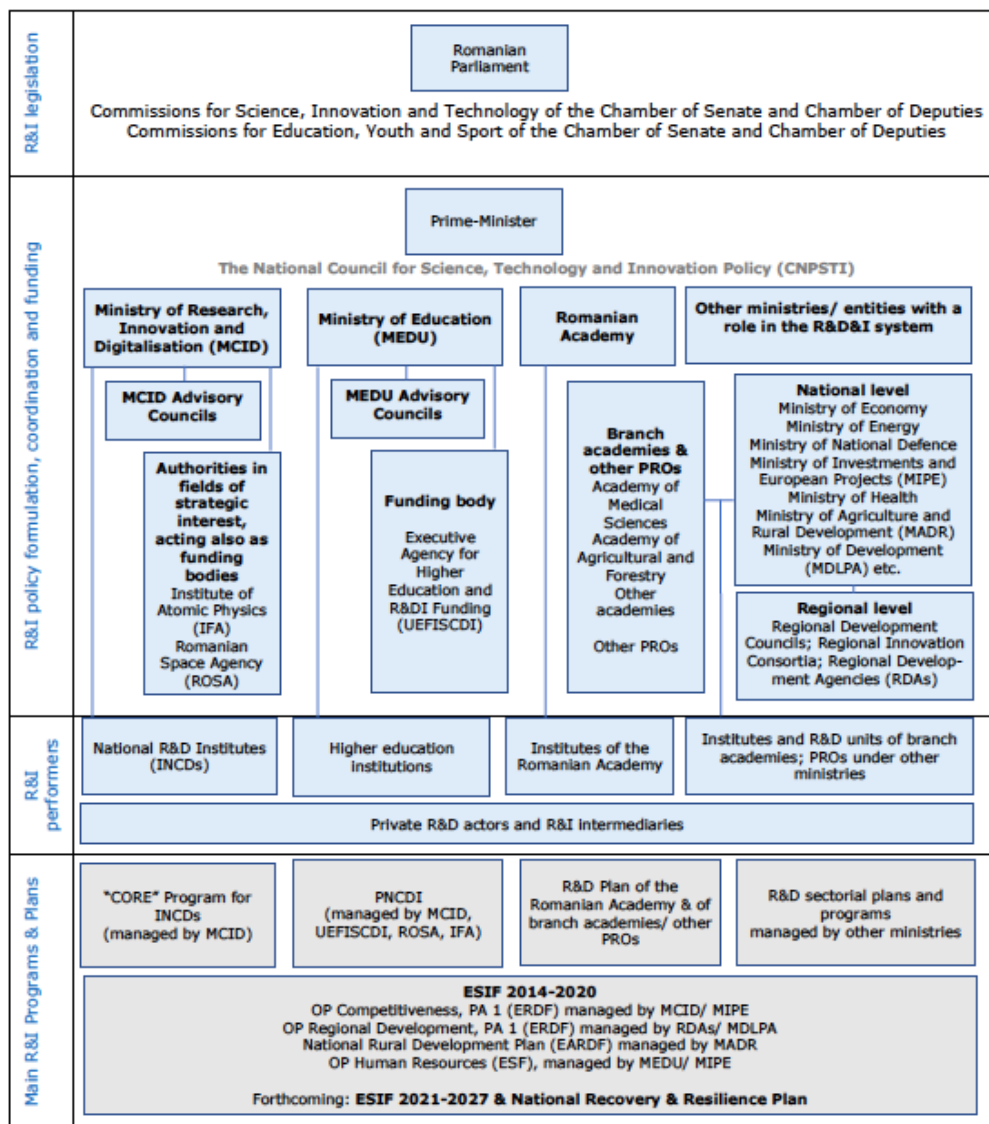
This chapter presents the R&I governance system, including key actors and R&D performing institutions, and provides an analysis of the R&I policy mix, funding flows and allocations for R&I. The key messages are as follows:

- The frequent institutional changes and reorganisations of the Central Authority for R&D have impacted the quality of governance.
- The National Council for Science, Technology and Innovation Policy (CNPSTI) – the consultative body under the Prime Minister that should have monitored the evolution of the whole national R&D&I system - has never been active.
- Inter-ministerial coordination and alignment of national – regional R&I agendas pose huge challenges.
- The public science base is highly fragmented and dominated by the division between (national) R&D Institutes and the institutes of the Academies of Sciences.
- The National R&D&I Strategy is the overarching R&I policy document setting out the vision for the 2014-2020 period; the mid-term evaluation shows a positive, but modest impact of the public interventions evaluated, given the low funding allocated (vs planned).
- SNCDI governance has not been operationalised, with negative consequences in terms of the elaboration and implementation of R&D&I policies.
- The R&I system is chronically under-funded and lacks financial predictability and multi-annual budgetary planning. There is no direct institutional funding for R&D in universities.
- There is a generalised lack of regular reporting, monitoring and evaluations of the efficiency of R&D investments.

3.1 R&I governance: key actors

The Romanian R&I system has a complex structure, organised over several levels and involving a large range of institutions and R&I performers (Figure 3.1).

Figure 3.1 Organogram – Institutional framework and governance of national R&I system 2021



Source: Own conceptualization

The Romanian Parliament, as the sole legislative authority of the country, passes laws and other juridical acts, including the law on the state budget. The regulatory activities of the Parliament concerning the R&D&I system are conducted by the **Commission(s) for Science, Innovation and Technology** of the Chamber of

Senate and the Chamber of Deputies. In December 2020, the former Commissions(s) for Education, Science, Youth and Sport of the Romanian Parliament were split, to better reflect the new organisation of the Romanian Government, with two different ministries being in charge with science, innovation and technology, on the one hand and education, on the other hand. The **Commission(s) for Education, Youth and Sport** of the Chamber of Senate and the Chamber of Deputies also play an important role in the R&D&I system, as they provide, inter alia, the legislative framework for the higher education system.

The **National Council for Science, Technology and Innovation Policy (CNPSTI)** has never been active, despite the fact that its roles and functions are established in both the Law on Research³⁸ and the National R&D&I Strategy 2014-2020.³⁹ CNPSTI should have worked as a consultative body under the Prime-Minister, should have monitored and evaluated the implementation of the national R&D&I strategy and the evolution of the national R&D&I system as a whole.

At present, the Central Authority for R&D in Romania is the **Ministry of Research, Innovation and Digitisation (MCID)**. The new organisational formula was created by the end of 2020, when the former Ministry of Education, Research and Innovation was split and MCID took over the R&I activities. According to the Government Decision 371/2021⁴⁰, MCID is the state authority for R&D&I, electronic communications, digitalisation, postal services and cyber-security; in the R&D&I area, MCID is in charge with the elaboration, application, monitoring and evaluation of R&D&I policies. The MCID:

- Develops, updates and ensures the institutional framework for the implementation of the National Strategy for Research, Innovation and Smart Specialisation (SNCDI).⁴¹
- Coordinates government policy at the national level.
- Monitors the R&D activity and conducts, in some cases, R&D programmes or parts thereof.
- Establishes the strategic objectives included in the National Plan for Research, Development and Innovation (PNCDI)⁴², as well as some other specific instruments for the implementation of SNCDI in accordance with the priorities of the Government's economic and social policies.

There are 43 National R&D Institutes under the coordination of MCID and two R&D&I institutions that operate under the authority of MCID; the Romanian Space

38 GO 57/2002 on scientific research and technological development, Art. 40

39 GD no. 929/ 2014 on the National Strategy for Research, Development and Innovation 2014 – 2020 (SNCDI)

40 GD 371/2021 on the organisation and functioning of the Ministry for Research, Innovation and Digitalization

41 GD no. 929/ 2014 on the National Strategy for Research, Development and Innovation 2014 – 2020 (SNCDI)

42 GD no. 583/ 2015 on the National Plan for Research, Development and Innovation (PNCDI)

Agency (ROSA) and the Institute of Atomic Physics (IFA) are under the subordination of MCID.⁴³

During the audit mission carried out at the level of INCDs, the Court of Accounts made a number of remarks on the coordination and monitoring of R&D&I activities at the central level.

Coordination and monitoring of R&D&I activities in Romania

The establishment of the Ministry for Research and Innovation in 2017⁴⁴ - as a distinct unit - created the necessary framework for national coordination and planning of R&D&I policies. However, the Ministry did not ensure the predictability of funding and did not operationalise the governance framework of the National Strategy for R&D&I, with negative consequences in terms of the elaboration and implementation of R&D&I policies.

The Ministry did not set up the R&D&I Policy Unit, whose role was to prepare annual reports on the implementation of SNCDI/ PNCDI, create and update the database with information on all R&D programmes, financial resources invested etc.

The Institutional Strategic Plan – which, according to the legislation in force, is the main planning tool at the level of public authorities – does not allow a clear correlation between the strategic objectives of the Ministry and the budgetary allocations for R&D.

Source: Court of Accounts (2020), Sinteza raportului de audit al performantei privind eficienta si eficacitatea activitatii de C&D finantate pentru institutetele nationale

The MCID is assisted by **six consultative bodies**: the National Council for Scientific Research (CNCS), the Romanian Committee for Research Infrastructures (CRIC), the Advisory Board for R&D&I (CCCDI), the National Council for Ethics in Scientific Research, Technological Development and Innovation (CNECSDTI), the National Council for Technology Transfer and Innovation (CNTTI), the Romanian Committee for Research Infrastructures (CRIC) and the Committee for Coordination of the Smart Specialisation (CCSI).⁴⁵

- **CNCS** assists the coordination, monitoring and evaluation of the scientific research activities in Romania. CNCS establishes standards, criteria and quality indicators for scientific research, conducts periodical audits of R&D activities (at the request of the competent ministry or on its own initiative), prepares reports on the state of R&D etc. CNCS also scientifically coordinates the implementation of programmes and sub-programmes within the PNCDI, namely those focussed on basic and frontier research, development of human

43 GD 371/2021 on the organisation and functioning of MCID, Annexes 3.5 and 6

44 GD 13/2017 on the organisation and functioning of the Ministry of Research and Innovation. Previously, the Authority for R&D functioned under the Ministry of Education.

45 GD 371/2021 on the organisation and functioning of MCID, Annex 2

resources for R&D and international cooperation sub-programmes focusing on basic research.⁴⁶

- **CRIC** assists MCID in planning long-term investment in research infrastructure.⁴⁷
- **CCCDI** provides specialised scientific support in the elaboration of national RDI policies and strategies, scientifically coordinates the implementation of programmes/ sub-programmes within PNCDI (as assigned by MCID) etc.⁴⁸
- **CNECSDTI** monitors the application of the legal provisions regarding the norms of moral and professional conduct by the R&D units and institutions, as well as by the R&D staff etc.⁴⁹
- **CNTTI** advises MCID on issues related to technology transfer, smart specialisation prioritisation, stimulation of knowledge demand, creation of synergies in funding R&D and innovation etc.⁵⁰
- **CCSI**⁵¹ was created in 2019 to support the coordination of smart specialisation interventions between various ministries and the Regional Development Agencies; CCSI responds to the 2021-2027 ESIF enabling condition related to “existence of competent regional / national institution or body, responsible for the management of the smart specialisation strategy”.⁵²

MCID manages the “Core” Programme for the National R&D Institutes and shares the administration of the National R&D&I Plan with three **executive agencies**:

- **The Executive Agency for Higher Education and R&D&I Funding (UEFISCDI)** is a public institution that coordinates (administratively) some specific programmes and sub-programmes of the National R&D&I plan (PNCDI) and provides evidence-based studies for the allocation of state funds for universities. UEFISCDI currently operates under the Ministry of Education and performs the management of a the PNCDI components based on a contract concluded with the National Authority for R&D/MCID. Along with the responsibilities for funding higher education and research, UEFISCDI is recognised as a foresight hub and as the developer/ administrator of strategic platforms such as ERRIS (European Research Infrastructures System), Study in Romania, Brainmap (the online community of researchers, innovators, technicians and entrepreneurs), and the Integrated Educational Register.⁵³ UEFISCDI is responsible for the coordination of various programmes and sub-programmes of the National R&D&I Plan, such as “Human Resources”,

46 Ministerial Order (MO) no 3463/2020 on the organisation of CNCS

47 Ministerial Order (MO) no 9311/2016 on the organisation of CRIC

48 Ministerial Order (MO) no 212/2017 on the organisation of CCCDI

49 Ministerial Order (MO) no 4655/2020 on the organisation of CNECSDTI

50 Ministerial Order (MO) no 214/2017 on the organisation of CNTTI

51 Ministerial Order no 458/2019

52 EC COM(2018) 375 final. Proposal for a Regulation laying down the common provisions on ESIF, Annex IV

53 UEFISCDI – About UEFISCDI: <https://uefiscdi.gov.ro/prezentare-institutionala>

“Increasing the competitiveness of the Romanian economy through R&D&I”, “European and international cooperation”, “Fundamental and frontier research”.

- The **Romanian Space Agency (ROSA)** is a public institution entirely self-funded that coordinates the space activities in Romania and the participation in European and international space programmes ROSA manages the STAR Programme “Space Technology and Advanced Research” (part of National R&D&I Plan), which ensures the national support for the implementation of the Agreement between Romania and the European Space Agency (ESA).⁵⁴
- The **Institute of Atomic Physics (IFA)** is a public institution under the MCID, whose mission is to contribute to the implementation of scientific research and technological development policy in the field of atomic and subatomic physics.⁵⁵ IFA manages the programmes in the National R&D&I Plan that support the participation in international scientific partnerships and major research infrastructure projects (ELI, EURATOM, CERN etc.).

The **Romanian Academy (RA)** functions autonomously and has its own chapter in the state budget; its research institutes conduct their activity on the basis of their own research plans, under the direction of the scientific sections of the Academy. The **Academy of Agricultural and Forestry Sciences (ASAS)** is the public autonomous institution that coordinates R&D activities in agriculture, forestry and food industry. The **Academy of Medical Sciences (ASM)** is the public institution of national interest that coordinates R&D activities in health sciences and biomedical research. The ASM is under the subordination of the Ministry of Health. Other academies coordinate R&D activities in specific fields of science.

The **Ministry of Education** is the central public authority responsible for the planning, management, execution, and control of state activities in education, training and scientific research at the university level. MEDU manages the National Strategy for Tertiary Education 2015-2020⁵⁶, monitors the application of the Law on Education, and allocates state funds for public universities, amongst other responsibilities. In the fulfilment of its functions, it is supported by various councils, agencies and consultative bodies, such as the National Council for the Financing of Higher Education (CNFIS⁵⁷), the National Council for Attesting Higher Education Titles, Diplomas and Certificates (CNATDCU), the National Council of Statistics and Forecast for Higher Education (CNSPIS), and the National Council of Rectors (CNR). The Romanian Agency for Quality Assurance in Higher Education (ARACIS) is an autonomous public institution of national interest whose mission is to carry out the quality external evaluation in higher education; ARACIS draws up the

54 The Romanian Space Agency: <http://www2.rosa.ro/index.php/en/>

55 The Institute of Atomic Physics: https://www.ifa-mg.ro/about_en.php

56 GD 565/2015 on the National Strategy for Tertiary Education 2015-2020

57 CNFIS proposes the university funding methodology.

methodology and standards for various types of HEIs programmes, which are endorsed by MEDU and approved by Government decision.

The **Ministry of Agriculture and Rural Development** manages the R&D Sectoral Plan for Agriculture, the National R&D Strategy for the agri-food sector on the medium and long term 2014-2020 / 2020-2030, the National Rural Development Plan (including the R&I measures for agricultural knowledge systems, cooperation for R&I, pilot projects etc.). The Gheorghe Ionescu-Sisesti Academy of Agricultural and Forestry Sciences functions under the coordination of the Ministry of Agriculture and Rural Development.

The **Ministry of Health** coordinates the National Strategy for Health 2014-2020 that has a specific objective related to the Promotion of R&I in Health; coordinates the R&D Sectoral Plan for Health. The Romanian Academy of Medical Sciences operates under the subordination of the Ministry of Health.

The Ministry of Economy, Entrepreneurship and Tourism is the central public authority that deals with strategic policy making, regulation and implementation in the fields of economy, industrial policies, competitiveness, intellectual property, inventions and trademarks, SMEs, entrepreneurship, trade, foreign direct investments etc. The Ministry coordinates, monitors and evaluates the National Strategy for Competitiveness, the National Strategy for Exports, the government strategy for SMEs, manages state aid support schemes, etc. (GD 315/ 2021).

Various other ministries and public organisations have a role in the R&D&I system. The **Ministry of National Defence** manages the R&D Plan for Defence, the **Ministry of Energy** manages R&D programmes in energy, the **Ministry of Finance** oversees R&D tax incentives, the **Ministry of Development, Public Works and Administration** is the managing authority for the POR and the **Ministry of Investments and European Projects** coordinates the implementation of ESIF.

At the regional level, the **Regional Development Councils** are the leading administration bodies; they are composed of the presidents of the county councils and have a role in coordinating the regional development strategies/ plans that back the ERDF-based Regional Operational Programmes. At present, Romania has eight development regions at NUTS2 level which have no legal and administrative status and serve mainly for the distribution of ESIF.⁵⁸ The **Regional Development Agencies (RDAs)** are the executive bodies of the Regional Development Councils; the RDAs elaborate and implement the RIS3 and organise the entrepreneurial discovery processes. Each region has set up a **Regional Innovation Consortium**, with a consultative role for RIS3 processes.

3.2 R&D performing institutions

The R&D&I system in Romania includes 259 public organisations and 221 private R&D entities. Table 3.1 shows the abrupt drop in the number of private R&D units

58 EC / Smart specialisation platform. RIS in Lagging regions: Romania. <https://s3platform.jrc.ec.europa.eu/romania>

in the last decade and the relatively stable position of the public R&D units in both the government and the higher education sectors.

Table 3.1 Number of R&D units by sectors of performance

R&D units	2011	2012	2013	2014	2015	2016	2017	2018	2019
PUBLIC	268	269	273	286	298	293	276	256	259
GOV	177	174	186	192	204	200	190	171	174
HES	91	95	87	94	94	93	86	85	85
PRIVATE	898	701	647	487	483	499	437	315	221
BES	884	683	623	460	462	476	414	298	204
PNP	14	18	24	27	21	23	23	17	17
TOTAL	1166	970	920	773	781	792	713	571	480

Source: National Institute of Statistics - Units with research - development activity, by sectors of performance at the end of year (CDP101B)

Research, technology development and innovation activities are regulated by Government Decision no. 57/2002 (henceforth called the Law of Research), according to which: "In Romania, the R&D activity is a national priority, with a key role in the strategy for sustainable economic development" (Art. 3). The Ministry of Research, Innovation and Digitisation organises and leads the national R&D&I system, that includes "all units and institutions of private and public law that have R&D as an object of activity" (Art. 6, Law on Research), namely:

- Units and institutions of **public law**: National R&D institutes (INCDs); institutes, centres or research units of the Romanian Academy and of the branch academies; other institutes, research centres organised as public institutions or institutions of public law, including the institutes of the higher education institutions organised as legal entities; accredited public higher education institutions or their structures; international R&D centres established on the basis of international agreements, with or without legal personality; R&D institutes or centres organised within the national societies, national companies or independent facilities of national interest; other public institutions of institutions of public law with R&D or structures thereof with R&D among their objects of activity (Art. 7, Law on Research).
- Units and institutions of **private law**: R&D units organised as non-profit entities; accredited private universities or their structures; R&D units organised as commercial companies; commercial companies with R&D among their object of activities (Art. 8, Law of Research).

R&D system of national interest

There are four categories of institution that make up the **R&D system of national interest**, namely:

- National R&D institutes (INCDs).
- Institutes, centres or research units of the Romanian Academy and of the branch academies.
- Accredited higher education institutions or their structures.
- R&D institutes or centres organised within the national societies, national companies or independent facilities of national interest.⁵⁹

3.2.1 National R&D Institutes (INCDs)

- 43 INCDs are under the coordination of MCID, most of which operate in technical and engineering fields. Few INCDs are under the coordination of other ministries. For example, the National Institute for Labour and Social Protection functions under the Ministry of Labour and Social Protection, the National Institute for R&D in Informatics is organised within the General Secretariat of the Government, and the National Institute for Land Improvements functions under the Ministry of Agriculture.

INCDs are legal entities organised according to the Law on Research, whose main activity is R&D. They operate on the rules of economic management and financial autonomy, manage public and private state-owned assets, have their own assets, and may carry out commercial and production activities, which are recorded separately from R&D activities in accounting records.⁶⁰ A reorganisation of the national research system took place at the end of 2014, when 43 out of 46 INCDs formerly subordinated to various other ministries turned under the coordination of the Authority for R&D (now MCID); this was an important step in reducing the fragmentation of the R&D&I system.

MCID ensures institutional funding for the INCDs operating under its coordination, especially through the "Core" (Nucleu) Programme targeted to support their research agendas. MCID has its representatives in the administrative boards of INCDs⁶¹, organises competitions for the position of general directors, approves the revenues and expenditure budgets and initiates and validates the results of the periodical evaluations for the accreditation of the INCDs. CCCDI coordinates

59 MCID – R&D System: <https://www.research.gov.ro/ro/articol/4481/sistemul-national-de-cercetare>

60 GO 57/2002 on scientific research and technological development

61 MCID – National R&D Institutes under the coordination of MCID.
<https://www.research.gov.ro/ro/articol/4514/sistemul-de-cercetare-institute-na-ionale-de-cercetare-dezvoltare-in-coordonare>

the evaluation process and approves the evaluation reports drafted by evaluation experts.⁶²

3.2.2 *Institutes and research centres of the Romanian Academy and of the branch academies*

- The Romanian Academy has 51 research institutes and 18 research centres (about 2230 researchers in 2020).

The Romanian Academy is the highest national scientific forum. It functions autonomously and administers its assets independently. According to Law 752/2001 on the organisation and functioning of the Romanian Academy, there are 181 acting members (academicians and associate members), all of them being elected for life; there are also 135 honorary members. The R&D institutes under the subordination of the Romanian Academy are established by Government decision, at the proposal of the General Assembly of the Academy (Art. 3); they may have subunits in university centres and may conclude, in their own name, research contracts with legal entities, with the funds obtained remaining entirely at their disposal (Art. 11).⁶³

The Academy's research institutes conduct their activity on the basis of their own research plans, under the direction of the 14 scientific sections:⁶⁴ Philology and Literature, Historical Sciences and Archaeology, Mathematical Sciences, Physical Sciences, Chemical Sciences, Biological Sciences, Geonomic Sciences, Engineering Sciences, Agricultural and Forestry Sciences, Medical Sciences, Economic, Law and Sociological Sciences, Philosophical, Theological, Psychological and Pedagogical Sciences, Arts, Architecture and Audio-Visual, Information Science and Technology (Art. 14 – Statute of the Romanian Academy). The sections decide on the topics of the research projects, organise and guide the scientific work, supervise, control and evaluate the activity of the members and of subordinated units etc. (Art. 15 - Statute of the Romanian Academy).⁶⁵ The Romanian Academy also organises postgraduate, doctoral and postdoctoral studies.

- Academy of Agricultural and Forestry Sciences (ASAS) has 4 national institutes, 13 branch institutes, and 45 agricultural research units (about 800 researchers in 2019).⁶⁶

62 GD 477/2019 on the approval of the evaluation methodology for the accreditation of INCDS. <https://www.research.gov.ro/uploads/sistemul-de-cercetare/evaluare-certificare/2019/documente/1-hg-nr-477-04-07-2019-privind-aprobarea-normelor-metodologice-pentru-evaluarea-in-vederea-acreditarii-institutelor-na-ionale-de-cercetare-dezvoltare.pdf>

63 Law 752/2001 on the organisation and functioning of the Romanian Academy. <http://legislatie.just.ro/Public/DetaliiDocument/81171>

64 The Romanian Academy – Academy today: https://acad.ro/academia2002/acadeng/pag_cont10_0.htm

65 Statute of the Romanian Academy (2009) <https://www.research.gov.ro/uploads/sistemul-de-cercetare/legislatie-organisare-si-functionare/legislatia-sistemului-de-cercetare/statut-acad-ro.pdf>

66 Academy of Agricultural and Forestry Sciences Academy today <http://www.asas.ro/wcmqs/academia/despre+noi+-+02+academia+astazi.html>

The Academy of Agricultural and Forestry Sciences functions autonomously and administers its assets independently. According to the Law 45/2009 on the organisation and functioning of the Academy of Agricultural and Forestry Sciences and of the R&D system in agriculture, forestry and food industry, ASAS has 181 acting members and 40 honorary members; ASAS has in its structure scientific sections that coordinate, monitor and control the R&D activity of the research units. The financing of the current and capital expenses of ASAS and of research institutes and units under the subordination of ASAS is ensured from own revenues and from subsidies from the state budget, through the budget of the Ministry of Agriculture and Rural Development (Art. 44).⁶⁷

- 95 units with R&D activities are listed on the webpage of the Academy of Medical Sciences, including clinical institutes and hospitals, regional centres for public health, and research centres.⁶⁸

The **Academy of Medical Sciences** functions under Law 264/2004 on the organisation and functioning of the Academy of Medical Sciences. Different research structures may carry out their activity under the coordination of the Academy of Medical Sciences, such as research groups, laboratories, sections, departments, institutes for medical assistance, education and medical scientific research and institutes of scientific research with legal personality and subordinated/ coordinated by the Ministry of Health, institutions without legal personality organised within the clinics or sections that carry out medical scientific research (Art. 26). When concluding medical scientific research contractors, the before-mentioned institutions directly inform the Academy of Medical Sciences on the results of the research for which they were funded (Art. 27). The financing of the Academy of Medical Sciences is ensured from own revenues and from subsidies from the state budget, through the budget of the Ministry of Health.⁶⁹

The **Academy of Technical Sciences** was established as a forum for scientific in the field of engineering. According to the provisions of Law 230/2008 on the functioning of the Academy of Technical Sciences, the financing of the Academy should be ensured from its own revenues and from subsidies from the state budget, through the budget of the National Authority for Scientific Research (Art. 29).⁷⁰ Yet, through different legislative interventions, the funding has been substantially reduced and limited only to the operating expenses.⁷¹

The **Academy of Romanian Scientists** – a successor of the Academy of Sciences of Romania - functioned as an NGO until the promulgation of Law 31/2007, when it became a public institution. The Academy is a national forum whose main goal is to promote, develop, support and protect science in all its

67 Statute of the Academy of Agricultural and Forestry Sciences

68 Academy of Medical Sciences -Research units on the Academy platform. <https://www.adsm.ro/unitati-de-cercetare-pe-platforma-asm-2/>

69 Law 264/2004 on the organisation and functioning of the Academy of Medical Sciences

70 Law 230/2008 on the establishment and functioning of the Academy of Technical Sciences <https://astr.ro/wp-content/uploads/2018/07/Lege-nr-230.2008.pdf>

71 Academy of Technical Sciences – Shorth history. <https://astr.ro/istoric/>

forms.⁷² By law, the financing of the Academy should be ensured from its own revenues and from subsidies from the state budget.⁷³ Yet, in 2021, the Academy was not granted funds from the state budget, but this decision was declared unconstitutional by the Constitutional Court.

3.2.3 Higher education institutions

- 55 public higher education institutions (407 faculties) and 35 private higher education institutions (139 faculties) in 2020; about a third of the faculties are located in the capital region, Bucharest-Ilfov.⁷⁴

The organisation and functioning of the national education system is regulated by Law 1/2011 (Law of Education), that was amended more than 100 times in the last decade.⁷⁵ By Law, universities and other higher education institutions are autonomous and have the right to implement their own development policies and to manage the funds from the state budget and other sources according to the provisions of the law and personal accountability. Starting with the 2005/2006 academic year, all higher education institutions in Romania implement the 3-cycle structure: Bachelor, Master and Doctorate.⁷⁶

Higher education is accomplished through universities, academies of studies, institutes, post-university study institutions (Art. 114), whose mission is education and research or only education. Law 1/2011 refers to three categories of universities: education-focussed universities, education and scientific research universities (or education and arts universities) and advanced research and education universities (Art. 193); only 12 HEIs were included in the category of advanced research and education following the 2011-2012 classification exercise.⁷⁷

Public higher education institutions are financed from the state budget, based on financing contracts between the Ministry of Education and the institutions. The financing of higher education has different components: core financing (calculated based on average costs per students), complementary funding (i.e. grants for accommodation, endowments, funds allocated on competitive basis for scientific research) and additional funding. Since 2016, universities have been able to submit projects to finance specific institutional development objectives,

72 Academy of Romanian Scientists – History <http://www.aosr.ro/en/academy-of-romanian-scientists-1996-present-day/?lang=en>

73 Law 31/ 2007 on the reorganisation and functionings of the Academy of Romanian Scientists

74 Ministry of Education (2020) Report on the state of higher education in Romania 2019-2020 https://www.edu.ro/sites/default/files/_fi%C8%99iere/Minister

75 Sorin Cimpeanu (Education Minister): “Legea educatiei a fost schimbata de 117 ori in ultimii 10 ani”. https://www.realitatea.net/stiri/actual/sorin-cimpeanu-legea-educatiei-a-fost-schimbata-de-117-ori-in-ultimii-10-ani_606de19787e6c277d7660672

76 Eurydice – Romania: Higher Education. https://eacea.ec.europa.eu/national-policies/eurydice/content/higher-education-64_en

77 UEFISCDI (2011) Metodologie de evaluare pentru clasificarea universitatilor si ierarhizarea programelor de studii. <http://chestionar.uefiscdi.ro/>

such as the development of new study programmes, regional involvement, and internationalisation.⁷⁸

HEIs have full freedom in the design of their research agendas (Art. 123) and academic freedom is guaranteed by law (Art. 124); they may set up – for a determined period and on projects – research units approved by the university Senate, with own revenue and expenditure budgets, own statutes and autonomy (Art. 131). The R&D&I activity is organised and operates on the basis of national and European legislation in the field. Each HEI having assumed scientific research in its mission have to create administrative structures to facilitate the management of the research activities (Art. 189).⁷⁹

3.2.4 Other public R&D&I units

Beside the INCDs, the institutes of the Romanian Academy and of other branch academies and the HEIs, the R&D system of national interest includes the R&D institutes or centres organised within the national societies, national companies or independent facilities of national interest, as well as different other public institutions that carry out R&D activities. There is no comprehensive evidence of these entities and the activities that carry out. The “Organisations Registry” – which is part of the BrainMap platform managed by UEFISCDI – counts about 20 national companies/ autonomous administrations with R&D activity (i.e. the National Meteorology Agency, the Autonomous State Owned Company Technologies for Nuclear Energy (RATEN) and different public institutions with strong participation in R&D projects (i.e. Ministry of National Defence/ The Military Equipment and Technologies Research Agency, the Scientific Research Centre for CBRN Defence and Ecology, UEFISCDI, the Romanian Space Agency etc.).⁸⁰

3.2.5 Private R&D actors and R&I intermediaries

As can be observed from Table 3.1, the number of private R&D units has dramatically declined in the last decade, mainly due to the weakening and chronic underfunding of the R&D system. There are about 7000 entities with R&D in their object of activity and being listed in the “Registry of potential contractors” managed by the authority for R&D.⁸¹ There is evidence that the low quality of the science base acts as a disincentive to private R&D⁸² and that private investment is geared towards capacity expansion (machinery and equipment: 56% and land, business buildings and infrastructure: 18%) and significantly less towards R&D, innovation and training of employees.⁸³

78 OECD (2019), Supporting Entrepreneurship and Innovation in Higher Education in Romania, pp. 35-37

79 Law 1/2011 on National Education

80 Organisations Registry: <https://www.brainmap.ro/index.php>

81 Registrul potentialilor contractatori

https://rpc.research.ro/index.php?content=contractori2.php&denumire_inst=&cod_fiscal=&nr_inreg=2&pag=5

82 EC (2018) SWD(2018) 221 final Country report Romania 2018

83 European Investment Bank (2020) EIB Investment Survey – Romania overview. https://www.eib.org/attachments/efs/eibis_2020_romania_en.pdf

- R&I intermediaries: 49 accredited/ authorised entities are part of the National Network for Innovation & Technology Transfer (ReNITT).⁸⁴

According with the Law of Research, the state supports the development of innovation and technology transfer infrastructure at the national, regional and local level; the initiative to establish such an entity may belong to public administration authorities, research units, HEIs, chambers of commerce and industry, employers' and professional associations, as well as to the economic agents based in Romania.⁸⁵ The establishment, operation, evaluation and accreditation of the entities from the innovation and technological transfer infrastructure (ReNITT) is regulated by the Government Decision no 406/2003.⁸⁶ By law, the authority for R&D should co-finance the establishment and development of ReNITT thorough the "Programme for the support and development of technology transfer and innovation infrastructure" (Art. 86); yet, the funding offered through this programme was discontinuous.⁸⁷ At present, the ReNITT counts 39 accredited entities and 10 provisionally authorised entities, including: technology transfer centres (31), technology and business incubators (6), technology information centres (11), office for business links (1).

Clustero - the main platform for cooperation, exchange of information and support for cluster development – joins at present 46 cluster organisations, 12 of which have received the European Cluster Collaboration Platform recognition (Gold, Silver, Bronze labels).⁸⁸

3.3 R&I strategies and plans

The **National R&D&I Strategy (SNCDI)**⁸⁹ is the overarching R&I policy document setting out the vision, the general and specific objectives, the main lines of action that support the specific objectives, the targets and the governance framework over the 2014-2020 period. SNCDI builds on the experience of the 2007-2013 Strategy for R&D&I and attempts to address a number of weaknesses identified in the previous programming period, such as the insufficient number of researchers, the limited intra- and intersectoral mobility, the insufficient use of the research infrastructures or the low public funding for R&D&I.

SNCDI was developed on the **vision** that: "By 2020, Romania will become competitive at regional and global level, through innovation fuelled by research and development, thus generating well-being for its citizens". SNCDI has three general objectives: setting the ambition to increase the competitiveness of the Romanian economy through innovation, to foster the contribution of the Romanian research to the progress of science, and to strengthen the role of

84 MCID (2021) Registry of accredited and provisionally uthorized Innovation and Technology Transfer Entities (updated in January 2021) <https://www.research.gov.ro/ro/articol/4728/sistemul-de-cercetare-infrastructuri-de-cercetare-infrastructura-de-inovare-si-transfer-tehologic-entitati-de-inovare-si-transfer-tehologic>

85 GO 57/2002 on scientific research and technological development

86 Government Decision no 406/2003

87 GO 57/2002 on scientific research and technological development

88 Clustero - <https://clustero.eu/>

89 GD no. 929/ 2014 – National Strategy for Research, Development and Innovation 2014 – 2020 (SNCDI) [RO]

science in society. The specific objectives of SNCDI are summarised in the box below.

Specific objectives (SO) of the National R&D&I Strategy (SNCDI)

SO1: Creating an enabling environment for the private sector initiative, through instruments that support entrepreneurship and the commercialization of R&D results.

SO2: Supporting smart specialisation, by concentrating R&I resources in areas with economic relevance and demonstrated R&D potential, through public-public partnerships leading to concentration, efficiency and effectiveness.

SO3: Concentration of an important part of R&D&I activities on societal issues, to support the development of the capacity of the public R&D&I sector to respond to the global challenges of importance for Romania;

SO4: Supporting the aspiration to excellence in frontier research, through the internationalisation of Romanian research, use of international evaluations, increase of the attractiveness of the Romanian R&D&I system;

SO5: (By 2020) Reaching out a critical mass of researchers to transform R&D&I in a driver for economic growth, by ensuring the rapid and sustainable increase of human resources in R&D&I;

SO6: Development of successful research organisations, able to operate regionally and globally, by stimulating the defragmentation of the R&D&I system, concentrating resources and prioritising allocations, encouraging public-private partnerships, funding science and assessing the impacts, introducing new funding models to spur innovation.

SNCDI also defines the national Smart Specialisation (S3) priorities for Romania. A large foresight process – coordinated by a consortium of relevant public and private institutions - was carried out in order to define the R&D&I priorities, including the smart specialisation priorities and the priorities of public interest. The process was based on data analytics and was supported by wide stakeholder participation (200 panellists and 4000 online respondents); the S3 specialisations resulting from consultations were extended by political decision⁹⁰ and the final set of priorities included: *Bioeconomy; ICT, Space and Security; Energy, Environment and Climate change; Eco-nano Technologies and Advanced materials; Health*. In addition, the national priorities include *Basic Research, Heritage and Cultural Identity* and *New and Emerging Technologies*, with the latter being more a framework for public procurement for innovation than a pre-defined set of technologies.⁹¹

90 Gheorghiu, R. (2015) RIO Country Report Romania 2014. European Commission & JRC, Report EUR 27303 EN

91 Curaj, A. and Chioncel, M. (2015) Stairway to Excellence Country Report: Romania, European Commission & JRC, Report EUR 27466 EN

SNCDI renewed the commitment to reach the official target of 1% of GDP public R&D expenditures, complemented by an additional 1% of GDP from private sources.⁹² These figures were considered as the basis for the SNCDI 2020 and its **main implementation instruments**: the National R&D&I Plan (PNCDI 2015-2020) and the Operational Programme (OP) "Competitiveness" 2014-2020, Priority Axis 1.

SNCDI is also supported from: the Regional OP 2014-2020, the SMEs competitiveness component; OP Human Capital 2014-2020, the Education & Training component; Rural Development Programme 2014-2020, the Knowledge transfer & Cooperation component; Sectoral R&D&I plans of other Ministries (i.e. Agriculture, Health, Energy, Defence etc.); R&D Plan of the Romanian Academy and its units; other instruments (i.e. EEA Financial Mechanism 2014-2021, R&D tax incentives etc.).

Smart specialisation projects related to the national S3 priorities have been eligible for funding from the National R&D&I Plan, as well as from other EU programmes coordinated by other ministries.

SNCDI was developed in synergy with the **National Strategy for Competitiveness (SNC) 2014-2020**⁹³, an "umbrella" strategy coordinated by the Ministry of Economy that aims to correlate the competitiveness interventions, taking into account the national areas of excellence. SNC identifies 10 economic sectors with competitive potential, which are linked to the S3 priorities identified within the SNCDI (Table 3.2).

92 The Law on Research sets the 1% of GDP public R&D expenditure target.

93 GD 775/2015 for the adoption of the National Strategy for Competitiveness 2015-2020

Table 3.2 Sectors of competitive advantage (SNC) and smart specialisation (SNCDI) in Romania 2014-2020

Sectors of competitive advantage (SNC) \ S3 priorities (SNCDI)	Bio-economy	ICT, space & security	Energy, environment, climate change	Eco-nano technologies and Advanced materials	Health
Tourism and ecotourism	√		√		√
Textiles and leather				√	
Wood and furniture, constructions ⁹⁴				√	
Creative industries		√		√	√
Car and car components		√		√	
ICT		√			
Food and beverage processing	√			√	√
Health and pharmaceuticals	√			√	√
Energy and environment management	√	√	√		
Bio-economy, biopharmaceutical and biotechnology sectors	√		√	√	√

Source: National Strategy for Competitiveness 2014-2020, p. 8

The National Strategy for Competitiveness 2014-2020 defines five strategic priorities related to (i) improving the regulatory environment; (ii) strengthening the partnerships between the public and the private sector; (iii) advancing the supporting factors and the support services (iv) promoting the 10 economic sectors with competitive potential and (v) preparing the Generation 2050 and addressing societal challenges. Under priority (iii), SNC plans to support the R&D&I activities of enterprises and to develop, especially in S3 priority areas, integrated structures that bring together companies and research organisations with similar and/or complementary profile (i.e. competence centres, innovation clusters). The **Government Strategy for the SME sector and business environment Horizon 2020⁹⁵** also includes different actions to support the innovative SMEs and to stimulate technology transfer, the protection of intellectual property rights, the creation of public-private partnerships, university spin-offs, innovative clusters etc. **Romania’s Export Strategy for the period 2014-2020** aims at increasing the role of R&D&I and of technology transfer in favour of experts, as well as to support the creation of an export-oriented network

94 Construction were added at a later stage (2018).

95 GD 859/2014 on the adoption of the Government Strategy for the SME sector and business environment: Horizon 2020

of innovative clusters.⁹⁶ However, nor the SNC or the strategy for SMEs were followed by clear action plans, resources and institutional commitments⁹⁷ and their implementation remains unclear. An intermediary independent evaluation of the SNC revealed that by 2018 only one out of the 27 strategic objectives was achieved (i.e. digital infrastructure), while seven objectives were only partially achieved. The objectives with an R&D&I component were not achieved at that time.⁹⁸

Beside the SNC, the National R&D&I Strategy has direct connections with the **Regional Smart Specialisation Strategies (RIS3)** elaborated by the development regions and coordinated by the Regional Development Agencies. As emphasised in Section 3.1, regional autonomy is quite limited in Romania, which means that the spectrum of instruments these strategies can use is very narrow and mostly focussed on the allocation of R&D&I funds under the Regional Operational Programme. The elaboration of the S3 strategies evolved at different speeds, with seven out of the eight RIS3 being drafted during the 2013-2018 period and the RIS3 of the capital region Bucharest-Ilfov being completed in 2020. Szavics and Benedek (2020) critically evaluated the definition of smart specialisation priority areas selected by the Romanian regions⁹⁹ (Annex 1) and concluded that the RIS3 present a high level of heterogeneity; the main shortcomings identified refer to a less targeted approach within priorities, overlapping between niches corresponding to different priorities and a lack of clear separation between vertical and horizontal priority areas.¹⁰⁰

The EC/ DG Regio/ JRC have provided targeted assistance to the Romanian regions through different closely complementary activities. The main instrument has been the **"Targeted Support to Smart Specialisation Romania" (2016-2020)** project, that implemented a Preparatory Action of the European Parliament called "The economic competitive advantages and the potential for smart specialisation at the regional level in Romania". In early 2016, two regions, namely North West and North East, received support for improving S3 governance and coordination, implementing entrepreneurial discovery processes, and engaging the quadruple helix actors in S3 implementation. Four extensions of the initial project allowed the rollout to all eight Romanian regions.

At the same time, assistance has been provided to Romania through other parallel projects coordinated by JRC, such as the **Stairway to Excellence (S2E)** project that was aimed at fostering synergies between ESIF, Horizon 2020 and other EU/ national programmes, the **Targeted Support to RIS3 in Lagging Regions**, which covered nine countries and regions from Southern, Central and Eastern

96 Ministerul Economiei, Departamentul de Comert Exterior si Relatii Internationale. Strategia Națională de Export 2014 – 2020, https://cursdeguvernare.ro/wp-content/uploads/2014/06/SNE_2014_2020.pdf

97 Gheorghiu, R. (2015) RIO Country Report Romania 2014. European Commission & JRC, Report EUR 27303 EN

98 INACO (2018) Prima monitorizare independenta a SNC 2015-2020 <https://inaco.ro/prima-monitorizare-independenta-a-snc-strategia-nationala-de-competitivitate-2015-2020/>

99 The RIS3 of the capital region was not included in the analysis

100 Szavics P., Benedek J. (2020) Smart Specialisation Priorities of Less Developed Regions. A Critical Evaluation. In: Bevilacqua C., Calabrò F., Della Spina L. (eds) New Metropolitan Perspectives. NMP 2020. Smart Innovation, Systems and Technologies, vol 177. Springer, Cham

Europe, including Romania, the **Higher Education and Smart Specialisation (HESS)** project that included North-East Romania as a case study etc.¹⁰¹ In 2019, Romania expressed interest for an **Industrial Transition Review** performed by the JRC. The lead partner was the Ministry of Economy (2019), as the national coordinator of the competitiveness policies and the Romanian Agency for Digitalisation (from 2020), given that the review theme proposed by the Romanian authorities is related to *digitalisation for agri-food areas, urban development and health*. Yet, as pointed by Ranga (2020)¹⁰², initial interest in this review was not driven by national economic and policy prioritisation, but by the need to fulfil Criterion 6 "Actions to manage industrial transition" of the 2021-2027 enabling condition for ERDF. According to the preliminary conclusions of the review, Romania lacks preparedness to meet the digitalisation challenges, but the proposed industrial review could help clarify the "division of labour" and the "desired state" of the transition.¹⁰³

The EC/ DG Regio/ JRC assistance has largely contributed to the introduction of a novel approach to regional innovation policy in a centralised country, which further needs to consolidate the multilevel governance structure and build a coherent regional level in R&I policymaking.¹⁰⁴ As indicated in the 2020 European Semester Country Report for Romania, such initiatives are very promising in terms of capacity building, but they "cannot achieve full potential and increase the country's performance and competitiveness unless a functional and robust national innovation and entrepreneurship ecosystem is set up".¹⁰⁵

SNCDI has also synergies with the **National Strategy for Tertiary Education 2015-2020**¹⁰⁶, as well as with the other strategies under the coordination of the Ministry of Education that make up the Strategic Policy Framework for Education and Training in Romania.¹⁰⁷ The long-term objective of this Strategy for Tertiary Education is to contribute to the Government of Romania's efforts to support economic growth, productivity increases and social cohesion by investing in human capital and research, as a precondition for a knowledge-based economy. The Strategy is structured on three pillars: (i) improving participation in tertiary education, (ii) flexible, relevant and high-quality programmes and (iii) strategic commitment to the economic sector. Among others, the strategy aims to:

101 EC/ DG Regio/ JRC: Targeted Support to Smart Specialisation in Romania (2016 - 2020). <https://s3platform.jrc.ec.europa.eu/romania>

102 Ranga, M. (2020) Industrial transition review of Romania. Joint Research Centre, october 2020. <https://s3platform.jrc.ec.europa.eu/w/ewrc-2020-evidence-for-industrial-transitions>

103 Idem

104 Ranga M. (2018) Smart specialisation as a strategy to develop early-stage regional innovation systems. European Planning Studies 26(2018) - Issue 11: Regional innovation systems and entrepreneurial embeddedness, 2125-2146

105 EC SWD (2020) 522 final Country Report Romania 2020, p. 51 <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1584543810241&uri=CELEX%3A52020SC0522>

106 GD 565/2015 on the approval of the National Strategy for Tertiary Education 2015-2020

107 The Strategic Policy Framework for Education and Training in Romania (2014-2020) includes the National Strategy for the Reduction of Early School Leaving; the National Lifelong Learning Strategy; the National Strategy for Romanian Tertiary Education; the Education and vocational training strategy in Romania during 2016-2020; and the Strategy for Infrastructure Investments in Educational Institutions.

increase the quality of the study programmes, especially in the areas with relevance for the (10) sectors of competitive advantage (defined by the SNC) and for the Romanian smart specialisation areas (defined by SNCDI) and to increase the quality and relevance of the doctoral and post-doctoral programmes.

Between 2016 and 2020, the Ministry promoted various measures to develop and integrate the information system in education and research, increase the internationalisation of higher education, promote entrepreneurial education, increase the quality of higher education and matching with the labour market needs etc.¹⁰⁸ Developing R&D in universities and increasing the performance of doctoral schools in conditions of transparency, ethics and academic integrity is among the strategic priorities of the Ministry of Education for 2021.¹⁰⁹

Other sectoral strategies have an R&D&I component, as follows:

- The **National Health Strategy 2014-2020** has a specific objective (SO 5.6) related to the *Promotion of R&I in health*, which is aimed at developing the R&D&I capacity in the health sector through support offered to basic and applied research projects, the creation of health clusters or the transfer of applications in medical practice.¹¹⁰ A sectoral R&D Plan for the health sector was elaborated in 2015 (for the 2015-2017), but its implementation and results remain unclear.¹¹¹
- The **Strategy for R&D&I in the agri-food sector on medium and long term 2014-2020/ 2020-2030** was prepared approved by the Ministry of Rural Development¹¹², but it has not been endorsed officially by Government Decision. The strategy aims to increase the efficiency and competitiveness of agricultural research at the national and European level and at strengthening the contribution of agricultural research to the development of the agri-food sector. The **National Plan for Rural Development 2012-2020** has specific R&D&I objectives that are intended to support innovation, cooperation and the creation of a knowledge base in rural areas, to strengthen the links between agriculture and food production, on the one hand, and R&I, on the other hand, including for the purpose of better environmental management.¹¹³
- A new version of **Romania's Energy Strategy (2019-2030, with perspective of 2050)** is under preparation by the Ministry of Energy.

108 Romania - National Reform Programme 2016-2020: Tertiary education

109 Ministry of Education (2020) Report on the state of higher education in Romania 2019-2020
https://www.edu.ro/sites/default/files/_fi%C8%99iere/Minister

110 GD 1028/2014 on the approval of the National Health Strategy 2014-2020 and of its Action Plan

111 Ministry of Health, Order no 813/2015 on the approval of the Sectoral R&D Plan (2015-2017)

112 MADR – Strategia pentru CDI în domeniul agroalimentar pe termen mediu si lung 2014-2020/ 2020-2030
<https://www.madr.ro/docs/cercetare/strategia-cercetare-inovare.pdf>

113 National Plan for Rural Development 2014-2020 – Version 2021. <https://www.pndr.ro/>

Increasing the quality of education and R&D-based innovation in energy is one of the eight strategic objectives of the Strategy.¹¹⁴

- **Romania's Sustainable Development Strategy (SNDDR) 2030**, which builds on the 17 global Sustainable Development Goals, envisages an increase of approximately 30% in the research budget each year, to support both applied research and innovation, and fundamental and frontier research, with a focus on areas of smart specialisation/ with potential for growth. By 2030, the goal is to significantly increase the number of R&D employees and the public and private spending (under SDG 9: Industry, Innovation and Infrastructure). The strategy also plans for the stimulation of R&D in the agri-food sector (under SDG 2: Zero Hunger), the support for medical research (under SDG 3: Good Health and well-being), for interdisciplinary research (under SDG 4: Quality Education), for the protection and conservation of protected areas and living aquatic resources (under SDG 14: Life below water) or for the conservation of ecosystems (SDG 15: Life on Land).¹¹⁵ The recent monitoring of the Sustainable Development Strategy shows a decline in all indicators related to R&D&I between 2008-2018/2019, i.e. budgetary allocations for R&D in agriculture (-11.7% per year), private R&D funding in agriculture (-10.6% per year), total R&D expenditure as % of the GDP (-0.006% per year), innovation turnover as % of total turnover (-1.02% per year).¹¹⁶ The Action Plan for the implementation of SNDDR is under preparation.
- Romania participates in the **EU Strategy for the Danube Region (EUSDR)**, the largest and most diverse macro-regional strategy in the EU, involving nine EU Member States, three Accession Countries and two Neighbouring Countries. One of the four pillars of EUSDR ("Building Prosperity") envisages actions to support the knowledge society (research, education and ICT), to foster the competitiveness of enterprises and human resources development. The Danube Interreg Transnational Programme supports EUSDR in many respects. The EC Report on the implementation of the EUSDR notices important achievements such as the establishment of the Danube Funding Coordination Network, which promotes joint funding actions for R&I, as well as the development of a Joint bio-based Industry Cluster Policy Strategy and of a bundle of new tools to support clusters and partnerships for transnational working; yet, some challenges remain and the actions in the upcoming period should strengthen the ownership and commitment of line ministries (governance) and continue to seek synergies with existing instruments (funding).¹¹⁷ The Action Plan of the EUSDR has been recently revised and

114 Ministry of Energy – Strategia energetica a Romaniei 2019-2030, cu perspectiva anului 2050. <http://energie.gov.ro/transparenta-decizionala/strategia-energetica-a-romaniei-2019-2030-cu-perspectiva-anului-2050/>

115 GD 877/2018 on the approval of Romania's Sustainable Development Strategy 2030

116 SGG (2021) Raport de evaluare a politicilor, planurilor si strategiilor de actiune sectorial in relatie cu obiectivele Strategiei Nationale pentru Dezvoltarea Durabila

117 EC SWD (2019) 6 Commission Staff Working Document on the implementation of EU macro-regional strategies. <https://danube->

different targeted activities have been established to promote coordination of national, regional and EU Funds for R&I, to promote participation of Danube countries in EU R&I Programmes, in particular in Horizon Europe, to strengthen cooperation among universities, research organisations and SMEs in the Danube Region, to support exchange of information and experience for the preparation of future strategic R&I documents applicable in the new programming period etc.¹¹⁸

- In 2019, Bulgaria, Georgia, Moldova, Romania, Russia, Turkey and Ukraine endorsed the *Bucharest ministerial declaration on the common maritime agenda for the Black Sea*. A strategic research and innovation agenda (**SRIA**) has been launched with the aim of advancing a shared vision for a productive, healthy resilient and sustainable Black Sea by 2030.¹¹⁹

The interim evaluation of SNCDI (2014-2019) was completed in 2019, but it had a focus on the interventions of the National R&D&I Plan and of the OP Competitiveness (Priority Axis 1) and not on all R&D plans and instruments that support the implementation of SNCISI. The preliminary results are synthesised in the box below.

Interim evaluation of SNCDI (2014-2019)

- Budget allocations have been significantly reduced as compared to the amounts established as projections. Although some progress has been made, the deviation from targets is significant. The lack of predictable funding affected the internal coherence of SNCDI.
- Overall, the planned interventions had a modest, but positive contribution to the achievement of the SNCDI's overall objectives. The micro impact assessment highlights positive effects at the level of all evaluated interventions and at the level of all smart specialisation areas.
- Synergies between SNCDI and complementary strategies need to be better exploited and coordinated in terms of results.
- SNCDI's governance system was not operationalised, which reduced the level of support and commitment required to achieve the strategy's objectives. CNPSTI should have evaluated the implementation of the national RDI strategy and should have prepared annual reports on this basis, including conclusions and recommendations on the strategic orientation of the national RDI system.

region.eu/download/ec_report_to_ep_ecouncil_eesc_cor_jan2019/?wpdmid=571&refresh=5d5fd5974203d1566561687

118 EC SWD (2020) 59 European Union Strategy for Danube Region <https://danube-region.eu/wp-content/uploads/2020/04/EUSDR-ACTION-PLAN-SWD202059-final-1.pdf>

119 EC (2019) A shared vision for sustainable Blue Growth in the Black Sea by 2030 https://ec.europa.eu/info/sites/default/files/research_and_innovation/research_by_area/documents/blackseasria_factsheet_final_corrected.pdf

- The beneficiaries of the analysed programmes (PNCDI, OP Competitiveness) were generally satisfied with the interaction with the calls' organisers. The most important issues raised in terms of funding instruments were the lack of a pre-established calls' schedule, the discontinuities in project financing, especially in the first part of the year (until the approval of expenditure budgets), the project evaluation process (i.e. the impossibility of contesting the evaluation results, except for the procedure, the long duration of evaluation) or the short duration of the interventions in relation to the time needed to achieve the R&D objectives.
- For the 2015-2018 period, it is estimated that SNCDI had a direct contribution to GDP of 0.205% and a direct contribution to employment growth of 0.518%. Although the direct effects are modest (due to the low level of R&D funding and the low number of R&D employees), the total cumulative contribution of SNCDI to the evolution of macroeconomic indicators (direct, indirect and induced effects) should not be neglected.

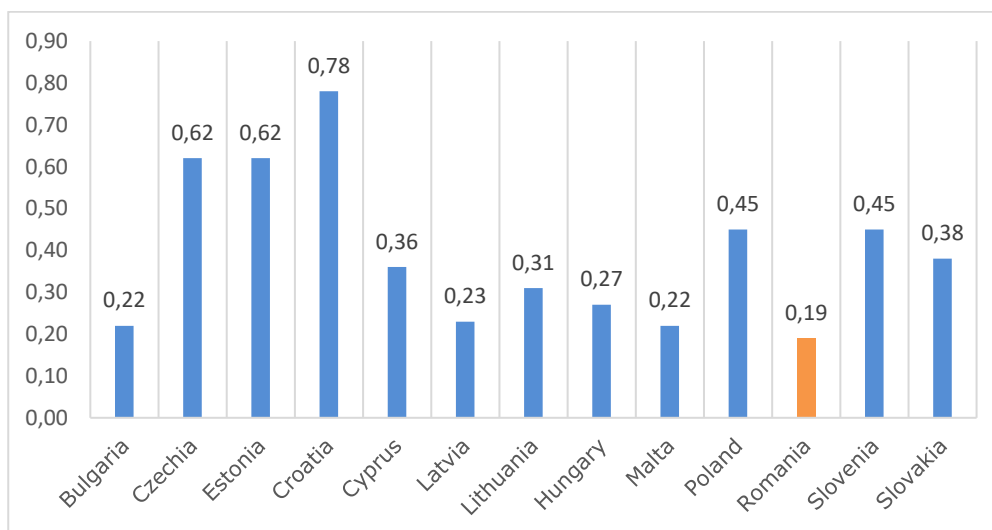
Source: INCSMPS (2019), Impact assessment of SNCDI 2014-2020, aggregated at the national level. Interim evaluation (2014-2019), June 2019

3.4 R&I funding mix

3.4.1 The R&I funding mix in EU13

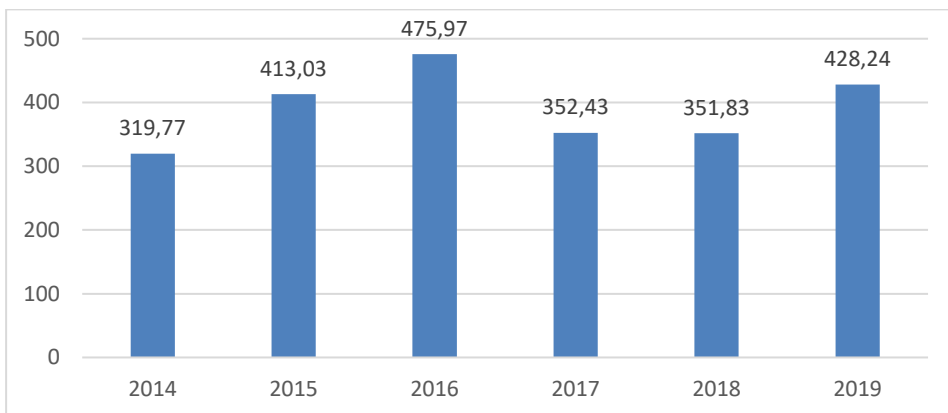
Within the EU13 group, Romania has the lowest share of government support for R&D (GBARD) in GDP (0.19% of GDP in 2019) (Figure 3.2). Between 2014 and 2019, total governmental allocations for R&D varied between €319.7 million (2014) and €475.9 million (2016) (Figure 3.3), which represents about 0.5% of total general government expenditure, compared to 1.4% at the EU27 level.

Figure 3.2 Total government budget allocations for R&D (% GDP), 2019



Source: Eurostat, GBARD by socioeconomic objectives (NABS 2007) [gba_nabsfin07]

Figure 3.3 Government budget allocations for R&D in Romania (GBARD, € million)



Source: Eurostat: GBARD [gba_nabsfin07]

No official statistics exist about the shares of institutional vs project funding in Romania, but there is some evidence that the competitive funding based on rigorous institutional evaluations is limited.¹²⁰

Table 3.3 shows the funding mix combining GBARD and Horizon 2020 funds, as well as the planned allocations for R&I under ESIF. A preliminary conclusion is that both the H2020 funds and ESIF funds for R&I account less in the funding mix of Romania as compared to most EU13 countries. Participation in H2020 remains below its potential; only €288.7 million has been awarded to Romanian researchers through H2020, while some countries much smaller in terms of population size have attracted much more (i.e. Slovenia, Cyprus, Hungary) (see also Chapter 7). On the other hand, even though Romania is one of the most important recipients of ESIF funds at the EU level, the ESIF allocations for R&I are rather modest (see also Chapter 4). In total, European R&I funds account for about one third of the funding mix based on GBARD, ESIF for R&I and FP contributions.

120 Chioncel (2020), op cit., p. 82

Table 3.3 2014-2020 GBARD, Horizon 2020 and 2014-2020 ESIF for R&I (Planned), € million

EU13	GBARD Total 2014-2020 <i>Spent</i>	Horizon 2020 <i>Spent</i> EU contri- bution	ERDF for R&I <i>Planned</i> EU contri- bution	EAFRD for R&I <i>Planned</i> EU contri- bution	ERDF & EAFRD for R&I <i>Planned</i> EU contri- bution
Bulgaria	816	154.8	293	41	334
Czechia	8277	493.8	2347	62	2409
Estonia	1116	258.4	588	23	611
Croatia	2618	128.9	689	9	698
Cyprus	485	310.8	87	2	89
Latvia	409	114.9	448	27	475
Lithuania	951	93.9	655	21	676
Hungary	2677	364.2	1843	74	1917
Malta	173	36.7	49	5	54
Poland	12574	713.2	7417	106	7523
Romania	2627	288.7	913	81	994
Slovenia	1316	372.6	498	19	517
Slovakia	2278	136	1143	55	1198

Source: Eurostat: GBARD [gba_nabsfin07]; EC ESIF 2014-2020 Data Platform: <https://cohesiondata.ec.europa.eu/>; EC Horizon 2020 – Country profiles

3.4.2 R&I funding by instruments and main funding bodies

According to the Law of Research (Art. 49.3), the state allocates public funds for actions financed on the basis of R&D programmes, as well as for other expenditures established under the law and ensures annually an increase in budget allocations, so that to reach 1% of GDP by 2020. However, by the end of 2019, government budget allocations for R&D (GBARD) accounted for only 0.19% of GDP. In this context, by an emergency ordinance from January 2020, it was decided that the provisions of Art. 49 (3) shall apply from 2022. The Law of Research stipulates that the funds allocated from the state budget are used primarily to finance the objectives of the National R&D&I Strategy and National

R&D&I plan, as well as to finance the activities of research units that obtain partial funding on international programmes to which the Romanian state contributes. The state also finances from the state budget the expenses for the operation, maintenance, decommissioning and guarding of facilities and special objectives of national interest, as well as the objectives of the sectoral plans and the core programme etc. (Table 3.4).

Table 3.4 Main R&I programmes managed by the Authority for R&D (MCID) and its funding bodies (€ million)

Main instruments	2014	2015	2016	2017	2018	2019	2020	Funding bodies
NATIONAL FUNDS								
Total budget managed by MCID	277.2	352.8	393.5	307.1	301.6	301	285.8	MCID
Of which:								
<i>National R&D&I Plan* (PNCDI)</i>	115.9	114.1	141.8	132.7	118.9	116.6	106.6	MCID, UEFISCDI, ROSA, IFA
<i>CORE Programme</i>	64.5	71.1	83.5	77.4	110.3	102.8	85.8	MCID
<i>R&D facilities and special objectives (IOSIN)</i>	15.9	19.4	21.5	19.3	23	21.4	19.6	MCID
<i>Membership fees for international organisations</i>	32.4	37.3	37.3	23.7	21.7	22.8	47.2	MCID
EXTERNAL SOURCES								
ESIF OP Competitiveness, PA 1 (ERDF)	Planned allocations for 2014-2020: €931.8 million, of which €780.4 million is made up by the EU contribution							MCID – Intermediate body
EEA & Norway Grants 2014-2021 , Research Programme	€55.5 million, of which €47.2 million is made up by the EEA & Norway contribution							UEFISCDI – Programme operator

Notes: Official average annual exchange rates used to convert Romanian Lei into Euro: 1 euro: 4.44 lei (2014); 4.44 lei (2015); 4.49 lei (2016); 4.56 lei (2017); 4.65 lei (2018); 4.74 lei (2019); 4.83 lei (2020) (<https://www.cursbnr.ro/curs-valutar-medi>); *PNCDI II for 2014-2015 and 2016; PNCDI III for 2016-2020

Sources: National funds: MCID – Budget execution (2015-2020)
<https://www.research.gov.ro/ro/articol/2427/sistemul-de-cercetare-bugetul-cercetarii-executie>; ESIF:
<https://cohesiondata.ec.europa.eu/>; EEA & Norway Grants: <https://eeagrants.org/>

- **PNCIDI 2016-2020**

As can be observed in Table 3.4, PNCIDI (project-based funding) had the largest share in the overall R&D budget administered by MCID, of about a third, throughout the analysed period.

PNCIDI is the main implementation instrument of the National Strategy for R&D&I, whose objective is to increase the competitiveness of the Romanian economy through innovation, increase the contribution of Romanian researchers to the progress of science and increase the role of science in society (Art. 3). The estimated budget of PNCIDI was of 15000 million Lei (about €3000 million)¹²¹, but by the end of 2020 PNCIDI had total allocations of less than €1,000 million (Table 3.4). In 2020, the implementation of PNCIDI was extended by one year. Annex 2 shows the architecture of PNCIDI by programmes and sub-programmes.

The interim evaluation of PNCIDI 2014-2019 reflects the consequences of R&D under-financing and shows the progress in PNCIDI implementation.

Interim evaluation of PNCIDI (2014-2019)

Reduced and unpredictable funding is PNCIDI's greatest vulnerability. For most instruments, only one competition – with relatively low allocation of financial resources - was organised between 2016-2018. Competition was fierce and the bidding efforts from the applicants were high.

There is continuity between the research directions of PNCIDI II (2007-2013) and the smart specialisation priorities defined in PNCIDI III (2014-2020), which is an important driver for the development of these fields. The financing instruments are slightly different, with PNCIDI III giving more importance to the competitiveness objective and to public-private partnership, as compared to its predecessor.

The continuity of research is limited by the fact that PNCIDI funding instruments are only of competitive type. Given that for most instruments only one competition was organised, it was impossible to submit projects and obtain results throughout the whole cycle, from idea to market.

The lack of operationalisation of the governance framework of PNCIDI has also negatively influenced the implementation of PNCIDI; there was a lack of transparency on how the decision on the allocation of resources was taken and how the funding priorities at the level of each strategic component were established.

121 GD 583/2015 on the approval of the National R&D&I Plan 2015-2020 (PNCIDI)

The collaboration with UEFISCDI's representatives – which coordinate the implementation of most PNCDI instruments – was favourably appreciated by the entities that carried out research projects. At the same time, the project submission and monitoring platform managed by UEFISCDI was favourably evaluated, with the exception of the section dedicated to the project budget, which requires, in the opinion of beneficiaries, too much detail of project activities and costs.

Source: INCSMPS (2019), Impact assessment of SNCDI 2014-2020, aggregated at the national level. Interim evaluation (2014-2019), June 2019

- **The CORE Programme**

The CORE Programme is the main public funding source for the INCDs' R&D agendas; each institute has a "core" portfolio of projects reflecting its own R&D strategy, as well as the specific objectives related to the development of the economic and social fields in which the INCDs operate. MCID takes the decision on the prioritisation of INCDs "core" programmes based on the analysis of the previous performance of the institutes and the estimated results and impacts, including the contribution to the achievement of SNCDI objectives.¹²² According to the Law on Research, the annual allocation from the CORE programme of an INCD may not be less than 20% and may not exceed 70% of the average revenue from R&D&I in the last 3 years.¹²³

As can be seen in Table 3.4, the share of the Core Programme in the total budget of MCID is at present about 30%; the allocations for this programme have increased from 2018 and are now close to the allocations for the National R&D&I Plan (see also Chapter 5).

An audit of performance of the efficiency of R&D&I funding of INCDs between 2016-2018 have been recently finalised, whose main results are presented in the box below.

122 MCID – "CORE" Programme <https://www.research.gov.ro/ro/articol/3768/programe-na-ionale-programe-nucleu>

123 GO 57/2002 on scientific research and technological development, Art. 67

External evaluation of the CORE Programme

- Between 2016-2018, about 37% of the total funding sources attracted by the INCDS came from the CORE Programme and about 10% came from the state budget related to INCDS' investments and operation of R&D facilities and special objectives of national interest. 26% of the funds were attracted from the competitions organised within the National R&D&I Plan (15%) and from ESIF sources (11%). Not least, about 17% of total INCDS budget came from private sources.
- More than half of the 2016-2018 budget of the CORE Programme went to only seven national R&D institutes, while the remaining INCDS (about 40 entities) have received the other half. The "Horia Hulubei" National Institute for Physics and Nuclear Engineering (IFIN-HH Bucharest), the National Institute for Laser, Plasma and Radiation Physics (INFLPR Bucharest) and the National Institute for Aerospace Research "Elie Carafoli" were the most important recipients of the Core Programme allocations.
- In a similar vein, more than half of the 2016-2018 budget for investments in INCDS' infrastructure (which are covered by a separate fund) went to only nine national R&D institutes, while the rest (about 30 INCDS) have received the other half.
- The lack of multi-annual budgeting frameworks and of the predictability of financing determined the management of some INCDS to contract bank loans to cover current expenses. The payment of the costs of these bank loans can be considered a proof of the inefficiency of the management of the Romanian R&D&I system.
- Actions are needed to clarify the conditions and criteria for staff remuneration within the Core Programme. Investments in INCDS' infrastructure also need clearer procedures and more transparency.

Source: Court of Accounts (2020), Synthesis of the performance audit report on the efficiency and effectiveness of the R&D activity financed for the national institutes.

- **IOSIN Programme**

According to the Law of Research (Art. 49), the costs for the operation, maintenance, decommissioning and guarding of the installations and special objectives of national interest (IOSIN) are financed from the state budget, within the limits of the budgetary funds allocated on an annual basis. The list of facilities and special objectives of national interest for which funds are allocated from the state budget is established and updated at Government level, while the selection criteria of facilities and special objectives of national interest are approved at the level of the Authority for R&D. In the analysed period, the allocations for IOSIN varied between 5% and 7% of the annual budget of MCID (See also Chapter 5).

The performance audit carried out by the Court of Accounts shows that the initial list of installations of national interest included only 11 examples of infrastructure, but later the selection became more permissive. In this context, the number of installations financed from the state budget increased: between November 2017 and July 2018, 37 new installations were evaluated and 16 installations that met the minimum score were selected for funding. There was no unitary and detailed procedure to explicitly define the maintenance, operation and guarding activities. In 2019, the IOSINs prepared detailed technical reports that can be consulted on the website of MCID.¹²⁴ Actions are further needed to clarify the conditions and criteria for IOSIN funding.

- **Participation in international organisations**

The **membership fees for participation in international R&D&I organisations and programmes** (i.e. ESA, CERN, FAIR, ICGEB Trieste) have an important share in the overall R&D budget administered by MCID, ranging from about 7% (2018) to more than 16% (2020) (see also Chapter 7.3).

- **Operational Programme Competitiveness (POC), Priority Axis 1**

The OP Competitiveness, Priority Axis 1 addresses the challenges stemming for the low support for R&D&I in Romania; its aim is to reinforce the R&D&I capacity of the country (resources and infrastructure), to boost private investments in R&D&I and to strengthen the links between innovative SMEs and research organisations. MCID is intermediate body for POC, PA1. A detailed presentation of this programme is provided in the chapter on ESIF (Chapter 4).

- **EEA & Norway Grants 2014-2021, Research Programme**

The Research Programme of the EEA and Norway Grants 2014-2021 was aimed at enhancing performance of Romanian research internationally and enhancing collaboration between beneficiary and donor state entities involved in the programme. The programme supports collaborative research projects in basic and applied research in six thematic areas. EEA and Norway Grants also support the Programme "Business Development, Innovation and SMEs" managed by Innovation Norway (€45 million).¹²⁵

Beside MCID, the Romanian Academy, as well as other relevant ministries have R&D allocations allocated from the state budget (Table 3.5).

124 MCID - <https://www.research.gov.ro/ro/articol/2417/instalatii-de-interes-national>

125 EEA and Norway Grants: Romania "Business Development, Innovation and SMEs" Programme <https://eeagrants.org/news/programme-implementation-agreement-signed-business-development-innovation-and-smes-programme-0>

Table 3.5 The R&D&I budget of the Romanian Academy and other ministries (€ million)

Funding body	53.01 Basic research R&D – state budget	86.01 R&D in economic fields
NATIONAL FUNDS		
Romanian Academy	63 (2015); 45.2 (2016); 52.1 (2017); 58.8 (2018); 66.5 (2019)	-
Ministry of Education	6.6 (2017) 7 (2018) 7.5 (2019)	-
Ministry of Agriculture and Rural Development	-	6.2 (2015); 11.5 (2016); 16.2 (2017); 34 (2018); 37.1 (2019)
Ministry of Energy	-	15 (2015); 14.3 (2016); 14.7 (2017); 14.9 (2018); 17.7 (2019)
ESIF FUNDS		
Ministry of Agriculture and Rural Development	National Rural Development Programme, Planned allocations for 2014-2022: €85 million (of which €81 million was made up by the EU contribution)	
Ministry of Public Works, Development, and Administration; RDAs	Regional Operational Programme, PA 1: Planned allocations for 2014-2020: €156.8 million (of which €133.2 million was made up by the EU contribution)	

Note: Official average annual exchange rates used to convert Romanian Lei into Euro: 1 euro: 4.44 lei (2014); 4.44 lei (2015); 4.49 lei (2016); 4.56 lei (2017); 4.65 lei (2018); 4.74 lei (2019); 4.83 lei (2020) (<https://www.cursbnr.ro/curs-valutar-mediu>)

Source: National funds: Court of Accounts – Public annual reports (2015-2019). Report on the state budget execution

- **R&D Plan of the Romanian Academy**

The Romanian Academy has its own chapter in the national state budget, designs its research agenda and distributes the budget among its research institutes and centres; the allocation is highly proportional to the number of researchers.¹²⁶ The Academy publishes annual reports on economic and R&D activity.¹²⁷ Following a

126 Gheorghiu, R. (2015) RIO country report Romania 2014

127 Romanian Academy – Activity reports - https://acad.ro/dari-de-seama/pag_raportari.htm

financial audit mission, the Romanian Court of Accounts expressed a contrary opinion on the financial situation of the Academy.¹²⁸ The box below presents the funding mix of the Romanian Academy.

The funding mix of the Romanian Academy

Between 2016-2020, the share of allocations from the state budget in the total R&D budget of Romanian Academy varied between 65% (2018) and 74% (2020), while the share of funds attracted from the competitions organised within the National R&D&I Plan varied between 17% (2020) and 29% (2016). ESIF shares varied between 3% (2016) and 17% (2018) in the total R&D budget of the Romanian Academy.¹²⁹

- **The financing of R&D activity in universities**

HEIs do not receive direct institutional funding for R&D&I. From 2016, the additional funding for universities has been allocated based on the criteria and quality standards established by the National Higher Education Funding Council (CNFIS) and approved by the Ministry of Education. There are four classes (C) of quality indicators, namely C1: Teaching/ Learning (30%); C2: Scientific activity/ artistic creation (40%); C3: Internationalisation (10%) and C4: Regional involvement/ social equity (20%); consequently, the high-performing universities – and especially those with a strong R&D component - receive higher financial resources from the state budget and used them in the conditions of university autonomy. Some resources for the R&D activity of universities are allocated – on a competitive basis – from the Institutional Development Fund; in 2019, there were 39 projects receiving funding for R&D from the Institutional Development Fund. The total funding amounted 11.5 million Lei (about €2.3 million).

As can be observed in Table 3.5, the R&D resources managed by the Ministry of Education were minimal in the analysed period. It is also important to note that the Romanian higher education sector on the whole is underfunded: in 2019, the budget allocated to the higher education was of only 5338 million Lei or about 0.5% of GDP.¹³⁰

A performance audit of the R&D activity of universities between 2015 and 2017 was carried out by the Court of Accounts. Its main results are summarised in the box below.

128 Curtea de Conturi a Romaniei (2020) Raportul public pe anul 2019. Academia Romana, pp. 124-125

129 Simionescu B. (2021) The 2020 Report of the Romanian Academy: Scientific research activity and training of researchers. <https://acad.ro/dari-de-seama/2020-Dare-de-seama-BCS.pdf>

130 CNFIS (2020) Raport public 2019 Starea finantarii invatamantului superior http://www.cnfis.ro/wp-content/uploads/2020/12/raport_public_CNFIS_2019.pdf

Evaluation of R&D funding at HEI level

Although universities are considered important actors in the national research system, they do not benefit from institutional funding from the R&D budget. Except for the universities in the category of Social, human and economic sciences, the amounts attracted by the Romanian universities from the national R&D budget are lower than those from non-reimbursable external funds.

Universities have developed their own strategies for R&D&I, either as stand-alone documents or as part of other strategic documents (e.g. University Charter, Rector's management plan, HEI strategic plan etc.). Yet, in most HEIs, the strategies for R&D&I are not accompanied by planning documents and budgetary projections.

The R&D material base of universities is mostly constituted on the basis of research projects obtained through national and international competitions. Ensuring the sustainability of the R&D infrastructure after the completion of projects is a major challenge for universities.

Universities have different approaches in establishing the university norm, which, by law, includes the teaching norm and the research norm. Only few universities make a clear separation between the teaching norm and the research norm or have dedicated R&D staff.

Periodic analyses of the activity of the R&D centres/ departments/ units organised at the university level are recommended, as a basis for the distribution of additional funding for excellence.

Court of Accounts (2019) Audit of the performance of the administration of the didactic and research base held by the higher education institutions

In 2021, a new fund amounting 100 million lei (about €20 million) was announced to support R&D in state universities.¹³¹

Some funds for R&D are also included in the funding of doctoral studies. According to the methodology developed by CNFIS and approved by the Ministry of Education, state universities are provided distinct funds for the financing of doctoral schools, which include the salary of the doctoral supervisor and of the members of the steering committees, the cost of doctoral training, R&D funds, the indirect costs for the functioning of doctoral schools. Doctoral scholarships awarded to PhD students are budgeted separately.¹³² Table 3.6 shows the allocations from the state budget for doctoral studies, as well as the planned allocations for support to doctoral and post-doctoral students planned under the Operational Programme Human Capital (POCU) (see also Chapter 5).

131 Ministerial Order no 3747/2021 on the financing of university scientific research within the state HEIs in 2021

132 CNFIS (2020) Raport public 2019 Starea finantarii invatamantului superior http://www.cnfis.ro/wp-content/uploads/2020/12/raport_public_CNFIS_2019.pdf

Table 3.6 Financing of doctoral and post-doctoral studies (€ million)

Funding body	National sources		ESIF sources
	Grants for doctoral schools	Grants for PhD students	
Ministry of Education	54.2 (2015) 55.9 (2016) 53.7 (2017) 52.4 (2018) 52.5 (2019)	N/A	OP Human Capital, PA6: Doctoral and post-doctoral studies (ESF) Planned allocations for 2014-2020: €84.7 million (of which €72 million is made up by the EU contribution)

Note: Official average annual exchange rates used to convert Romanian Lei into Euro: 1 euro: 4.44 lei (2014); 4.44 lei (2015); 4.49 lei (2016); 4.56 lei (2017); 4.65 lei (2018); 4.74 lei (2019) (<https://www.cursbnr.ro/curs-valutar-mediu>)

Source: CNFIS (2020) Raport public 2019 Starea finantarii invatamantului superior, p. 19; POCU/380/6/13

- **R&D activities supported by the Ministry of Agriculture and Rural Development**

The Ministry of Agriculture, Forestry and Rural Development is responsible for government policies in the field of agriculture; it establishes the objectives of priority interest for the research-development activity, monitors the results of the R&D activity funded from its resources, approves and funds the sectoral R&D plan for agriculture and rural development (ADER).¹³³ The salaries of the personnel from the public agricultural R&D units are ensured from the state budget.

Law 45/2009 proposed a profound reorganisation of the national agricultural R&D&I system and the R&D&I units subordinated to the Academy of Agricultural Sciences should have been reorganised as institutions of public law by government decision. However, only three R&D units (out of more than 80 R&D units) were reorganised until 2016 and the financing from the state budget has been drastically reduced. Consequently, between 2011 and 2016, the main sources of financing for the R&D units under the subordination of ASAS (about 75%) were own revenues (i.e. property income and revenues from sales of goods and services).¹³⁴

133 Law 45/ 2009 on the organisation and functioning of the Academy of Agricultural Sciences

134 Court of Accounts (2017) Sinteza raportului de audit Performanta activitatii de cercetare fundamentala si aplicativa in domeniile agriculturii in perioada 2009 - 2016

The current **R&D Sectoral Plan of the Ministry of Agriculture** – ADER 2022 – is implemented over a four year period with funding from the state budget of about €28 million.¹³⁵ The main aim of ADER is to support R&D in the field of agriculture and rural development and identify solutions tailored to specific regional agro-eco-climatic conditions in Romania.

The Ministry of Agriculture and Rural Development is also the Managing Authority for the National Rural Development Programme funded from the European Agricultural Fund for Rural Development (EAFRD), which supports, inter alia, knowledge transfer and innovation in agriculture (Measure 1), as well as cooperation between farmers, research institutes and agricultural universities (Measure 16) (see Chapter 4).¹³⁶

- **R&D funded by the Ministry of Energy**

The Ministry of Energy promotes the R&D&I activities in its areas of expertise (energy, natural resources, nuclear activities etc.). It coordinates the participation of the autonomous state-owned company “Technologies for Nuclear Energy” (RATEN) to national and international R&D programmes in the nuclear field.¹³⁷ As can be observed in Table 3.5, the R&D budget of the Ministry of Energy totals €15 million per year on average. A detailed profile of Romania’s R&D activities in nuclear power is provided by the International Atomic Energy Agency.¹³⁸

- **Regional Operational Programme (POR), Priority Axis 1 (Ministry of Development)**

The Ministry of Development, Public Works and Administration is the Managing authority for the (Integrated) OP Regional Development 2014-2020, whose Priority Axis 1 aims at “Promoting technology transfer”. The programme addresses the challenges related to the limited transfer of research results in the market, as well as the low uptake of innovation in companies. A detailed presentation of this programme is provided in the chapter on ESIF (Chapter 4).

135 MO 341/2016 Ministry of Agriculture and Rural Development – on the approval of ADER 2022
<https://www.madr.ro/docs/cercetare/2019/extras-anexa-2-OM-341-Plan-sectorial-2019-30.10.2019.pdf>

136 PNDR 2014-2020

137 MO 800/2021 on the organisation and functioning of the Ministry of Energy

138 IAEA (2020) Country Nuclear Power Profiles. Romania. Chapter 2.8 Research and Development.
<https://cnpp.iaea.org/countryprofiles/Romania/Romania.htm>

4. ESIF FUNDING FOR R&I

Key messages:

This chapter presents the funding flows and allocations to R&I from the EU Structural Funds (ERDF, EAFRD, ESF) and provides an analysis of the common outputs and results obtained so far. The key messages are as follows:

- Romania is one of the major recipients of ESIF, but has the lowest share of ESIF allocated to research and innovation.
- The 2007-2013 OP for Competitiveness (PA2 - RTDI) had a positive performance in terms of the rate of achievement of the proposed targets, despite the serious problems and delays in implementation.
- Investments in infrastructure in the 2007-2013 programming period were nine times higher than planned.
- For the 2014-2020 programming period, R&I is supported mainly via the OP "Competitiveness", PA1 (RTDI), Regional OP, PA 1 (Promotion of Technology Transfer), the National Rural Development Programme (Measure 1 – Knowledge transfer, Measure 16 – Cooperation), the OP "Human Resources" etc.
- Similar to other EU13 countries, ERDF investments in Romania are targeted mainly to Investment in public R&I infrastructure (Code 058 ERDF). R&I activities in public research centres (Code 060 ERDF) comes as the second most important intervention field for most EU13 countries, but not for Romania, where tech transfer and university-SME cooperation is the preferred option (Code 062).
- POC PA1 (R&D&I) demonstrated its relevance to the economic context; yet, there are still many challenges in implementation. For POC PA1, there is a risk of not reaching the target of the financial indicator for the less developed regions.
- DG Regio/ JRC has provided targeted assistance to the Romanian regions within the "Lagging regions" initiative, which contributed to capacity building and a change in the POR PA1 (Promoting technology transfer). The implementation of the POR PA1 has been long delayed; at present, the programme is at risk of failure to meet the proposed targets.
- EAFRD interventions support the establishment of operational groups (GO) for the European Innovation Partnerships (EIP). ESF interventions support doctoral and postdoctoral studies.

4.1 Results and impact of 2007-2013 ESIF for R&I

Romania joined the EU in 2007 and received substantial Cohesion policy funding for the first time in the 2007-2013 programming period. In total, support from the ERDF and Cohesion Fund amounted to €15.4 billion over the 2007-2013 period, 80% of which went to three main policy areas: transport, the environment and, to a lesser extent, enterprises.¹³⁹

Romania allocated only 5.9% of 2007-2013 ESIF funding to Innovation & Research and Technological Development (RTD), while the most innovative countries in the EU13 group (e.g. Estonia, Slovenia) allocated more than 20% of their ESIF resources to strengthening the science and innovation base (Table 4.1). By the end of the implementation period, ERDF support in Romania was afforded to nearly 560 R&I projects and 41 cooperation projects between enterprises - research institutions; in a comparative perspective, the number of cooperation projects is particularly low. Overall, the ERDF measures co-financed over the 2007-2013 period led directly to the creation of about 1950 research jobs; about four times more than initially planned.

Table 4.1 2007-2013 ERDF-CF Allocations for Innovation & RTD and main achievements

EU13	Decided OPs 2013, (€ million)*	Decided OPs 2013, (% ESIF*)	Number of RTD projects**	Cooperation projects enterprises-research institutions**	Research jobs created**
Bulgaria	293.1	4.4%	450	82	874
Czechia	3971.7	15%	2199	168	6240
Estonia	681.3	20%	2336	N/A	N/A
Croatia	120.4	14%	N/A	N/A	N/A
Cyprus	36.7	6%	N/A	203	587
Latvia	752.8	16.6%	184	36	445
Lithuania	992.4	14.6%	1440	28	2266
Hungary	2125.9	8.5%	3756	624	4187
Malta	76.2	9.1%	31	52	N/A

¹³⁹ EC (2016) Ex post evaluation of Cohesion Policy programmes 2007-2013, focusing on the European Regional Development Fund (ERDF) and the Cohesion Fund (CF) WP1 Synthesis – Country report: Romania. Retrieved from https://ec.europa.eu/regional_policy/sources/docgener/evaluation/pdf/expost2013/wp1_ro_report_en.pdf

EU13	Decided OPs 2013, (€ million)*	Decided OPs 2013, (% ESIF*)	Number of RTD projects**	Cooperation projects enterprises-research institutions**	Research jobs created**
Poland	9303.6	13.8%	2811	1989	16313
Romania	1127.8	5.9%	558	41	1945
Slovenia	1012.6	24.7%	345	N/A	N/A
Slovakia	1299.9	11.3%	524	425	166

Source: *Breakdown of EU Structural Funds by Theme and Member State for the programming period 2007-2013. Source: <https://cohesiondata.ec.europa.eu/2007-2013-Categorisation/Breakdown-Of-The-Available-Funds-By-Theme-For-2007/w597-agi6>. Updated May 23, 2020

** 2007-2013 ERDF-CF final achievements. Source: <https://cohesiondata.ec.europa.eu/dataset/2007-2013-ERDF-CF-final-achievements-Select-desele/p7rb-p5tk>

In the 2007-2013 programming period, the ESIF funds for Innovation and RTD in Romania were implemented mainly within the **OP Increase of Economic Competitiveness (POSCCE), Priority Axis 2 (PA2) “Research, Technological Development and Innovation for competitiveness”**. The programme focussed on several issues meant to increase the research capacity by investing in the development of R&D infrastructure. These included attracting young researchers and high-level specialists, strengthening the knowledge supply from universities and research institutes, stimulating technology transfer based on cooperation between R&D institutions and enterprises, stimulating innovation demand from enterprises, the creation and reinforcement of high-tech firms, and the development of poles of excellence and competitiveness.

POSCCE PA2 targeted three major intervention areas (DMI): R&D cooperation between universities/ research institutes and companies (DMI 2.1), Investments in R&D infrastructure and development of administrative capacity (DMI 2.2) and Support for SMEs access to R&D&I (DMI 2.3).¹⁴⁰

POSCCE PA2 had a total initial allocation of €645.8 million, of which €536 million was from ERDF and €109.8 million was from the state budget.¹⁴¹ By the end of programme implementation, PA2 had received €840 million from the ERDF and national contribution.¹⁴²

140 POSCCE (2011) Version 1, January 2011. Retrieved from: https://www.fonduri-ue.ro/files/programe/COMPETITIVITATE/POSCCE/DCI_POSCCE_Feb.2011.pdf

141 Idem

142 POSCEE (2017) Final implementation report of the Operational Sectoral Programme “Increasing of Economic Competitiveness” 2007-2013. Retrieved from: https://www.fonduri-ue.ro/images/files/programe/COMPETITIVITATE/POSCCE/2018/Raport_Final_de_Implementare_POS_CCE_2007-2013-revizuit_1.pdf

The major project “**Extreme Light Infrastructure – Nuclear Physics**” (ELI-NP) implemented by the Horia Hulubei National Institute of Physics and Nuclear Engineering (IFIN-HH) - formed part of the POSCCE - PA2.

ELI-NP is the most advanced research facility in the world in the field of photonuclear physics bringing together, for the first time, high-power lasers and nuclear physics; ELI-NP is the nuclear physics pillar of the Pan-European Distributed Research Infrastructure ELI-Extreme Light Infrastructure.¹⁴³

At the proposal of Romanian authorities, the Commission approved the phasing of this major project to the 2014-2020 programming period “due to delays in the construction works, the inclusion of new ancillary construction works in the second phase of implementation and the installation of additional equipment for research activities following the completion of the technical design reports approved by the International Scientific Advisory Board of the major project”. By Decision C(2016) 775 final, the amount to which the co-financing rate for the PA2 of the OP applied for the major project was set at €136 429 782.¹⁴⁴

There were 1567 proposals submitted under the POSCCE PA2. Of these, 687 were contracted and only 558 were completed by the end of the implementation period (2016). **49% of the completed projects were implemented in the Bucharest-Ilfov region**, while the remaining projects were implemented in the other seven development regions. Table 4.2 introduces the main targets, outputs and results of POSCCE PA2 (2016).

Table 4.2 POSCCE PA2 2007-2013: targets and achievements

Common output, result and additional indicators	Target value	Achievements (2016)
Output: No of cooperation projects enterprises-research institutions	200	41
Output: No of RTD projects supported	600	558
Output: No of innovative start-ups and spin-offs supported	30	116
Result: Research jobs created (no)	500	1945
Result: Private R&D&I attracted in R&D&I projects (mil lei)	567.4	1035
Result: Patent applications from supported projects (no)	50	285

143 Extreme Light Infrastructure Nuclear Physisc (ELI-NP). Retrieved from: <http://www.eli-np.ro/eli-np-in-a-nutshell.php>

144 EC Decision C(2016) 775 final Retrieved from: [https://ec.europa.eu/transparency/documents-register/detail?ref=C\(2016\)775&lang=ro](https://ec.europa.eu/transparency/documents-register/detail?ref=C(2016)775&lang=ro)

Common output, result and additional indicators	Target value	Achievements (2016)
Result: Innovative support structures - Excellence poles (no)	50	0
Result: New research infrastructures	100	893
Result: Modernized research infrastructures	100	367
Additional indicator: no of foreign researchers employed	N/A	53
Additional indicator: no of articles in scientific journals	250	1000
Additional indicator: no of R&D&I results transferred	N/A	100
Additional indicator: no of institutions supported to increase the administrative capacity	21	81

Source: POSCEE (2017) Final implementation report of the Operational Sectoral Programme "Increasing of Economic Competitiveness" 2007-2013 – PA2. Retrieved from: https://www.fondurie.ro/images/files/programe/COMPETITIVITATE/POSCEE/2018/Raport_Final_de_Implementare_POS_CCE_2007-2013-revizuit_1.pdf

Overall, POSCEE PA2 had a positive performance in terms of the rate of achievement of the proposed targets; the initial target values were significantly exceeded for the **number of research jobs created** (about 4 times more than the target value), number of start-ups and spin-offs supported, number of patent applications and articles in scientific journals etc. A special case is also that of the number of **new research infrastructures** supported within the programme, whose final value was nine times higher than planned.

The most important problems encountered during the implementation period were related, inter alia, to:

- The delays in implementation; the high number of signed, but unfinished contracts (which was caused mainly by the impossibility to cover the co-financing costs by the private companies).
- The limited capacity of beneficiaries to manage and implement projects.
- The disinterest of enterprises in certain types of collaborations, which is also evident from the **low number of cooperation projects supported** (only 41 vs 200 planned).¹⁴⁵

¹⁴⁵ POSCEE (2017) Final implementation report of the Operational Sectoral Programme "Increasing of Economic Competitiveness" 2007-2013 – PA2. Retrieved from: https://www.fondurie.ro/images/files/programe/COMPETITIVITATE/POSCEE/2018/Raport_Final_de_Implementare_POS_CCE_2007-2013-revizuit_1.pdf

The **mid-term evaluation of the National Strategy & National R&D&I Plan 2007-2013** noted “the lower priority for RDI within the Structural funds planning” (p. 95), the “serious delay in consuming the (POSCCE PA2) funding and in related operational activities” (despite a serious decline in national funding in that period) (p. 96), as well as the “considerable problems in the management of the respective projects and contracts both by the beneficiaries, as well as by the respective authorities” (p. 98).¹⁴⁶

In a similar vein, the **ex-post evaluation of Cohesion Policy programmes 2007-2013** carried out at the EC level (2016) highlighted the serious problems that led to delays in implementation and the slow absorption of funding: “implementation was hampered by adverse economic conditions, limited capacity of public administration, lack of experience in dealing with structural funds, lack of clear means of coordination, unclear and overlapping responsibilities among the different authorities, lack of clarity over the definition of the indicators etc.” (p. 14).¹⁴⁷ As regards the investments in **Innovation and RTD**, the ex-post evaluation of Cohesion Policy 2007-2013 also noted the relatively small share of funding that went to these thematic areas, as well as the “wide disparity in investment in R&D across the country”. By the end of the 2007-2013 programming period, “R&D expenditure increased by 91% in the North West region, while it declined by 64% in the West and 97% in the East” (p. 16).¹⁴⁸

4.2 2014 – 2020 ERDF for R&I

4.2.1 ERDF for R&I in EU13

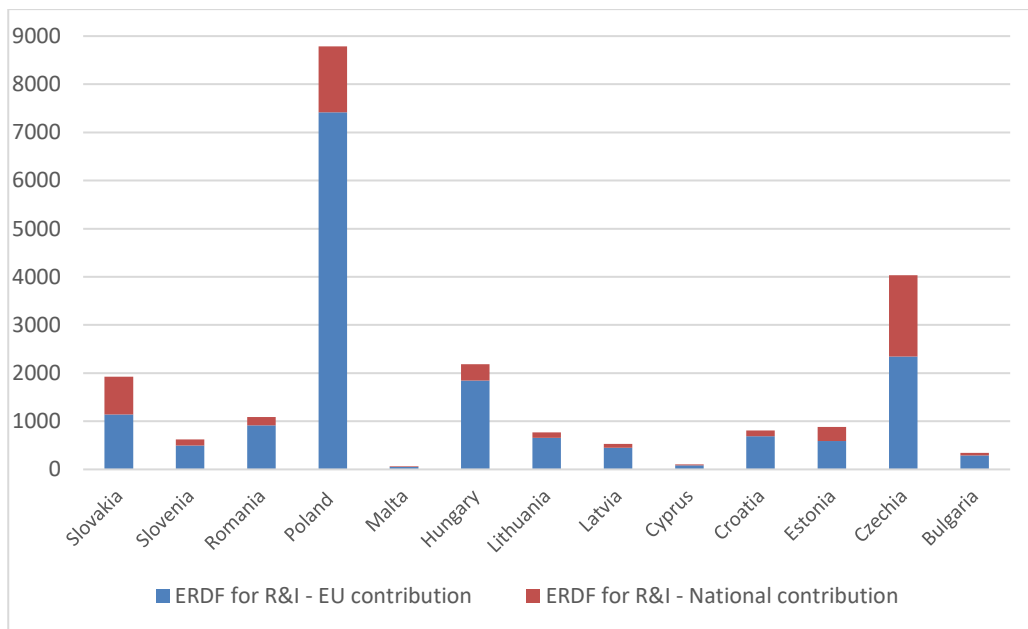
For the 2014-2020, the promotion of research and innovation was a central feature of Cohesion Policy programmes, in particular those primarily or exclusively supported through the ERDF. Throughout this period, more than €40 billion – and more than €65 billion including national co-financing – was allocated to EU regions through the ERDF to support the R&I planned under the smart specialisation strategies. The EU13 countries received more than one third of the total ERDF support for R&I. Figure 4.1 shows the planned ERDF finances for R&I (EU and national financing), with Romania being only the fifth largest recipient of ERDF R&I funding in the group. Similarly to the 2013-2020 period, Romania has allocated only a small share of its ESIF funding to R&I (2.9%).

146 Technopolis (2012). Mid-Term Evaluation of the National Strategy and of the. National RD&I Plan 2007-13. https://www.research.gov.ro/uploads/organizare/mid_term-evaluation/mte_national_strategy_plan_final_report_2012_01_23.pdf

147 EC (2016) Ex post evaluation of Cohesion Policy programmes 2007-2013, focusing on the European Regional Development Fund (ERDF) and the Cohesion Fund (CF) WP1 Synthesis – Country reports and data Retrieved from https://ec.europa.eu/regional_policy/sources/docgener/evaluation/pdf/expost2013/wp1_ro_report_en.pdf

148 idem, p. 69

Figure 4.1 2014-2020 Planned ERDF for R&I (EU and National contribution (€ million) (July 2021 data)

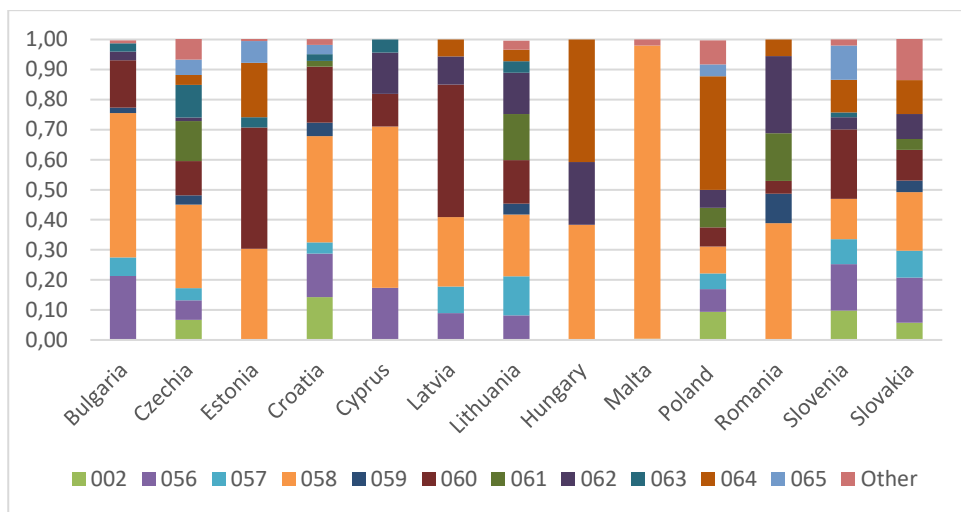


Source: EC, 2014 – 2020 ESIF. Total budget by country (daily update): Research & Innovation. <https://cohesiondata.ec.europa.eu/themes/1> Data refreshed at 22/07/2021

Investment in public R&I infrastructure (Code 058 ERDF) is the most important intervention field for Romania, but also for other EU13 countries (Bulgaria, Czechia, Croatia, Cyprus, Hungary, Malta). R&I activities in public research centres (Code 060 ERDF) comes as the second most important intervention field for most EU13 countries, but not for Romania, where tech transfer & university-SME cooperation (062) appears to be the second most important category of intervention.¹⁴⁹ Compared to the other EU13 countries, Romania allocates smaller shares of funding to investments in SMEs directly linked to R&I activities (Code 056 ERDF) and to R&I processes in SMEs (vouchers, process, design etc.), but allocates more for R&I private infrastructure (Code 059 ERDF).

¹⁴⁹ Tech-transfer & university-SME cooperation (Code 062 ERDF) is supported from POC PA1 and POR, PA1 as well.

Figure 4.2 Planned EU financing for R&I by ERDF intervention fields (%)



Note 1: 002 – R&I processes in large enterprises; 056 – Investments in SMEs directly linked to R&I activities; 057 – Investments in large companies linked to R&I activities; 058 – Research and innovation infrastructure (public); 059 – R&I infrastructure (private, incl. Science parks); 060 – R&I activities in public research centres; 061 – R&I activities in private research centres, incl. Networks; 062 – Tech-transfer & university-SME cooperation; 063 – Cluster support & business networks (SMEs); 064 – R&I processes in SMEs (vouchers, process, design etc.); 065 – R&I processes, tech-transfer & cooperation in firms focusing on the low carbon economy and on resilience to climate change.

Note 2: ERDF Interventions for Romania cover the R&I allocations from the OP Competitiveness and OP Regional Development

Source: Own computation based on EC –2014-2020 Planned EU financing by detailed ERDF R&I themes (categorisation) <https://cohesiondata.ec.europa.eu/funds/erdf>

4.2.2 OP Competitiveness (POC), Priority Axis 1

OP Competitiveness 2014-2020 (POC), Priority Axis 1 (PA1) “Research, technological development and innovation supporting economic competitiveness and the development of business” addresses the main challenges stemming from the low support and performance of the R&D&I sector in Romania. The planned allocations for POC PA1 amount €931.8 million, of which €780.4 million is made up by the EU ERDF contribution, and €151.4 million by the national contribution.¹⁵⁰ About three quarters of total funds are allocated to the less developed regions (seven NUTS 2 regions), with the rest being allocated to the sole more developed region in Romania, Bucharest-Ilfov. The Ministry of Investments and European Projects is the Managing Authority for POC, while the Ministry of Research, Innovation and Digitisation (OI Research) is the Intermediary body. There were two ex-ante conditionalities for ERDF funding under the thematic objective 1, namely:

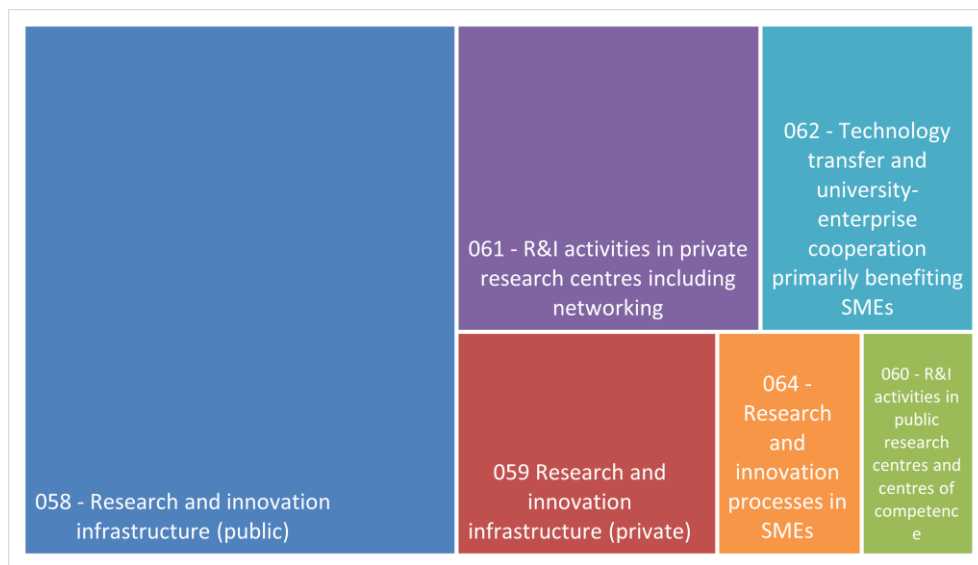
150 POC 2014-2020, Version 6.2 (2020)

- *The existence of a national or regional smart specialisation strategy in line with the National Reform Programme, to leverage private research and innovation expenditure, which complies with the features of well performing national or regional R&I systems.* In this respect, the National Strategy for R&D&I 2014-2020, including smart specialisation (SNCDI 2014-2020) was officially endorsed in 2014 (GD 929/2014).
- *The existence of a multi annual plan for budgeting and prioritisation of investments in research and innovation infrastructure.* The “Romanian National Roadmap of Research Infrastructures 2017-2025” was adopted in 2017, which led to the fulfilment of the ex-ante conditionality.

ELI-NP (Phase 2) and Danubius RI were initially included on the list of major projects supported by POC; yet, given that the documentation for Danubius RI project was not ready, only a preparatory action estimated at €5 million was decided by 2020.

Figure 4.3 shows the ERDF allocations by intervention fields and prompts to the fact that investments in R&I infrastructure (public) are by far the most important ones, while investments in R&I activities in public research centres (category 060) are the less intensive ones.

Figure 4.3 POC PA1, ERDF allocations by intervention fields



Source: OP Competitiveness 2014-2020 (V6, 2020)

Annex 3 displays the planned interventions from POC PA1 by objectives.

The key performance indicators for POC PA1 are presented in Table 4.3. It should be noted that important changes in the target values of indicators were made between POC PA – Version 1 (2016) and POC PA – Version 6 (2020).

Table 4.3 POC PA1 2014-2020: Key performance indicators and targets

Common (CO) and programme specific (S) indicators	Baseline value (year)	Target value (2023)
CO01 Number of enterprises receiving support	N/A	373
CO24 Number of new researchers in supported entities	N/A	488
CO25 Number of researchers working in improved research infrastructure facilities	N/A	628
CO26 Number of enterprises cooperating with research institutions	N/A	61
CO27 Private investment matching public support in innovation or R&D projects	N/A	€124 million
CO28 Number of enterprises supported to introduce new to the market products	N/A	221
3S1 Public private co-publications per million inhabitants	8.30 (2011)	18
3S2 Funds attracted from H2020	136.50 (2014)	270
3S3 Private R&D expenditures as percentage in BERD (% BERD)	66.29% (2012)	80%
3S4 Innovative SMEs collaborating for innovation (% of SMEs)	2.90 (2011)	6.60%
3S5 Support centres for international (H2020) projects	N/A	14
3S6 High-skilled personnel from abroad in supported projects (no persons)	N/A	50
3S7 Patent applications from supported projects (no patents)	N/A	151
3S51 Studies/ analyses completed and used in the implementation of the major project (Danubius) (no of studies)	N/A	10

Source: OP Competitiveness 2014-2020 (V6, 2020)

The interim evaluation of POC PA1 was finalised in 2020 and its main conclusions are summarised in the box below.

Interim evaluation of POC PA1 interventions

Overall, POC PA1 responded to the needs and challenges related to the low level of economic competitiveness and demonstrated its relevance towards the 2014-2020 economic and R&D&I context. POC interventions have successfully supported the employment of new researchers, the increase in the number of researchers working in improved research infrastructures, the number of supported companies collaborating with research institutions. POC A1.2.2 created the first entrepreneurship accelerators in Romania, which can further support the development of the private equity and venture capital industry. Both the research organisations and the companies appreciate that in the absence of funding, the achievement of the same research results would have taken many years, or could never have been realised.

POC PA1 has contributed positively, but quite modestly, to the increase of the Romanian contribution to the progress of knowledge, to the increase of the amounts attracted by the Romanian participants from Horizon 2020 or to the increase of private expenditures on research and development. The Bucharest-Ilfov region had a major contribution to achieving the programme indicators. In general, there is a concentration of POC investments around large university centres, which is somehow natural.

With regard to programme implementation, the COVID-19 pandemic was an important contextual factor that has hampered the implementation of projects and the achievement of results. Other specific factors that have prevented the effects were: high bureaucracy and changes in reporting during implementation; the lack of clarity of funding guidelines; the non-intuitive platform for project management (MySMIS); the long duration of project evaluation, procession of reimbursement requests, public procurement procedures etc.

It is recommended to increase the financial allocations for synergies with Horizon 2020, for innovative start-ups and spin-offs and for knowledge transfer partnerships, for which the interest of the beneficiaries was very high and the results obtained were very relevant.

Actions are further needed to improve the legislative and institutional framework, to increase the attractiveness of the research career or to support the implementation of the "open science" principles.

Source: Ministry of European Funds (2021) First evaluation report of POC interventions in the R&D&I area. 25 January 2021

With regard to the POC PA1, there is a high risk of failing to reach the target of the financial indicator for the less developed regions. Developing a more detailed indicator guide for beneficiaries is highly recommended, in order to avoid incorrect reporting by beneficiaries.¹⁵¹

151 MFE (2020) - Evaluarea progresului in indeplinirea indicatorilor din cadrul de performanta - Tema E, 2020, p. 9

4.2.3 OP (Integrated) Regional Development (POR), Priority Axis 1

The OP (Integrated) Regional Development (POR), Priority Axis 1 (PA1) – “Promotion of technology transfer” is aimed at supporting innovation take up by SMEs in areas of smart specialisation defined in (eight) RIS3. PA1 represents only 1.87% of the total POR budget allocation. The planned allocations for POC PA1 amount to €156.8 million, of which €133.2 is made up by the EU ERDF contribution and €23.6 million by the national contribution. The Regional OP has a separate budget for each of the eight development regions. The Ministry of Public Works, Development, and Administration (ex-Ministry of Regional Development and Public Administration) is the Managing authority for POR, while implementation is ensured by the Regional Development Agencies.

POR has been modified several times since its adoption, in 2016. With regard to POR PA1, a new specific objective was introduced in 2019, namely: OS.1.2 – “Increasing innovation in companies through multisectoral approaches”, to support the implementation of the projects resulted from the “Lagging Behind Regions Initiative in Romania”. The North East and North West regions were selected as pilot regions that have received targeted support for smart specialisation from the DG Regio/JRC. The call launched under OS1.2 was non-competitive and was targeted at the R&D&I actors from the two pilot regions that have developed mature projects through entrepreneurial discovery processes. A separate call under OS1.2 was organised for the South East region. There are also plans to fund a number of calls under the OS1.2 which have been prepared together with the World Bank, i.e. Proof of concept, Structured Research Contract, Research Valorisation Programme. Annex 3 shows the main interventions planned under POR PA1, while Table 4.4 displays the key performance indicators and targets.

Table 4.4 POR PA1: Key performance indicators and targets

Common (CO) and programme specific (3S) indicators	Baseline value (year)	Target value (2023)
CO01 Number of companies supported	N/A	714
CO02 FIRMS: grant aided (no)	N/A	144
CO04 FIRMS: advised (no)	N/A	570
1S1 Innovative SMEs collaborating for innovation (% SMEs)	2.90 (2011)	6.60%
1S2 Supported TTOs (no)	N/A	17
1S70 Number of cooperation projects supported in the Lagging Behind Regions Initiative	N/A	75

Source: POR (V6.1), 2020

POR PA1 is at high risk of failure to meet the proposed targets. In 30 June 2021, only 11 projects were contracted under POR PA1, five of which in the North West region; no project has been implemented in three out of the seven less developed regions.¹⁵²

An interim evaluation of POR PA1 interventions was completed in August 2019, but at that time only three projects were admitted for funding (of the 126 projects submitted); for these reasons, the evaluation's objective was only to assess the preparation process for the implementation of POR PA1. Overall, the evaluation concluded that the process developed by POR PA1 (e.g. smart specialisation entrepreneurial discovery processes, quadruple helix approaches) added value by bringing partners together and by creating the opportunity to "speak with the same voice". Yet, in practice, the financing of technology transfer encountered many difficulties, such as the frequent changes brought to the Applicant's Guide, weak conceptual clarification, the strict interpretation of the selection methodologies (i.e. accepting partnerships only between/ with EITT already accredited etc.), and the use of pre-call letters of intent that restricted the access of all potential beneficiaries.¹⁵³

4.3 2014 – 2020 EAFRD for R&I

Adapting research activities and results to the needs of farmers and processors is one of the priority needs of the National Rural Development Plan 2014-2020 (PNDR), the main instrument funded from EAFRD in Romania and implemented by the Ministry of Agriculture and Rural Development / the Agency for Financing Investments Rural.

Priority 1 of PNDR aims at "Fostering knowledge transfer and innovation in agriculture, forestry and rural areas" through three focus areas and types of support measures (Annex 4). Of particular interest for the present study is Measure 16, which, in accordance with the definition of Art. 35 of the EAFRD, provides support for:

- Cooperation approaches among different actors in the Union agriculture sector, forestry sector and food chain and other actors that contribute to achieving the objectives and priorities of rural development policy, including producer groups, cooperatives and inter-branch organisations.
- The creation of clusters and networks.

152 REGIO - Lista proiectelor contractate - Regio 2014 - 2020 la 30 iunie 2021
<https://www.inforegio.ro/ro/implementare/lista-proiectelor-finantate>

153 Lattanzio Advisory Spa, Lattanzio Monitoring & Evaluation (2019) - Evaluation of ROP 2014-2020 interventions. August 2019
https://www.inforegio.ro/images/documente/implementare/evaluare-program/Evaluarea_interventiilor_POR_2014-2020_-_Etapa_I_-_EN/Evaluation_report_of_ROP_2014-2020_AP_1_Technological_transfer.pdf

- The establishment and operation of operational groups (GO) of the European Innovation Partnerships (EIP)¹⁵⁴ for agricultural productivity.¹⁵⁵

Measure M2 – Advisory services – and Measure M01 - Knowledge transfer complement Measure 16.

Annex 5 shows the planned allocations for the measures that support R&I actions under PNDR 2014-2020.

It should be noted that the initial allocations for Measure 16 (Cooperation) were of €41.3 million. Yet, through the Common Agricultural Policy (CAP) Transitional Regulation 2021-2022 adopted at the EU level in 2020, it was decided to extend most of the CAP rules that were in place during 2014-2020 until the planned introduction of CAP strategic plans in 2023; an additional amount of €8 billion from the Next Generation EU Recovery Instrument (EURI) was assigned to the EAFRD.¹⁵⁶ Following these changes, the total allocation for Measure 16 under PNDR increased from €31.3 million to €81.3 million, as an additional amount of €50 million is provided to M16 from EURI.¹⁵⁷

Table 4.5 introduces the key performance indicators and targets for the R&I actions supported under PNDR 2014-2020.

Table 4.5 PNDR 2014-2020: Key performance indicators and targets for R&I

Common indicators	Target value (2013)
Percentage of expenditure under Measure 1 – Knowledge transfer, Measure 2 – Advisory services and Measure 16 – Cooperation in relation to the total expenditure for the RDP	0.72%
Total number of EIP Operational Groups supported out of the total number of cooperation operations	36
Total number of cooperation operations supported under the Cooperation measure	423
Number of agricultural holdings participating in cooperation/ local promotion among supply chain actors (M16.4)	1148

154 At the EU level, the EIP for agricultural productivity and sustainability (EIP-AGRI) is the network that should facilitate the exchange of expertise and good practices between farmers and the research community and facilitate the inclusion of all stakeholders in the knowledge exchange process. The Operational Groups (GO) are set up by interested actors such as farmers, researchers, advisors and businesses involved in the agriculture and food sector, who are relevant for achieving the objectives of the EIP.

155 Regulation (EU) No 1305/2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation (EC) No 1698/2005

156 Regulation (EU) 2020/2220 of the European Parliament and of the Council of 23 December 2020 laying down certain transitional provisions for support from the EAFRD and from the EAGF in the years 2021 and 2022

157 PNDR 2014-2020, Version 13, June 2021 <https://www.pndr.ro/>

Common indicators	Target value (2013)
Total number of beneficiaries advised	10400

Source: PNDR, V13, June 2021

The ongoing evaluation of PNDR shows that Measure 2 was launched later than expected and that there was a low interest from the providers of advisory services on the application of this measure. Measure 16 is performing better, but it is in its early stage (the first 24 Operational Groups in Romania were only established in 2019).¹⁵⁸

4.4 2014 – 2020 ESF support for doctoral education

For the 2014-2020 programming period, the OP Human Capital (POCU) has a specific objective (Objective 6.3) which is aimed at increasing the number of university and non-university tertiary education graduates who find a job (including a research job) as a result of the access to learning activities, with a focus on the sectors of competitive advantage identified in the National Competitiveness Strategies and the smart specialisation priorities of SNCDI.

In this respect, €84.7 million has been allocated for *Support for doctoral and postdoctoral researchers*, to improve their transversal and entrepreneurial skills in support of research and innovation. The expected results refer to an increase of students' participation in learning programmes that facilitate the insertion into the labour market.

Table 4.6: POCU 2014-2020: Key performance indicators and targets for doctoral and post-doctoral studies

Common indicators	Target value (2023)
4S130 Number of PhD students / postdoctoral researchers supported in the programme	3481
4S118 Students having obtained the PhD degree following the support received	1920
4S119 Researchers having completed post-doctoral programmes as a result of the support received	865

158 MADR (2019) On-going evaluation of NRDP 2014- 2020 in the period 2017-2020 September 2019 https://www.madr.ro/docs/dezvoltare-rurala/evaluare_/2020/studiu-de-evaluare-II_AIR_EN.pdf

A first call for proposals was launched in 2018 and 18 projects were selected for financing. The interim evaluation of POCU 2014-2020 shows that the intervention has positive effects for both the recipient institutions and the beneficiaries. One of the critiques of the programme refers to the fact that the activities supported from ESF are more focussed on entrepreneurship and less on the research component of the PhD and post-PhD programmes.¹⁵⁹

POCU 2014-2020 has also different interventions focussed on providing education and training to enterprises, students, VET schools in areas related to the smart specialisation priorities defined by SNCDI¹⁶⁰, but these are beyond the purpose of this study (i.e. as they do not have a research component).

4.5 Post 2020 ESIF for R&I. Planned investments under the RRM

Various strategic documents feed in to preparation for the 2021-2027 programming period. The **2021-2027 National Strategy for R&I and Smart Specialisation (SNCISI)** is under preparation by MCID. This strategy will include the necessary actions to fulfil the enabling condition for Cohesion Policy Objective 1: *Good governance of national or regional smart specialisation strategy*, as follows:

- An up-to-date analysis of bottlenecks for innovation diffusion, including digitalisation has been prepared¹⁶¹ and will be updated.
- Existence of competent institution responsible for the management of the smart specialisation strategy: the functioning mechanisms of the Committee for Coordination of Smart Specialisation (CCSI) is under review.
- SNCISI will include monitoring and evaluation tools to measure performance towards the objectives of the strategy.
- The methodology that backs the entrepreneurial discovery processes (EDP) at the national level is under review; the Ministry of Development, Public Works and Administration has prepared the EDP methodology to be used at the regional level.
- The timetable for updating the research infrastructure roadmap has been established.

159 Ministry of Investments and European Funds (2021) Prima evaluare a interventiilor POCU 2014-2020 in domeniul educatiei. Februarie 2021

160 POCU 2014-2020, V10 (2020)

161 Chioncel (2020), op. cit.

- The action plan to manage industrial transitions is under consultation and is planned to be finalised by December 2021.
- SNCISI will include measures for international collaboration. A methodology for the identification of potential international partnerships has been prepared; MCID has also initiated the ministerial consultations for the identification of Horizon Europe partnerships of interest for Romania.¹⁶²

The (8) **Regional Smart Specialisation Strategies** have been revised and approved by the Regional Development Councils. For the 2021-2027 programming period, the initial proposal for Romania was of around €6 billion for Policy Objective 1 ("A smarter Europe").

The National Competitiveness Strategy, the National Health Strategy (2021-2027), the Strategic Policy Framework for Education and Training etc. are also under review. The 2030 vision and action plan of "Educated Romania" – the national project initiated by the President of Romania to support the repositioning of society on values, the development of a culture of success based on performance, work, talent, honesty and integrity - have been recently launched.¹⁶³

The **National Resilience and Recovery Plan (PNRR 2021 - 2026)** is under the evaluation of the European Commission Services. Under Pillar 3 – *Smart, sustainable and inclusive growth* - PNRR will include the following R&D&I reforms (R) and investments (I):

- R1: Streamline governance of research, development and innovation;
- R2: Reform of research career;
- R3: Enhanced cooperation between business and research;
- R4: Support to integrate the research, development and innovation organisations in Romania in the European Research Area;
- I1: Establishment and operationalisation of five Centres of Competence, to enhance excellence for successful participation in Horizon Europe missions (€25 million);
- I2: Development of Horizon Europe mentoring programme (€5 million);
- I3: Strengthening excellence and supporting Romania's participation in partnerships and missions in Horizon Europe (€31 million);

162 Ministerul Investițiilor și Proiectelor Europene (2021) Memorandum: Stadiul măsurilor necesare îndeplinirii condițiilor favorizante 2021-2027 <https://sgg.gov.ro/new/wp-content/uploads/2021/02/MEMOANEXA.pdf>

163 Educated Romania. <http://www.romaniaeducata.eu/#>

- I4: Development of a programme to attract highly specialised human resources from abroad in R&D&I activities (€183 million);
- I5: Support for the holders of certificates of excellence received in the Marie Skłodowska Curie Individual Fellowship Award (€8 million);
- I6: Establishment and financial support of a national network of eight regional career guidance centres as part of the European Research Area Talent Platform (€4 million)¹⁶⁴.

164 Planul National de Redresare si Rezilienta. Vesiunea Iunie 2021, pp. 719- <https://mfe.gov.ro/wp-content/uploads/2021/06/0c2887df42dd06420c54c1b4304c5edf.pdf>; EC COM (2021) 608 final Annex to the Proposal for a Council Implementing Decision on the approval of the assessment of the recovery and resilience plan for Romania. Brussels, 27.09.2021

5. FRAMEWORK CONDITIONS FOR PUBLIC RESEARCH

This chapter describes Romania's situation regarding the human resources in science and technology and analyses the human resources policies and the incentives / barriers for public research organisations.

Key messages:

- Human resources is one of the weakest areas in Romania's S&T ecosystem. Romania has the smallest pool of employees in R&D and science in the EU and it is not increasing over time.
- The pool of human resources is significantly affected by the brain drain.
- Gender equality in the field of science and technology is one of the best in Europe.
- Romanian researchers are among the least mobile in the EU; with an exception of experienced researchers; 42% of them participated in a short term mobility (highest share in the EU).
- Retaining talented researchers is difficult, as research careers are not attractive (low wages, poor working conditions etc.). The target of the National R&D&I strategy – to double the number of researchers – is far from being reached.
- Romania has substantially improved the state of the research infrastructures, but their potential is under-utilised.
- Only few Romanian R&D organisations have endorsed the European Charter and Code of Conduct for Researchers.
- Different HR support measures are in place, such as the income tax exemption for R&D personnel, the "Human resources" programme within the National R&D&I Plan, a dedicated action within the OP Competitiveness for "Attracting highly-skilled researchers from abroad", the scholarships offered to PhD and post-doc students via the OP "Human resources" etc.
- The National Resilience and Recovery Plan proposes the reform of the R&D&I system, including the reform of the research career.

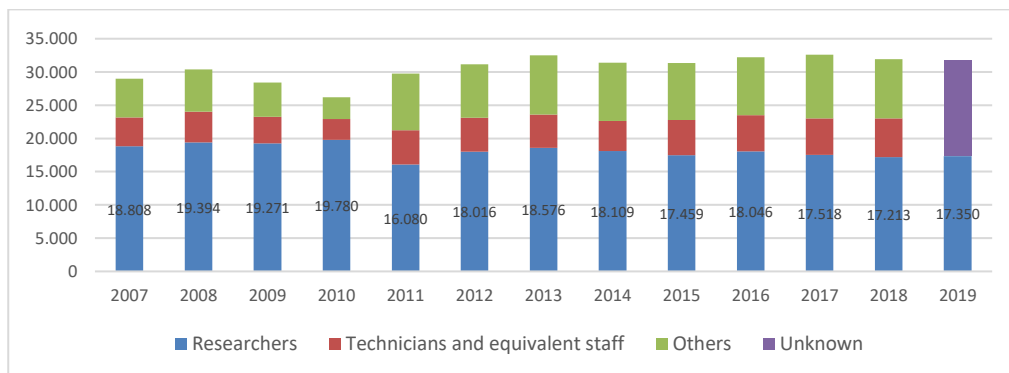
5.1 Human resources for S&T and brain drain

This sub-section describes the dynamics of R&D personnel (including researchers, technicians and recent doctorate graduates), women in science and brain drain.

R&D staff

Over the last decade, the number of R&D personnel in Romania remained relatively stable. The largest share of R&D workers were researchers; in 2019, over 17 thousand researchers were working in R&D in Romania (Figure 5.1).

Figure 5.1 R&D personnel in FTE by their professional position (2007-2019)



Source: Eurostat

Based on the data available in the MORE IV study¹⁶⁵, most Romanian researchers work in the field of natural sciences, engineering and technology. Over nine thousand Romanian researchers make over 11% of the overall stock of natural sciences, engineering and technology researchers in EU13 countries. Such data suggest that among the EU13 countries, Romania takes a strong position in the field and is only behind Poland (37% of EU13 researchers' stock) and Czechia (13% of EU 13 researchers' stock).

Table 5.1 Number of researchers per field of study (2019)

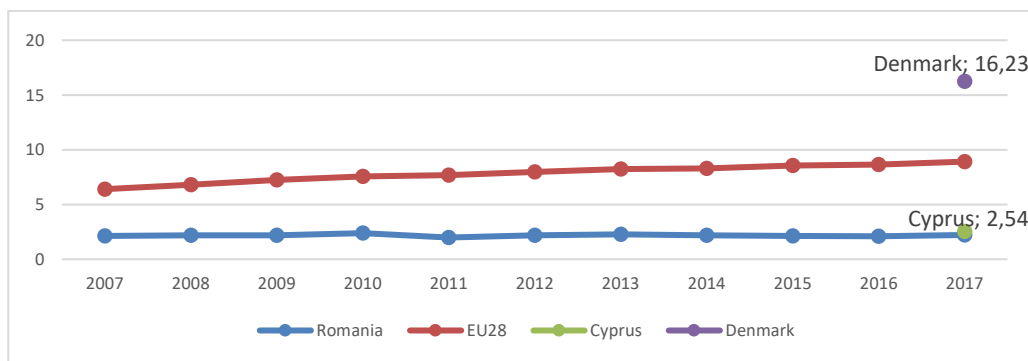
Field of study	No of researchers in Romania	Romanian researchers as a share of total EU researchers' stock	Romanian researchers as a share of total EU13 researchers' stock
Medical Sciences and Agricultural Sciences	3667	1.1%	8.7%
Natural Sciences and Engineering and Technology	9413	1.7%	11.7%
Social Sciences and Humanities	2003	0.4%	2.8%
All fields of science	15083	1.1%	7.7%

Source: More IV study.

165 EC (2019) MORE4 study: Support data collection and analysis concerning mobility patterns and career paths of researchers.

The data in the figure below illustrates that the number of researchers in Romania is the lowest in the EU. In 2017, out of a thousand employees in a country, there were only 2.21 researchers. Such a number is substantially smaller than the EU average of 8.91 researchers per thousand workers. Also, while the relative number of researchers in the EU was growing over time, the number of researchers in Romania remained relatively stable.

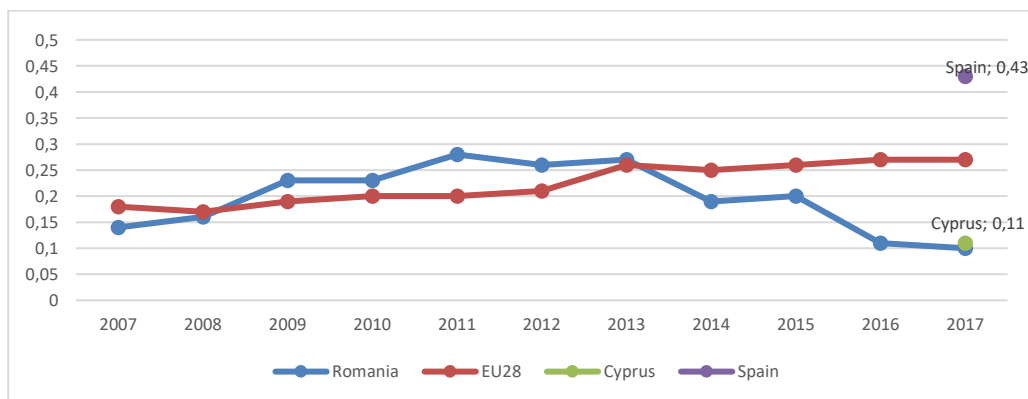
Figure 5.2 Number of researchers per thousand of employees in the country (2007- 2017), as compared to the second-lowest rate (Cyprus) and the highest rate (Denmark)



Source: More IV study

The low number of researchers can partly be associated with a low number of PhD graduates in Romania. The number of doctorate graduates dropped in 2013 and has not yet picked up. In 2017, Romania had the lowest number of PhD graduates (per thousand habitants) in the EU; in comparison, the highest rate of 0.43 was in Spain, and the EU28 average was 0.27.

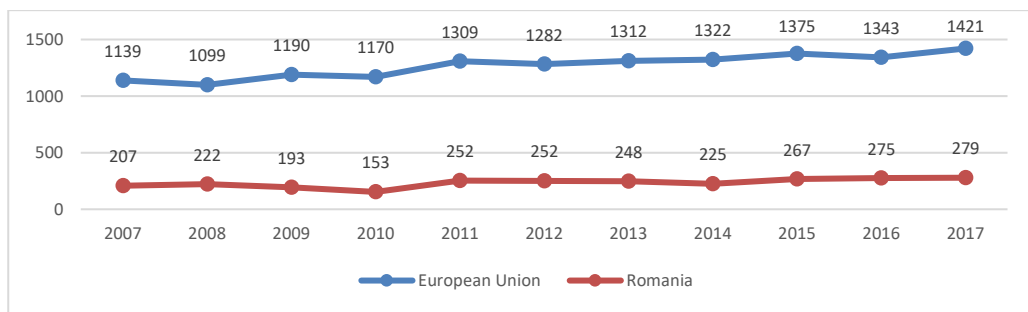
Figure 5.3 Number of PhD graduates (ISCED8) per thousand population in the country (2007-2017), as compared to the second-lowest rate (Cyprus) and the highest rate (Spain)



Source: More IV study

In addition to a low number of researchers and PhD graduates, Romania also has the lowest number of technicians in R&D (per million people) among the EU countries. In 2017, Romania had five times fewer technicians in R&D than the EU average.

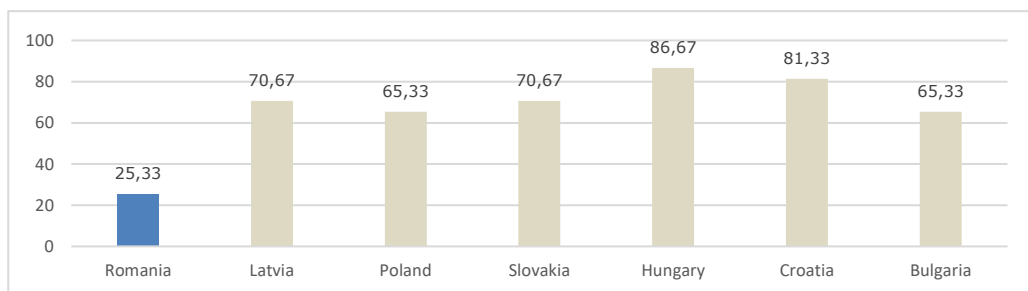
Figure 5.4 Technicians in R&D per million people (2007-2017)



Source: The World Bank.

The European innovation scoreboard data classifies Romania (along with the six other EU Member States) as an emerging innovator (Section 2.3). As illustrated in the figure below, Romania, compared to other emerging innovators, has the least employees working in knowledge-intensive activities. The second-lowest score in terms of employment in knowledge-intensive activities belongs to Bulgaria, and it is approximately three times higher than that of Romania’s.

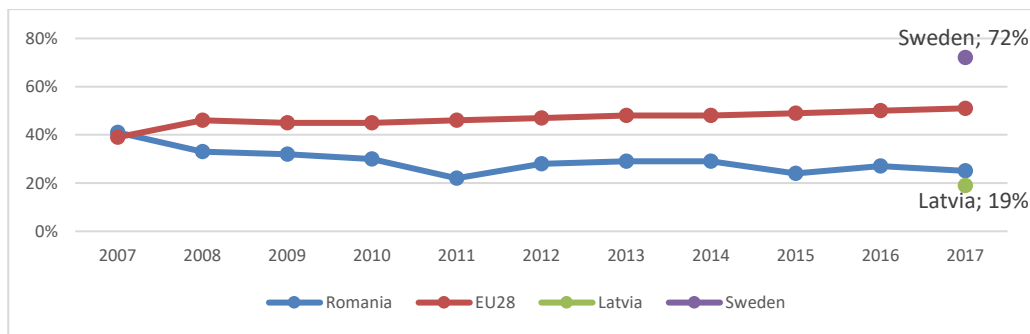
Figure 5.5 Employment in knowledge-intensive activities as evaluated by the European Innovation scoreboard (2021)



Source: European Innovation Scoreboard, 2021.

As discussed above, Romania does not have a large pool of researchers (as compared to other EU countries) and based on the data illustrated above, only a fourth of them work in the private sector. A low concentration of researchers working in the private sector implies that Romania’s research and innovation ecosystem mostly relies on academic research.

Figure 5.6 Share of researchers in the private sector in the total number of researchers in the country (2007- 2017), as compared to the lowest rate (Latvia) and the highest rate (the UK)

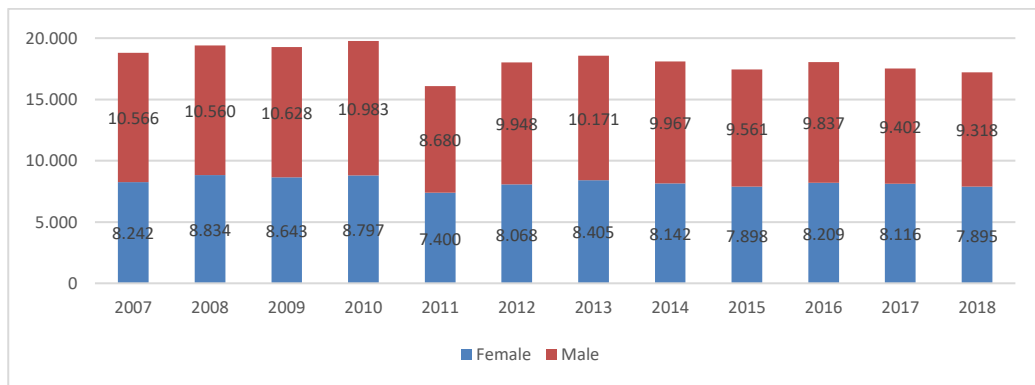


Source: More IV study.

Gender aspect

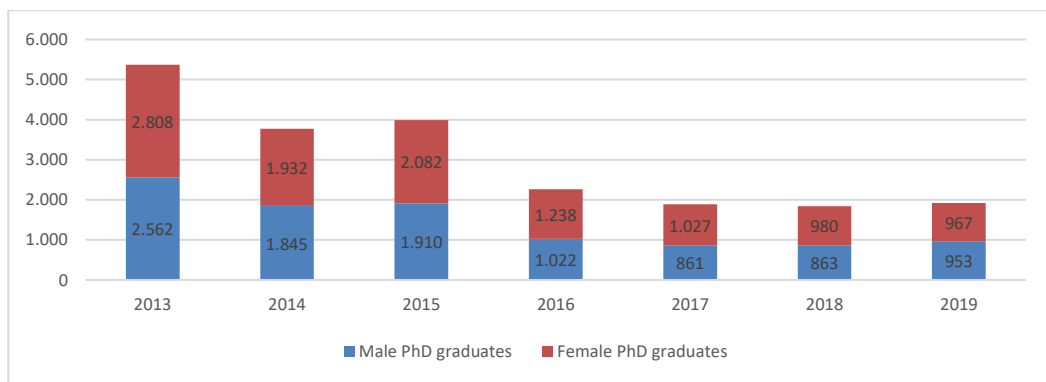
Gender equality in science and technology does not seem to be a concern in Romania. The number of researchers and PhD graduates is somewhat balanced between men and women. The two figures below illustrate this observation. For example, 46% of researchers were female in 2018.

Figure 5.7 Number of female and male researchers in Romania (2007-2018)



Source: Eurostat.

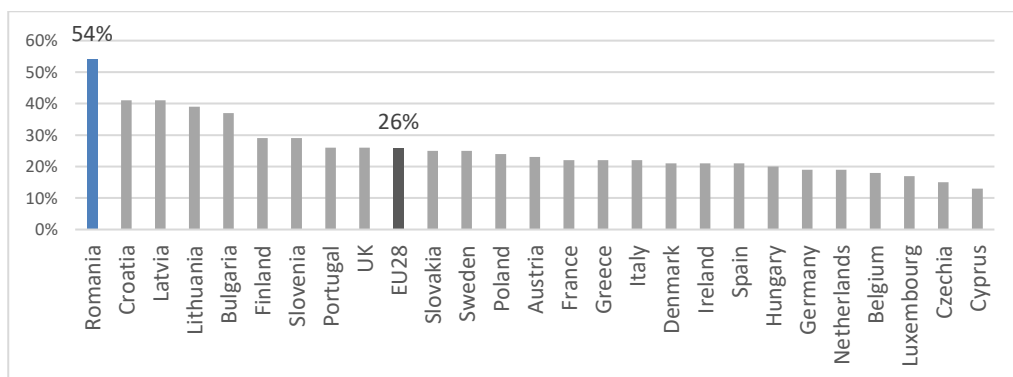
Figure 5.8 Number of PhD graduates by gender (2013-2019)



Source: Eurostat.

In addition, Romania outperforms other EU countries regarding the proportion of women in high academic positions. Data provided in More IV study shows that over half of grade A¹⁶⁶ academic staff in Romania are female. In comparison, the EU average is 26%.

Figure 5.9 Proportion of women as grade A academic staff (2017)



Source: More IV study.

Brain drain

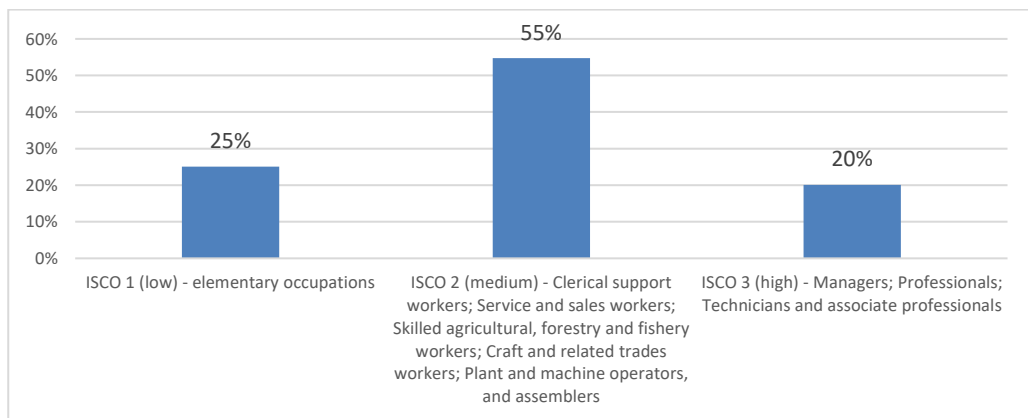
Emigration and brain drain are significant problems faced by Romania today. To a large extent, it was triggered by Romania’s accession to the European Union in 2007. While some restrictions on free mobility remained in place as late as 2014, Romanians increasingly migrated to other European Union countries such as Italy, Spain and the United Kingdom. Emigration has become a major social and economic phenomenon for Romania. The population has fallen from 22.4 million

¹⁶⁶ As defined by the OECD, Grade A academic position is the single highest grade/post at which research is normally conducted. Example: “Director of research” or “Full professor”.

in 2000 to 19.5 million in 2018, with outward migration responsible for more than 75% of this decline (OECD, 2019).¹⁶⁷

The census data of 2015/2016 indicate that around 20% of Romanians abroad work in positions that require technical knowledge and experience in one or more fields of physical and life sciences, or social sciences and humanities. According to the OECD (2019)¹⁶⁸ data, the best-educated mobile Romanians choose to live in Germany, Spain, Italy, UK, and the US – over a half of the highly educated mobile Romanian workers live in these five countries.

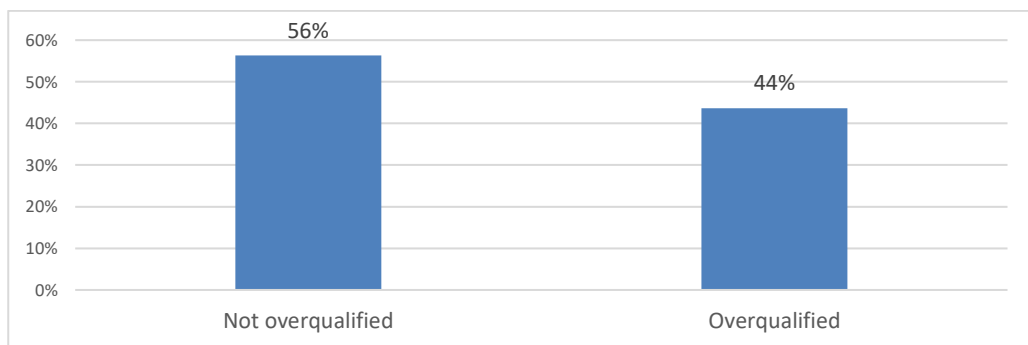
Figure 5.10 Romanian immigrants abroad by their skill level (2015/2016 census)



Source: OECD Database on Immigrants.

In addition, around a half (44%) of Romanian migrants, according to 2015/2016 census data, are overqualified for the work that they are doing (see figure below).

Figure 5.11 Highly educated Romanian immigrants abroad who are overqualified for their jobs (2015/2016 census)



Source: OECD Database on Immigrants.

167 OECD (2019) Talent Abroad: A Review of Romanian Emigrants. retrieved from: <https://www.oecd.org/fr/publications/talent-abroad-a-review-of-romanian-emigrants-bac53150-en.htm>.

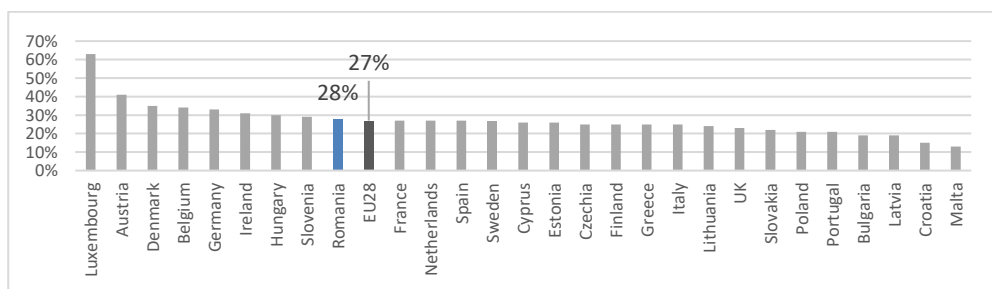
168 Ibid.

All in all, the human resources for S&T is one of the weakest points of Romania’s research and innovation ecosystem. Compared to other EU countries, Romania has the smallest pool of employees in R&D and science. Even more concerning aspect to it is that the number of researchers, PhD students, technicians in R&D does not show any significant growth over time. In addition, the pool of human resources is significantly affected by migration to and beyond Europe.

5.2 R&D careers and mobility

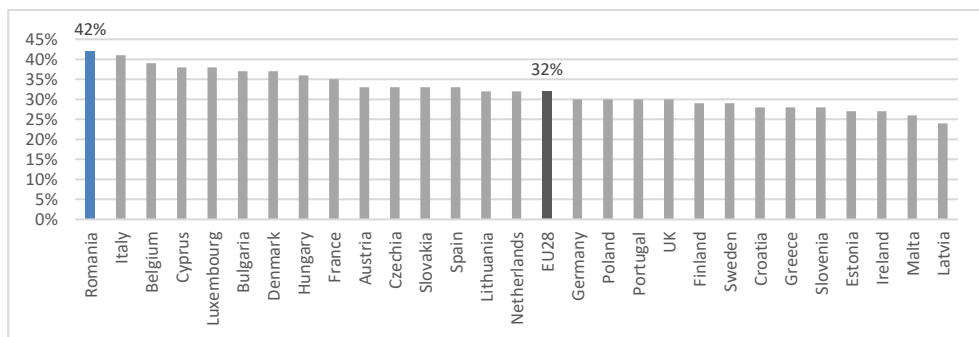
The rate of international mobility by Romanian (post PhD) researchers is among the highest in EU. According to the MORE IV study¹⁶⁹, 28% of researchers have been engaged in long-term mobility by 2019. Such rate increased since 2016 when only 16% of researchers had worked abroad for more than three months. A higher share of researchers (42%) had participated in the short-term mobility, which is the highest in the EU (see two figures below).

Figure 5.12 Share of researchers (post PhD) that have worked abroad as a researcher for more than 3 months in the last 10 years, 2019



Source: More IV study.

Figure 5.13 Share of researchers (post PhD) that have worked abroad as a researcher for less than 3 months in the last ten years, 2019

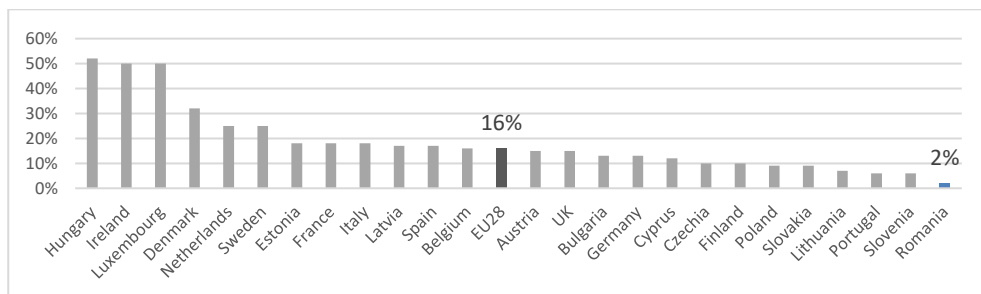


Source: More IV study.

169 EC (2019) MORE4 study: Support data collection and analysis concerning mobility patterns and career paths of researchers

On the other hand, the mobility of early-stage researchers is extremely limited in Romania. By 2019 only 2% of doctoral candidates participated in any mobility activities making Romanian PhD students the least-mobile doctoral students in the EU. In comparison, the EU average is 16%.

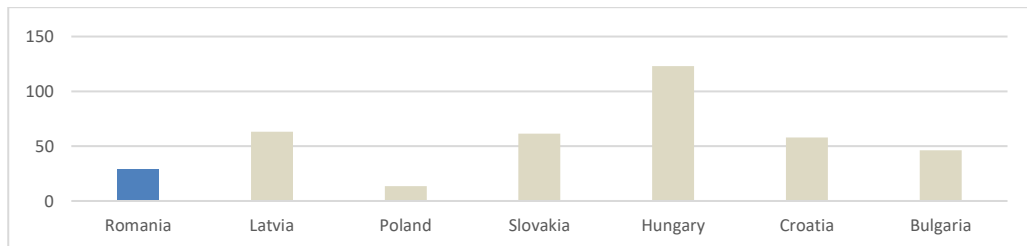
Figure 5.14 The proportion of mobile PhD candidates as a measurement of international mobility at early career stages (R1-R2 PhD degree mobility), 2019



Source: More IV study. Note: no data available for Croatia, Greece, Malta.

In addition, European Innovation Scoreboard data indicates that Romania is the second least popular destination after Poland for PhD students among the emerging innovator countries.

Figure 5.15 Foreign doctorate students as a % of all doctorate students as evaluated by the European Innovation scoreboard (2021)

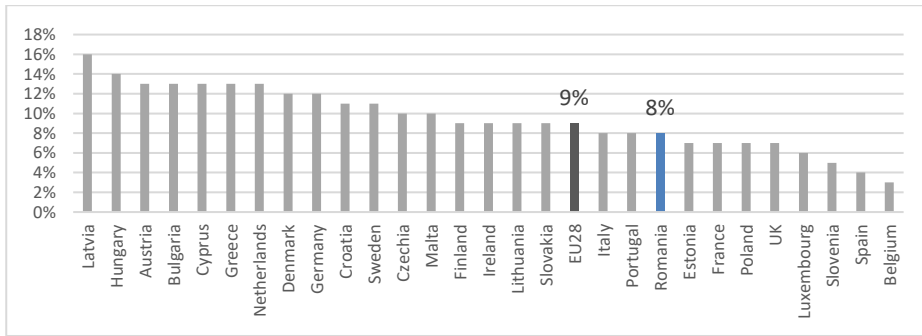


Source: European Innovation Scoreboard, 2021.

Sectoral mobility is also not common in Romania. According to the MORE IV study¹⁷⁰, 8% of researchers in Romania has some experience from the private sector. Nevertheless, a low rate is also observed among other EU countries, as around 9% of overall EU researchers have experience from the private sector.

Figure 5.16 Share of researchers with experience in the private sector, 2019

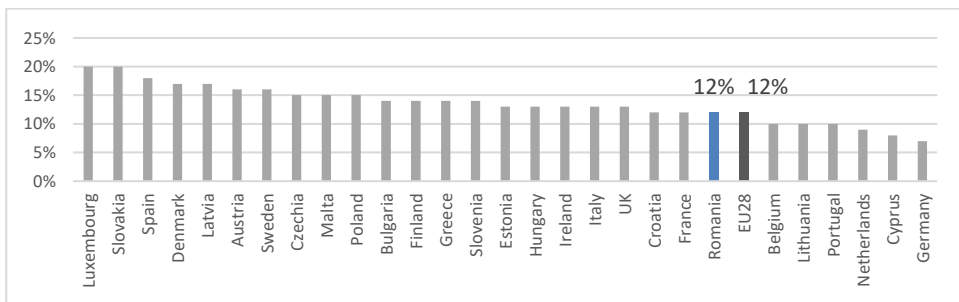
170 EC (2019) MORE4 study: Support data collection and analysis concerning mobility patterns and career paths of researchers



Source: More IV study.

Mobility from the public sector in Romania is also very similar to the overall EU mobility. There were 12% of researchers who have worked as a researcher in the public or government sector.

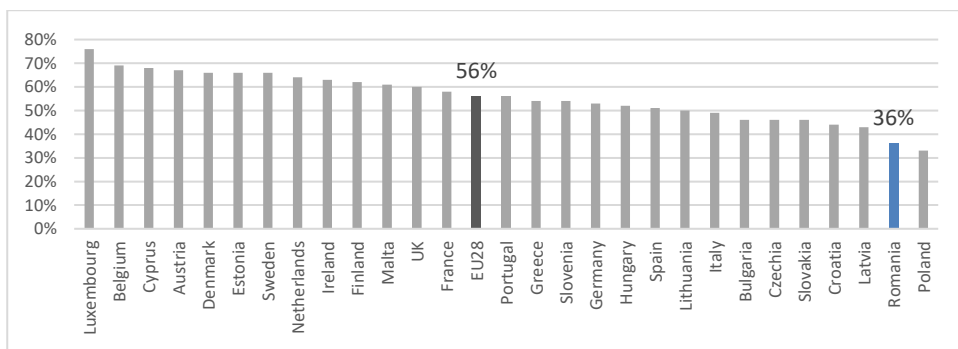
Figure 5.17 Share of R2-3-4 researchers who have worked as a researcher (excluding PhD) in the public or government sector, 2019



Source: More IV study.

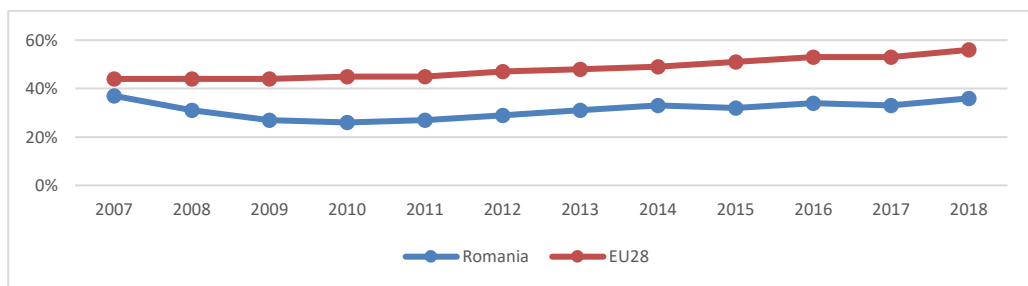
When it comes to international cooperation in terms of co-publications, Romanian researchers do not collaborate as extensively with researchers from other countries. As of 2018, only around 36% of publications were co-authored with researchers from other universities. This is the second-lowest rate in the EU after Poland. In addition, the share of international co-publications has been somewhat static since 2007.

Figure 5.18 Percentage of co-publications of the country with an author from another country – Scorecard (articles, reviews, and conference proceedings (i.e., peer-reviewed material), 2018



Source: More IV study.

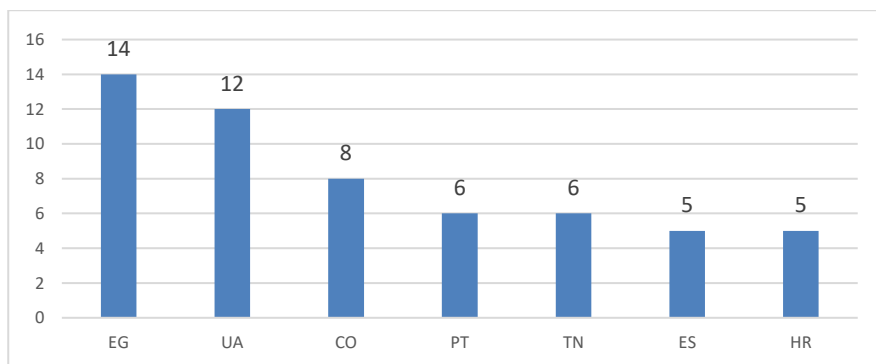
Figure 5.19 Percentage of co-publications of the country with an author from another country – Scorecard (articles, reviews, and conference proceedings (i.e., peer-reviewed material), 2007-2018



Source: More IV study.

Romania’s participation in Marie Skłodowska-Curie Actions is limited. In the period of 2015-2020, Romania hosted 93 researchers, the majority of which were non-EU researchers. The figure below presents researcher flows from originating countries with five or more researchers hosted in Romania.

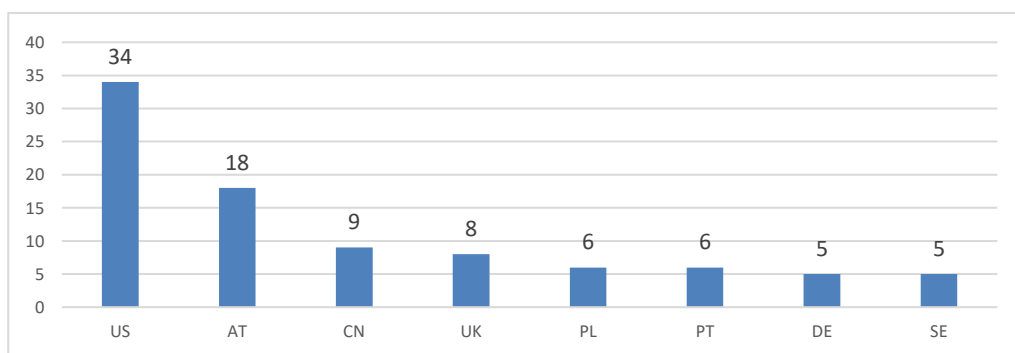
Figure 5.20 Researchers’ mobility under MSCA programme (INT, IF, RISE), researchers hosted in Romania (with five and more researchers from an originating country) (2015-2020)



Source: Corda.

As a sending country, Romania has sent 125 of its researchers abroad under MSCA since 2015. The institutions in the USA hosted the majority of them between. The second most popular destination was Austria.

Figure 5.21 Researchers' mobility under MSCA programme (INT, IF, RISE), researchers sent from Romania (with five or more researchers sent to the host country) (2015-2020)



Source: Corda.

Based on the data presented above, we see that the strongest aspect in terms of researchers' mobility is the long-term and short-term mobility of experience researchers. However, in terms of international co-publications, early-stage researchers' mobility as well as attraction of foreign PhD students, Romania is far behind other EU countries.

5.3. HR policies for R&I. Incentives and barriers to conduct high quality research

Human resources for R&D

Law 319/2003 on the Status of research and development personnel provides the framework conditions for undertaking a research career in Romania. It stipulates the categories of R&D personnel, the conditions to be met for career progression, the rights and obligations, the conditions for personnel mobility etc. In line with the provisions of this law, MCID takes the responsibility for the qualification and certification of human resources involved in R&D activity (Art. 2). Law 319/2003 stipulates the following categories of R&D personnel a) R&D personnel (ranked on five professional degrees), teaching staff at the university level, R&D support staff and administrative staff (Art. 6).¹⁷¹

The Status of the teaching and research staff at the university level is regulated by the Law of Education (L1/2011, Art. 285-301), which also establishes the rules for the equivalence of the teaching functions with the research functions, as follows: PhD teaching assistants with scientific researchers, lecturers with scientific researcher degree 3 (CSIII), associate professors with scientific researcher degree 2 (CSII) and professors with scientific researcher degree 1 (CSI). The law also describes the status of the PhD students, the rights and obligations of the teaching staff, issues related to the academic ethics, and sanctions. Ethics in research is regulated by Law 206/2004 on good conduct in scientific research, technological development and innovation.¹⁷²

While acknowledging the fact that Romania lacks researchers and the critical mass for developing promising fields, SNCDI has set specific objectives related to doctoral and postdoctoral education and research labour market, i.e. the integration of a large share of PhD students and young researchers in R&D&I projects, funding for doctoral and post-doctoral programmes, the attraction of foreign researchers with advanced skills to manage projects in a host institution in Romania, making it compulsory for all PROs to publish job openings in Euraxess and to endorse the European Charter and Code for Researchers. The Romanian ERA Roadmap has strengthened these commitments under ERA Priority 3: An open labour market for researchers. At present, there are 16 Romanian R&D&I organisations that have endorsed the Charter & Code principles¹⁷³ and the country has made progress in reducing its gap in performance for Euraxess use (yearly average increases of 20%).¹⁷⁴ Figure 5.22 displays the main instruments targeted at attracting human resources in research.

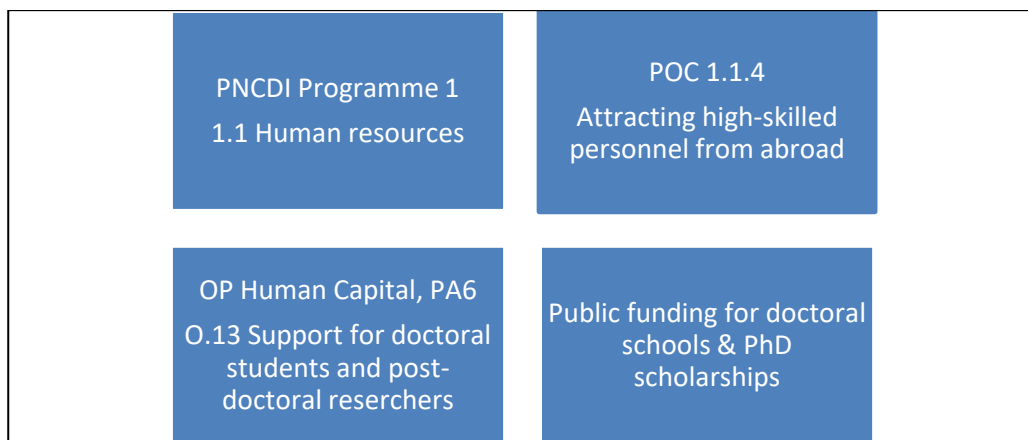
171 Law 319/2003 on the Status of R&D personnel <http://www.research.gov.ro/uploads/sistemul-decercetare/legislatie-organizare-si-functionare/legislatia-sistemului-de-cercetare/legea-319-2003.pdf>

172 Law 206/2004 on good conduct in scientific research, technological development and innovation (updated) <http://legislatie.just.ro/Public/DetaliuDocument/52457>

173 Euraxess – Romania: Declarations of endorsement of Charter & Code https://euraxess.ec.europa.eu/jobs/charter/declaration-endorsement#show_Romania

174 EC (2019) ERA Progress Report 2018 Country profile: Romania

Figure 5.22 Main instruments targeted at attracting human resources in research



Source: own conceptualisation

Instruments, beneficiaries, (expected) results

- PNCDI Sub-programme 1.1 Human Resources supports many types of projects, i.e. postdoctoral research projects, research projects for young independent teams, fellowships for young researchers, rewarding research results: articles and patents, Mobility projects for researchers (including from diaspora), other types of research grants for young researchers. The main objectives envisaged by this sub-programme refer to the increasing of the number of researchers and of the attractiveness of the research career, most of the proposed instruments being targeted to young researchers.
- POC 1.1.4: Attracting high-skilled personnel from abroad is aimed at creating competence centres within the Romanian R&D organisations (universities, R&D institutes, companies) led by outstanding specialists from abroad, who are hired by the host institution at least for the duration of the project. 51 projects have been supported under this call.
- OP Human Capital, PA6 (O1.13) provides ESF support to doctoral students and post-doctoral researchers to develop transversal and entrepreneurial skills. The financial support is granted to scholarships and for internal and transnational mobility
- Public funding for doctoral schools is provided by the Ministry of Education; in 2019, it represented about 6% of the total institutional funding received by the universities.¹⁷⁵ In the 2019/2020 academic year, there were about

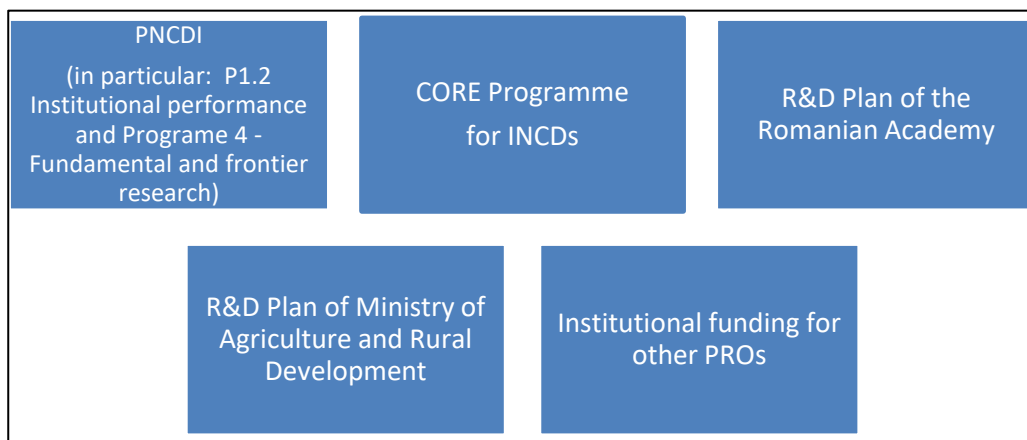
175 CNFIS (2020) Raport public 2019 Starea finantarii invatamantului superior http://www.cnfis.ro/wp-content/uploads/2020/12/raport_public_CNFIS_2019.pdf

21600 students enrolled in doctoral study programmes and a fairly small number (310 persons) in post-doctoral programmes.¹⁷⁶

Institutional capacity and performance

Increasing institutional capacity is one of the cross-cutting actions of SNCDI, which formulates a number of principles to be applied in institutional funding and proposes two basic measures in this respect: (i) ensuring basic institutional funding for all public research organisations (institutes and universities) following an institutional evaluation and (ii) widespread adoption in Romanian public research organisations of “intellectual capital” reports, as an instrument for self-evaluation and strategic planning. At the same time, SNCDI encourages organisational concentration, including initiatives for merging public research organisations. Despite some recent changes in the methodologies for allocation of institutional funding, there is evidence that institutional quality evaluation remains a challenge, with negative consequences in terms of R&D performance; the fragmentation of the systems is still a challenge. Figure 5.23 synthesises the main instruments for supporting institutional capacity of public research organisations.

Figure 5.23 Main instruments supporting institutional capacity and performance of public research organisations



Source: own conceptualization

The main instruments providing institutional support to public research organisations have been introduced in Chapter 3, which has also stressed the fact that universities in Romania still do not receive direct institutional funding for R&D. Nevertheless, beside the programmes directly targeted at research institutes, is worth mentioning that PNCDI has dedicated instruments for institutional performance, which are opened to all public research institutions, including universities. **PNCDI P1.2 - Institutional performance** – is aimed at

176 Ministry of Education (2020) Report on the state of higher education in Romania 2019-2020 https://www.edu.ro/sites/default/files/_fi%C8%99iere/Minister

supporting the institutional development plans of research organisations and at reducing fragmentation, by encouraging complex projects implemented in consortia of at least three public research organisations with similar or complementary specialisation profiles based on a common agenda. **PNCDI P4 – Fundamental and frontier research** has also the public research organisations as main beneficiaries. The main types of projects funded are exploratory, ERC-like and complex frontier research projects, whose main aim is to develop the niche areas where Romanian fundamental research has comparative advantages.

Research infrastructures

SNCDI supports investments in major infrastructures (i.e. ELI-NP Pillar, Danubius RI, other pan-European research infrastructures, open infrastructures ESFRI-like); at the same time, the Strategy reaffirms the need to optimise the use of existing infrastructures by creating a national roadmap of R&D infrastructures and a national register of infrastructures (for both the public and private infrastructures) and by creating commitment to open access to infrastructures.

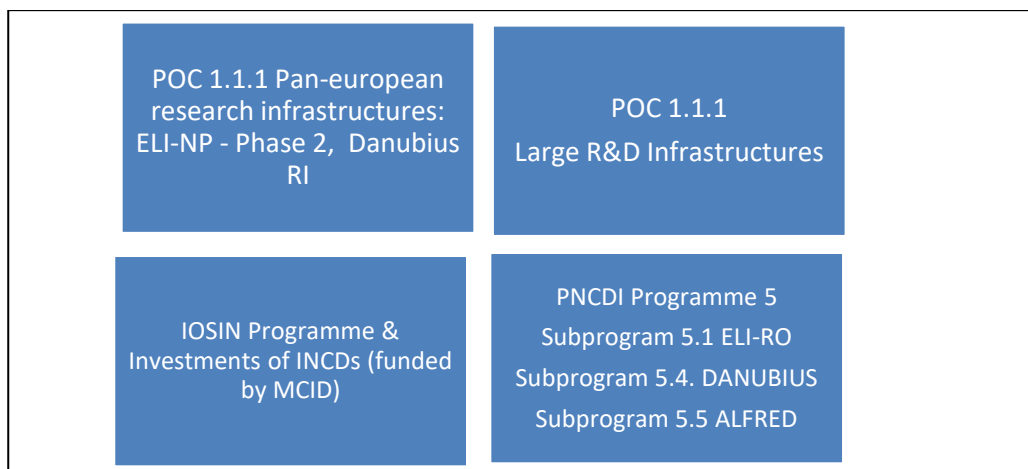
In line with these provisions, the National Roadmap for Research Infrastructures 2017-2025 was finalised in 2017¹⁷⁷ and the Register of Research Infrastructures (ERRIS) became functional. ERRIS is organised as an online platform which connects the research infrastructure owners with potential clients: researchers and company representatives. At present, there are more than 2000 research facilities registered in the platform, which are associated with more than 9000 research services and about 460 technological services. A number of research facilities from Slovenia, Montenegro, Republic of Moldova have been added to the registry, which turned into a European register for research infrastructures (EERIS).¹⁷⁸ A recent analysis of the existing stock of research infrastructures registered in ERRIS shows there is room for improvement as regards the optimal and sustainable exploitation of the facilities.¹⁷⁹ Figure 5.24 introduces the main instruments currently supporting the creation, maintenance and exploitation of research infrastructures.

177 Romanian National Roadmap of Research Infrastructures 2017-2025
https://www.research.gov.ro/uploads/sistemul-de-cercetare/infrastructuri-de-cercetare/cric/romania-national-roadmap_2017.pdf

178 <https://eeris.eu/>

179 Ciobotaru, R., Spanache, I. and Trif, I. (2020) Raport privind analiza stocului existent de infrastructuri de cercetare, prin prisma prezenței în ERRIS, existenței și transparenței procedurilor de acces și utilizare a acestora, posibilității de a crea rețele „tematice” de infrastructuri de CD, tip ERIC, la nivel național

Figure 5.24 Main instruments supporting (creation and maintenance of) research infrastructures



Source: own conceptualisation

Instruments, beneficiaries, (expected) results

- POC 1.1 – Major projects - supports the implementation of the pan-European project Extreme Light Infrastructure – Nuclear Physics Phase II (i.e. construction of the gamma beam system and of the special buildings for experiments). The construction of the pan-European facility Danubius International Centre of Advanced Studies for Rivers- Deltas-Seas will only start after the inclusion on the ESFRI list.
- POC 1.1.1 – Large R&D infrastructures – supports three types of actions dedicated to (A) Private R&I infrastructure, (B) Innovative clusters and (C) Public R&I infrastructures – included in the National Roadmap for Research Infrastructures and focussed on smart specialisation.
- IOSIN Programme is supported from the MCID budget and finances the special facilities and objectives of national interest (see also Section 3.4 – Evaluation of IOSIN Programme).
- In synergy with POC investments, PNCDI Programme 5 has different subprogrammes that support the R&D&I activities of major infrastructures (i.e. R&D&I projects, experiments, measurements and specific analyses, support projects etc.)

Overall, this chapter has shown that some incentives exist to support both investments in human resources and research infrastructures, but the framework conditions still need improvement. The lack of critical mass of researchers continues to be a major challenge for the Romanian R&D&I system. SNCDI set ambitious targets in terms of human resources, but these targets have not been attained, i.e. to reach 17000 FTE researchers in the public sector by 2020 (current value 12500) and 14500 FTE researchers in the private sector (current value

4600).¹⁸⁰ The underfinancing of both the educational and the R&D&I system – which translates into poor job prospects, limited career development opportunities, low wages etc. - is one of the root causes of the lack of attractiveness of the research careers. Romanian researchers have pushed for a reform of national R&D funding.¹⁸¹

A number of reforms of the R&D&I system have been announced to improve the framework conditions for public research in Romania (see the box below).

180 Eurostat R&D personnel by sector of performance, professional position and sex [rd_p_persocc]

181 <https://sciencebusiness.net/news/romanian-researchers-push-reform-national-rd-funding>

Planned reforms in the Romanian R&D&I system

- The government's Programme 2020-2024 reaffirms the ambition to reach a 2% R&D intensity by 2024 (1% of the GDP public R&D and 1% of the GDP private R&D). Government's objectives for the R&D&I sector refer to structural changes in the national R&D&I system, improving the framework conditions for public research and stimulating public-private partnerships. The evaluation of all research institutes and research infrastructures – by a body of international experts – is envisaged.¹⁸²
- Developing the research component at the university level and increasing the performance of doctoral schools in conditions of transparency, ethics and integrity is on the 2021 agenda of the Ministry of Education. Actions are envisaged to increase the financing of research at the university level, change the human resources policies so that advancement in research career should not be automatically linked to the progress in the teaching career, involve foreign researchers in the activities of doctoral schools, attract foreign researchers from diaspora, evaluate ethics, assess periodically the instruments that monitor academic ethics and integrity, evaluate all the institutions with a role in R&D management.¹⁸³
- One of the strategic objectives for the Romanian Academy for 2021 is the initiation of a comprehensive evaluation process and the reorganisation of R&D activities.¹⁸⁴
- The National Recovery and Resilience Plan proposes the reform of the research career. The actions envisaged refer to a new legislative framework that will amend the conditions for promotion/ recruitment, assessment of professional performance, the existing incentives, research ethics etc. Investments will be made in the creation of a national network of regional career guidance centres as part of the ERA Talent Platform, in programmes to attract highly qualified specialists from abroad and in supporting MSCA Individual Fellowship mobilities.¹⁸⁵

182 The Government's Programme 2020-2024 <https://gov.ro/ro/obiective/programul-de-guvernare-2020-2024>

183 Ministry of Education (2020) Report on the state of higher education in Romania 2019-2020 https://www.edu.ro/sites/default/files/_fi%C8%99iere/Minister

184 Dumitrache, I. (20121) 2020 Activity Report of the Romanian Academy, p. 99. <https://acad.ro/dari-de-seama/2020-Dare-de-seama-ID.pdf>

185 Ministry of Investments and European Projects (2021) National Recovery and Resilience Plan, July 2021 Version <https://mfe.gov.ro/pnrr/>

6. PUBLIC-PRIVATE PARTNERSHIPS

Key messages:

This chapter examines quantitative and qualitative data related to knowledge flows, involvement of the private sector in the public science base, commercialisation activities, intermediary structures, etc. The key messages are as follows:

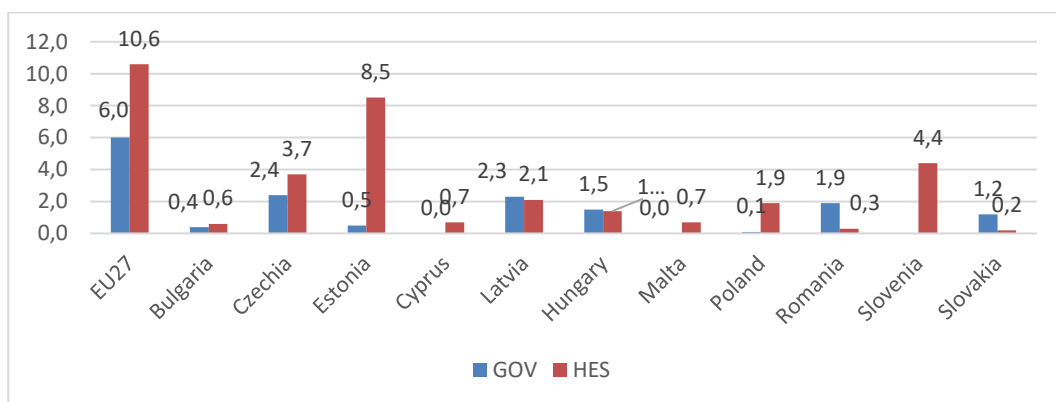
- Public-private cooperation – measured in public-private co-publications and percentage of enterprises cooperating with public R&D organisations – is weak.
- Business demand for R&D&I is low. SMEs are mainly interested in developing their production capacities.
- Lack of trust and predictability, difficulties in access to finances for innovation and the limited capacity of higher education systems to play a more active role in the entrepreneurial system are among the biggest barriers hindering the development of Romanian innovation eco-systems, according to the PSF Specific Support to Romania (2017) evaluations.
- The National Network for Innovation & Technology Transfer (ReNITT) counts 49 accredited/ authorised entities. No direct public support has been offered to ReNITT since 2010. The profile of ReNITT entities does not cover all the smart specialisation areas in Romania.
- A number of regulatory barriers hamper academia-business links and public-private partnerships.
- Different support measures are in place to stimulate business demand for R&I and encourage public – private collaboration. The National R&D&I Plan has a dedicated programme for “Increasing the competitiveness of the Romanian economy through RDI” (Programme 2), the OP Competitiveness, PA1 gives support to Knowledge Transfer Partnerships, innovative start-ups and spin-offs, the Regional OP, PA1 focuses on “Promoting technology transfer”, the National Rural Development Programme gives support to agricultural knowledge and innovation systems etc.
- The National Recovery and Resilience Plan proposes a legislative reform and different interventions to simplify cooperation between business and research and to integrate the Romanian business sector into European value chains and Romanian RTOs in ERA.

6.1 Collaboration and knowledge flows

There is substantial evidence in the literature suggesting that the innovation systems in Central and Eastern Europe – and especially in their less developed regions – are in their infancy due to various “system failures”, but also to structural conditions.¹⁸⁶

Public R&D financed by business enterprises is one of the most relevant quantitative indicators describing the intensity of science-business linkages. At the CEE level, only in Romania, Hungary, Slovakia and Latvia, the enterprises provide higher financing to the R&D carried out in the government sector (as compared to the higher education sector), which is also in contrast to the EU27 situation.

Figure 6.1 Public R&D (GOV&HES) financed by business enterprises (€ per inhabitant, 2018)

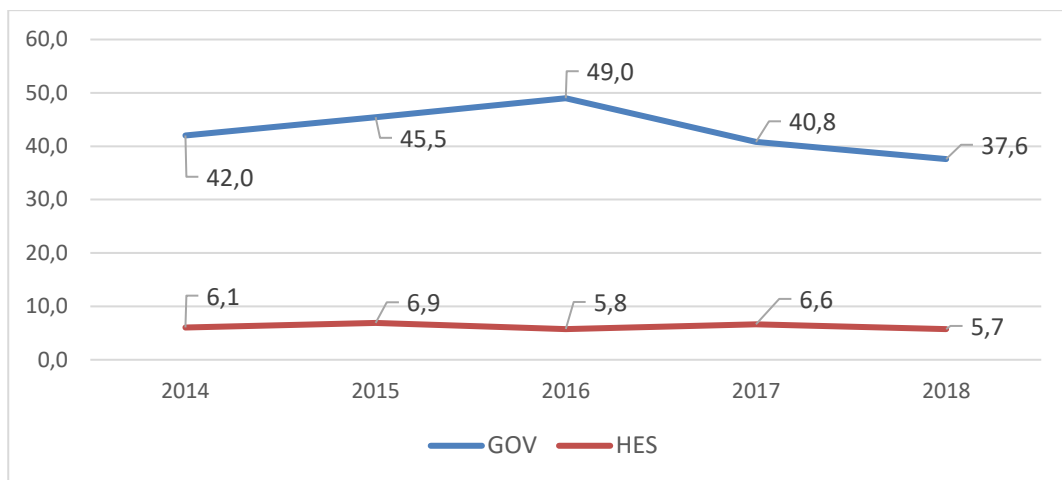


Source: Eurostat GERD by sector of performance and source of funds [rd_e_gerdfund]

The evolution of public R&D financed by business enterprises in Romania is presented in Figure 6.2. On average, the business sector annually invests around €6 million in the R&D carried out in universities and more than €40 million in the public organisations, except for 2018, when the values were much lower for both sectors.

186 European Commission (2017), Competitiveness in low-income and low-growth regions. The lagging regions report. Brussels, 10.4.2017SWD(2017) 132 final

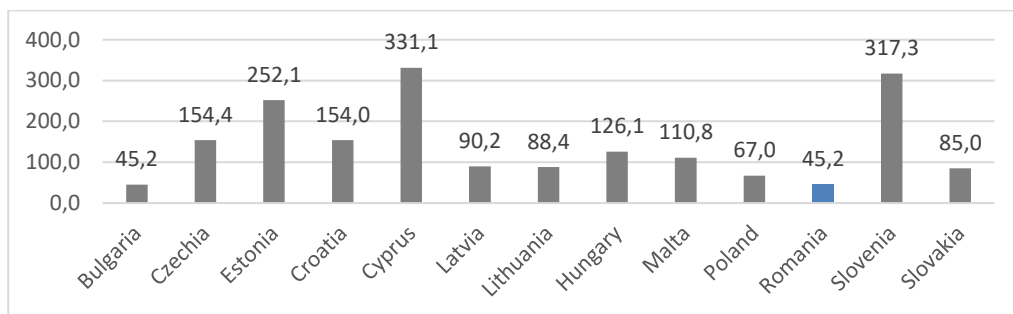
Figure 6.2 Public R&D (GOV&HES) financed by business enterprises in Romania (€ million)



Source: Eurostat GERD by sector of performance and source of funds [rd_e_gerdfund]

Figure 6.3 shows the number of public-private co-publications per population¹⁸⁷ at the CEE level, which captures the research linkages and active collaboration activities between business sector and public sector researchers. Romania still stays at the bottom of the EU level on this indicator, despite a significant increase, of more than 40%, from 2013.

Figure 6.3 Public-private co-publications per population at the CEE level (2020)

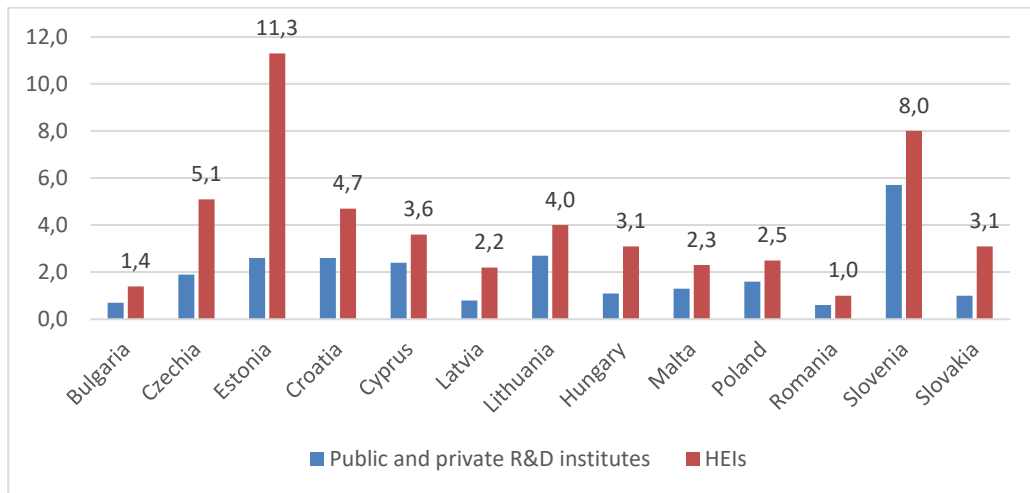


Source: European Innovation Scoreboard, 2021.

The percentage of enterprises cooperating with universities or higher education institutions, as well as with government, public or private research institutes is used as a proxy for knowledge circulation, including in the ERA roadmap monitoring reports. For Romania, the percentage of enterprises co-operating on R&D is very low, irrespective of the cooperation partner (Figure 6.4).

¹⁸⁷ Based on Scopus data

Figure 6.4 Percentage of enterprises co-operating on R&D and other innovation activities with universities or other higher education institutions (2018)¹⁸⁸



Source: Eurostat: Enterprises that co-operated on R&D and other innovation activities with other enterprises or organisations, by kind and location of co-operation partner, NACE Rev. 2 activity and size class[inn_cis11_coop]

The shares are also low when it comes to the innovative enterprises cooperating on R&D, which prefer rather the cooperation with suppliers of equipment and clients. Large enterprises show higher openness to cooperation on R&D than the SMEs (Table 6.1).

188 INDICATOR: P5a. (ERA) Share of product and/or process innovative firms cooperating with universities, government, public or private research institutes

Table 6.1 Percentage of innovative enterprises that co-operated on R&D and other innovation activities with other organisations, by size class and type of cooperation partners, Romania, 2018.

Cooperation partners	10-49 employees	50-249 employees	+250 employees	TOTAL
Enterprises within the same group	1	5	13	2.8
Consultants or commercial labs	2.1	6.6	10.4	3.7
Suppliers of equipment, materials	9.6	12.8	18.9	11
Clients or customers from the private sector	3.3	11.2	12.6	5.7
Competitors or other enterprises in the same sector	1.2	4.3	6.8	2.3
Universities or other HEIs	1.5	7.5	11.3	3.5
Government, public or private research institute	0.6	4.6	7.1	1.9
Clients or customers from the public sector	0.8	3.5	5.1	1.7
Non-profit organisations	0.8	2.3	5.3	1.5

Source: Eurostat: Enterprises that co-operated on R&D and other innovation activities with other enterprises or organisations, by kind and location of co-operation partner, NACE Rev. 2 activity and size class[inn_cis11_coop]

6.2 Public-private partnerships for R&I - qualitative perspectives

This section provides a synthesis of a number of relevant studies carried out at the EU/ national level on topics related to public-private partnerships, university-business cooperation, commercialisation and technology transfer or analysis of the barriers to the innovation diffusion in Romania.

The box below provides a brief overview of the main conclusions of the previous PSF Support to Romania, that had a focus on "Start-ups, Scale-ups and Entrepreneurship". The report emphasises the lack of adequate support schemes for public-private partnerships, as well as the need to introduce incentives for researchers to involve themselves in entrepreneurial ecosystems.

Main conclusions and recommendations of the 2016-2017 PSF Support to Romania, with relevancy for public-private partnerships

- Lack of trust, predictability and transparency, limited access to finance, limited capacity of higher education institutions to play a more active role in the entrepreneurial ecosystem, inadequate communication among the stakeholders and poor coordination between the government policymakers are the most important barriers hindering the development of the Romanian entrepreneurial ecosystem.

- There is a small number of R&D and innovation-oriented programmes, including public-private collaborative programmes, some of which have been introduced only recently. Most of the funding schemes are based on *de minimis* rules (and have limited allocations). R&D and innovation schemes are focussed on commercialisation of R&D results, which capture only a small share of potential firms (i.e. given the low business R&D intensity).
- The introduction of comprehensive integrated funding schemes for start-ups & SMEs (especially for those with high growth ambitions) could reduce administrative burden, while the establishment of new types of public-private partnerships could be conducive to higher levels of collaboration between research, academia and business.
- There are no formal incentives for university professors to involve themselves in entrepreneurial ecosystems and there are no metrics on progress or relevance connecting researchers and teachers from academia with companies.
- Developing a specific scheme to support the involvement of academics in entrepreneurial activities is recommended, together with specific programmes that could be organised by technical universities in partnerships with business.

Source: EC (2017) Specific Support to Romania – Starts-ups, Scale-ups and Entrepreneurship in Romania

A comprehensive study on university-business cooperation in Romania, with a total 477 HEI and 47 business responses, revealed that Romanian academics are involved in different types of cooperation with business, in particular in mobility of students and business consulting; in research activities, commercialisation of R&D results and further education, Romanian academics collaborate to a lesser extent. For Romanian HEI representatives, accessing business R&D facilities is the main driver stimulating university-business interactions, which is different from the general perception at the EU level, where the existence of mutual trust and of a shared goal is the main facilitator of cooperation. Not least, HEI representatives in Romania consider the IP rights legislation for academic research as the most developed instrument for university-business linkages in Romania and perceive the policy mechanisms (including laws, rules and hiring policies) at a medium-low level, which is similar to the perceptions of European counterparts.¹⁸⁹

From the business perspective, Romanian companies cooperate with universities especially for R&D projects, mobility of students, consulting and dual education programmes; valorisation activities (i.e. commercialisation of R&D results, entrepreneurship) are significantly less developed. Compared to their European counterparts, Romanian companies lack awareness of university research

189 EC (2018) The State of Romanian University-Business Cooperation: the university perspective. Study on the cooperation between higher education institutions and public and private organisations <https://www.ub-cooperation.eu/index/reports>

activities/ offerings, which is an important barrier hindering university-business cooperation, together with the bureaucracy related to cooperation in universities, the differing time horizons between universities and business or the lack of governmental funding for collaboration. For most companies involved in the survey (38%), the practice of recruiting PhD students or scientists in the business is the most important supporting mechanism for university-business cooperation; the existence of a structured/ systematic R&D programme is considerably less present in Romania than at the European level.¹⁹⁰

A number of recent studies on technology transfer in Romania highlight many barriers to effective public-private interactions.

While analysing the potential supply of technology transfer services in North East Romania, Toliás concludes that all regional HEIs and PROs have technology transfer and capitalisation of research outcomes in their development strategies, but they do not put emphasis on this part of their mission. The incongruity between patenting and licensing activity by HEIs/ PROs was deemed a special attention, as he found that the increase in the number of patent portfolios was not accompanied by an increase in the commercialisation revenues; “a poor track record of zero licensing revenues” was found, which poses important sustainability challenges. The author suggests policy interventions that stimulate first-time interactions of firms with HEIs/PROs, the promotion of intersectoral mobility schemes and industrial masters, as well as a change in the government-designed accreditation methodology of research units so that to consider alternative indicators (focussed on outcomes, not outputs).¹⁹¹

A similar analysis was carried out at the level of North-West region of Romania; the results of a survey applied at the regional level show that the local businesses are looking for innovation partnerships (i.e. research labs, fablabs, living labs, test bench) (70%), innovation funding (64%), research contracts to integrate knowledge/ technology in products or services (i.e. prototyping, tests, consultancy, technical assistance etc.) (61%), business support (i.e. technology scouting, market surveys, commercialisation bootcamps etc.) (45%) and only less than 30% of companies are looking for technology assessment, brokerage events and IPR issues. Overall, the interest and awareness of SMEs for the technology transfer services of the R&D&I organisations is medium to low and there is much room for improvement and development of a common cooperation and communication culture between the R&D&I sector and the SMEs.¹⁹²

190 EC (2018) The State of Romanian University-Business Cooperation: the business perspective. Study on the cooperation between higher education institutions and public and private organisations <https://www.ub-cooperation.eu/index/reports>

191 Toliás, Y. (2017) Report on Potential Supply of Technology Transfer Services in North East Romania https://adnrdest.ro/user/file/news/17/Toliás%20Y.%202017_raport%20asupra%20ofertei%20de%20TT%20din%20Regiunea%20Nord-Est.pdf

192 Loeffler, J. (2017) Analysis of Needs, Offers and Gaps for Innovation & Technology Transfer Services for Companies in the North-West Region of Romania <https://www.nord-vest.ro/wp-content/uploads/2016/09/Analysis-of-ITT-services-for-companies-NW.pdf>

Cosnita et. al (2019) have conducted an analysis of the activity of 49 technological transfer entities in Romania (ReNITT network). 88% of ReNITT entities do not have legal personality, but are organised as departments within some host organisations, i.e. INCDs, universities, companies; such a status ensures their institutional and financial stability. Between 2016-2018, ReNITT members have mediated about 120 technology transfers, 288 innovation support services, 117 support services for internationalisation and about 142 IPR support activities. About a third of ReNITT entities are located in the capital region, Bucharest Ilfov; some regions have only few or no ReNITT entities (i.e. South Muntenia). One major weakness is that the profile of ReNITT entities does not cover all the smart specialisation areas in Romania. At the same time, the lack of public financial support from the state budget, as well as the lack of national – regional coordination on technology transfer support programmes represents important threats for the efficiency and effectiveness of innovation activities in Romania.¹⁹³

Not least, Chioncel (2020) has provided a comprehensive analysis of the factors that obstruct the diffusion of innovation in Romania, while emphasising the fact that “for diffusion to happen, firstly quality research has to be performed, in order to generate new knowledge that could lead to innovation” (p. 6). Systemic challenges i.e. socio-demographic decline, lack of predictability of the legal framework, the high administrative bureaucracy, the low quality of infrastructure etc. - should be addressed as priorities. Beyond these, specific obstacles were identified at all levels of the innovation system that refer to low funding for education and R&D, low level of human resources in science and technology, low knowledge production, and low levels of knowledge demand.¹⁹⁴

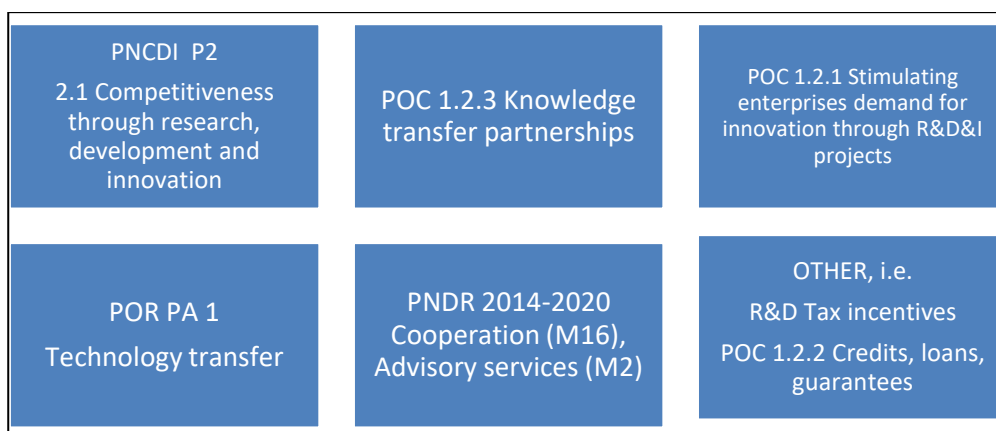
6.3 Policies and instruments for public-private collaboration. Key challenges

SNCDI set targets for activating the business sector and increasing economic impact, with a focus on smart specialisation domains. Creating a stimulating environment for the private sector initiative is supported via tax credits, venture capital funds and guarantee funds, management of intellectual property; the implementation of smart specialisation is carried out mainly through support offered to projects initiated by companies individually or in partnership with R&D institutes and universities, as well as through support for technology transfer and knowledge exchange partnerships. Figure 6.5 introduces the main instruments supporting private R&D and public-private partnerships.

193 Cosnita, D., Iorgulescu, F., Dulgheru, A. (2019) Analiza institutionala a furnizorilor de transfer tehnologic din Romania. August 2019

194 Chioncel, M. (2020) Analysis of the factors that obstruct the diffusion of innovation, UEFISCDI, SIPOCA 592

Figure 6.5 Main instruments supporting public-private collaboration



Source: own conceptualisation

Instruments, beneficiaries, (expected) results

- PNCDI 2.1 - Competitiveness through research, development and innovation - is the main national programme aimed at stimulating business demand for innovation and public-private partnerships. The financing instruments are: bridge grants (transfer of knowledge to the economic agents), demonstration projects, transfer to the economic operator, cluster organisation and development, innovation checks and solutions. The latter is a top-down type action, where the R&D sector responds to a problem raised by public authorities (public procurement for innovation).
- POC 1.2.1 – Stimulating enterprises demand for innovation – supports R&D&I projects undertaken by companies either individually or in partnership with R&D institutes and universities (i.e. start-ups and spin-offs, innovative technological projects).
- POC 1.2.3 Knowledge transfer partnerships – aims at supporting companies’ access to the expertise and facilities of R&D&I institutions through consultancy, access to R&I facilities, R&D&I services for enterprises, and collaborative partnerships.
- PNDR Measure 16 – provides support to the establishment and operation of the European Innovation Partnership Operational Groups and to pilot projects for the development of new products and processes. Measure 16.4 also supports horizontal and vertical cooperation between the actors in the supply chain, while Measure 2 supports the provision of advisory services.
- POR PA1 – Technology transfer – supports the creation and development of the technology transfer infrastructure, scientific and technological parks, specific support services and partnerships between SMEs and technology transfer organisations. A call for proof of concept and research valorisation programme is planned for the near future.

- R&D tax incentives. Romania has recently introduced a number of fiscal measures, i.e. an additional tax deduction of 50% for R&D expenditure of enterprises in establishing the taxable profit (Common Order 1056/4435/2016 of the Ministry of Finances and Ministry of Education on the approval of Rules regarding the deductions for R&D expenses in establishing taxable profit); the exemption from income tax (on salaries and incomes assimilated to salaries) for all persons included in the R&D&I team (GO 32/ 2016); in 2017, a 10-year tax exemption for R&D firms was introduced (GO 3/3027), but the procedural norms are in preparation.

The use of fiscal facilities in practice was very challenging and many companies are still reluctant to apply the incentive - given that the definition of eligible R&D activities for which the deductions may apply is very broad and generate uncertainties.¹⁹⁵ The OECD estimates that in 2016 R&D tax incentives accounted for 15% of total government support for business R&D in Romania, which is also very low (less than 0.04% of GDP in 2016).¹⁹⁶ The increase of business R&D expenditure in recent years was attributed to the fiscal facilities introduced after 2017, but there is scarce evidence on the use of R&D incentives and their impact on BERD growth.

- POC 1.2.1 Credit instruments and venture capital measures in favour of innovative SMEs and research organisations (about 60 EUR mil) – is implemented through a State aid and *de minimis* scheme in the form of venture capital investments for SMEs (Order no 194/2018), managed by the European Investment Fund and a subsidised interest loan instrument. Until 2021, there were 65 SMEs benefiting from venture capital investments or loans to support innovative activities in smart specialisation areas.¹⁹⁷

The interim evaluation of SNCDI noted the higher importance given to public-private partnerships in the current programming period, and the larger number of projects applied under the dedicated competitions organised under PNCDI. At the same time, the interim evaluation of POC PA1 observed an improvement in the number and quality of science-business interactions. Both studies recommend an increase in funding predictability and an improvement of the regulatory framework on knowledge and technology transfer. The National Recovery and Resilience Plan proposes a legislative reform to simplify cooperation between business and research that shall include, for example, the creation of a uniform contracting framework for all funding programmes, to reduce the administrative burden.¹⁹⁸

195 KPMG (2018) R&D&I Tax incentives and economic growth in Romania
<https://assets.kpmg/content/dam/kpmg/ro/pdf/2018/Research-innovation-EN-2018-web.pdf>

196 OECD (2021) R&D Tax Incentives: Romania, 2020 www.oecd.org/sti/rd-tax-statsromania.pdf, Directorate for Science, Technology and Innovation, March 2021.

197 Romania's National Reform Programme 2021

198 Ministry of Investments and European Projects (2021) National Recovery and Resilience Plan, July 2021 Version
<https://mfe.gov.ro/pnrr/>

7. INTERNATIONALISATION OF THE R&I SYSTEM

This chapter provides an overview of Romania's participation in FP7 (2007-2014) and Horizon 2020 (2014-2020), as well as in ERA and other relevant international initiatives. Key messages are as follows:

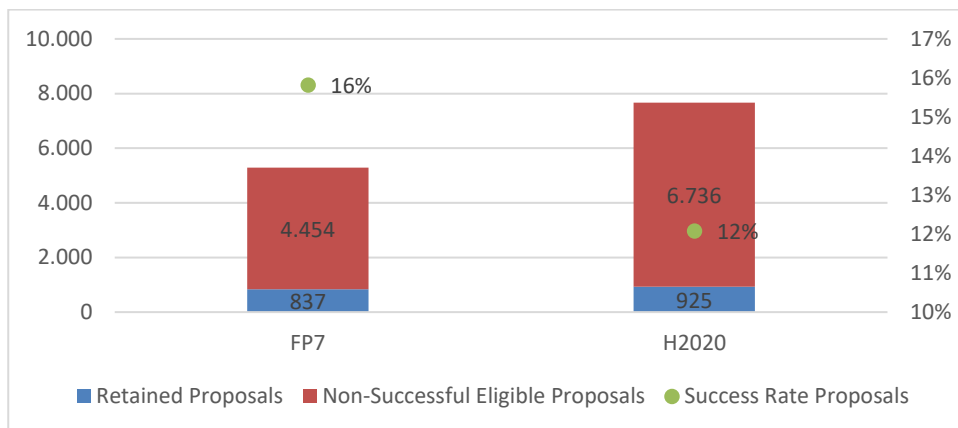
- Romania's participation in the Framework Programmes increased from FP7 to H2020; however, its success rate decreased from 16% to 12%.
- The most active participants in Framework Programme projects belonged to the private for-profit (PRC) sector and research organisations (excluding education) (REC).
- In terms of cooperation in addressing grand societal challenges Romania has a strong lead in public-to-public cooperation. However, the number of co-publications and public financing to transnational R&D projects could be increased to catch up with other EU countries.
- The insufficient number of qualified project managers, the poor quality of the NCP support and the preference for national calls are some of the factors that explain the low participation in FP schemes, according to evaluations carried out under the "Stairway to Excellence" initiative of the EC/ JRC.
- The National R&D&I Plan has a dedicated programme supporting "European and International Cooperation" (Programme 3), while the OP Competitiveness, PA1 gives support for "Creating synergies with Horizon 2020 and other international R&D&I programmes" (Action 1.1.3). Support is also provided to participation in various international organisations and in international R&I programmes in strategic areas (nuclear physics, atomic and subatomic physics, space research, river-delta-sea systems etc.).
- ELI-NP (ESFRI-ELI), Danubius-RI and ALFRED (Advanced Lead Fast Reactor European Demonstrator) are the major international R&I infrastructures supported from the National R&I Plan 2015-2020.
- Romania was not included in the European consortium ELI-ERIC approved by the EC on May 2021, even if the country hosts ELI-NP, one of the three pillars of the distributed research infrastructure.

7.1 Participation in EU Framework Programmes (FP7 and H2020)

The success rate in FP7 and H2020 for Romania's participation was 16% and 12%, respectively. Romanian researchers successfully and unsuccessfully

participated in nearly 5300 proposals. Such participation was more extensive in H2020; over 7600 proposals were submitted which included Romanian participants.

Figure 7.1 Romania’s success rates in FP7 and H2020



Source: EC dashboard, Cordis data.

The table below also illustrates that Romania’s participation in H2020 was more extensive than compared to FP7. For example, the total cost increased approximately three times, SME’s participation increased by nearly nine times.

Table 7.1 Snapshot of Romania’s participation in FP7 and H2020

Indicators: all participants	Value for FP7	% of FP7	Value for H2020	% of H2020
Participations	753	0.54%	1570	0.91%
Unique participations	164	0.55%	521	1.30%
EU contribution	€95.62 M	0.21%	€289.2 M	0.44%
Total cost	€127.1 M	0.19%	€368 M	0.45%

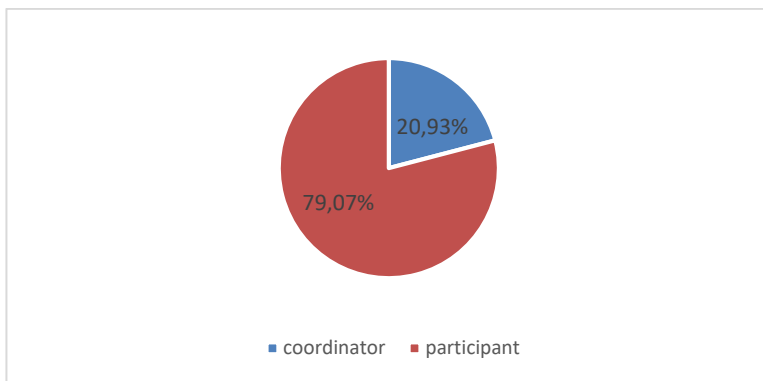
Source: EC dashboard, Cordis data.

Indicators: SMEs	Value for FP7	% of Romania’s FP7 participations	Value for H2020	% of Romania’s H2020 participations
Number of participating SMEs	24	3.19%	211	13.44%
SME EU participations	€4.98 M	5.21%	€34.32M	11.87%

Source: EC dashboard, Cordis data.

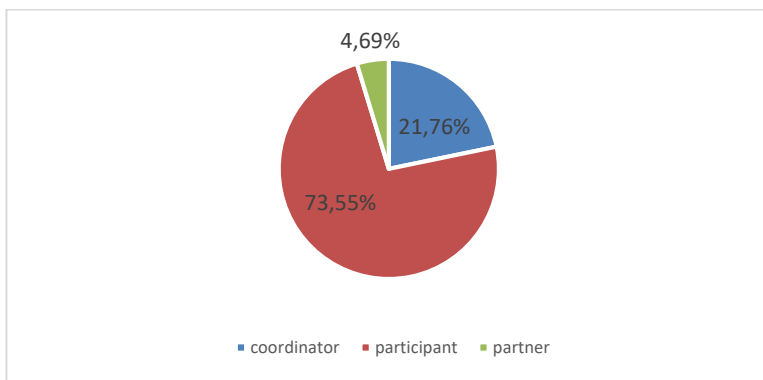
In both, FP7 and H2020 projects, Romanian research consortium members mostly took on the role of participant, rather than coordinator. In both framework programmes Romanian institutions coordinated around 20% of the projects.

Figure 7.2 Role of Romanian participants in FP7 projects



Source: Cordis data.

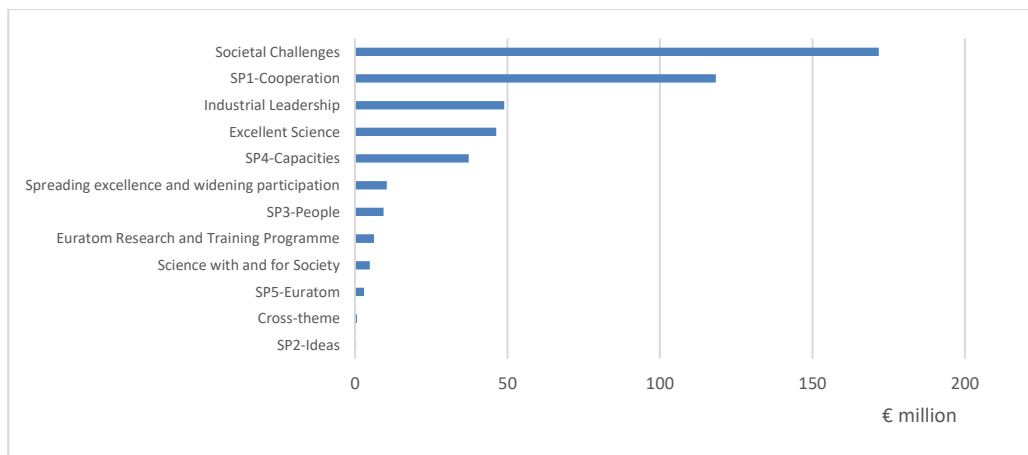
Figure 7.3 Role of Romanian participants in H2020 projects



Source: Cordis data.

Societal Challenges and SP1-Cooperation were the most significant areas for Romania’s participation in framework programmes. The EU contributions to projects under these pillars compounded around 63% of total contributions.

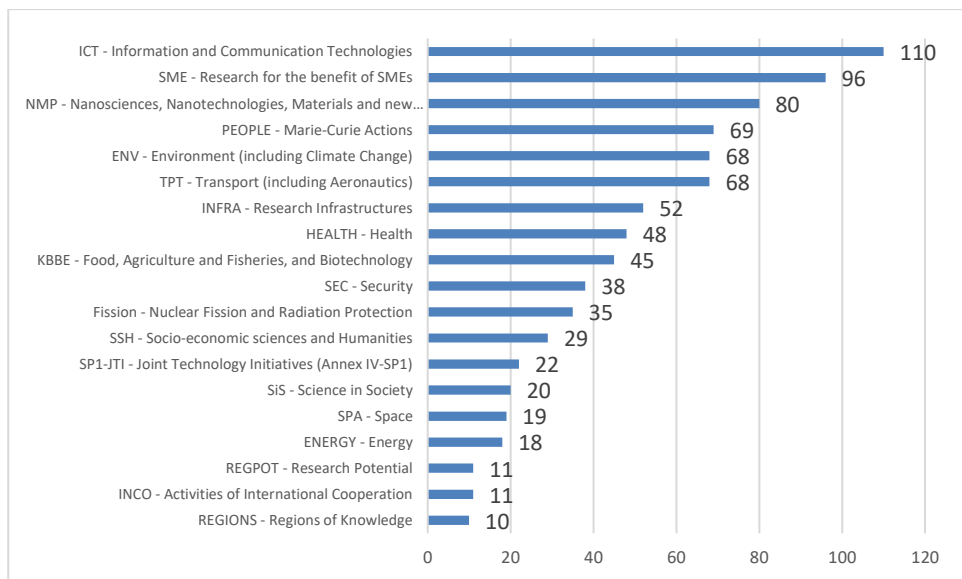
Figure 7.4 EU contribution by thematic priority/type of action/pillar, total R&I programmes (both FP7 and H2020)



Source: EC dashboard, Cordis data.

In terms of thematic priorities, the two most frequent areas for Romania’s participation were Information and Communication Technologies and Research for the Benefit of SMEs.

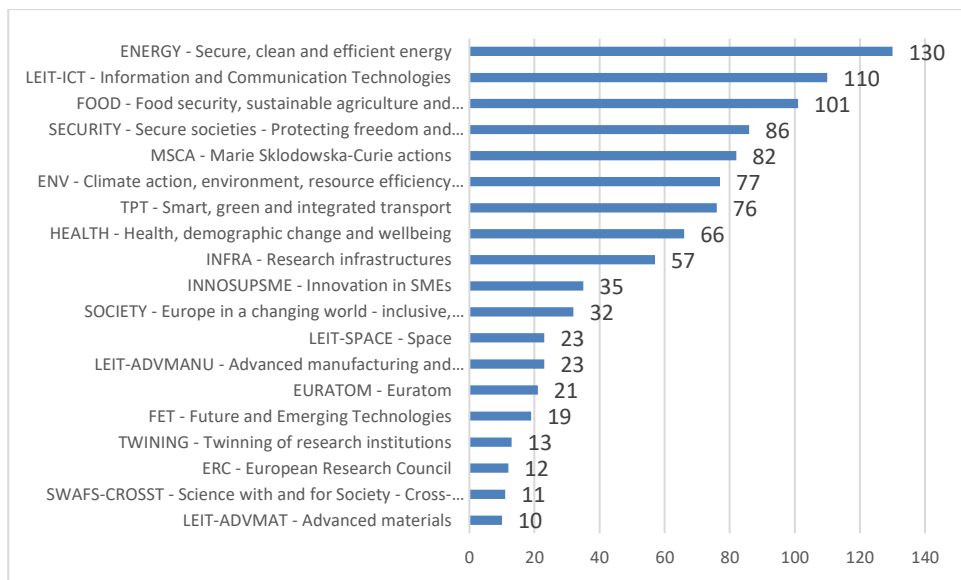
Figure 7.5 Number of signed grants by pillar/thematic priority in FP7 (selected areas with 10 or more grants)



Source: EC dashboard, Cordis data.

In H2020, Information and Communication Technologies remained under the most important thematic priorities. In addition, secure, clean and efficient energy as well as food security, sustainable agriculture and forestry, marine and maritime and inland water research were also among the most important thematic areas for Romania.

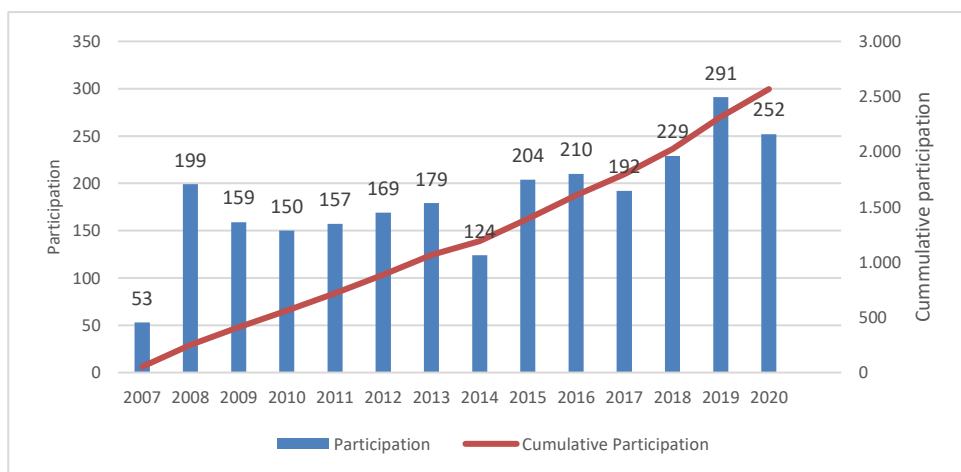
Figure 7.6 Number of signed grants by pillar/thematic priority in H2020 (selected areas with 10 or more grants)



Source: EC dashboard, Cordis data.

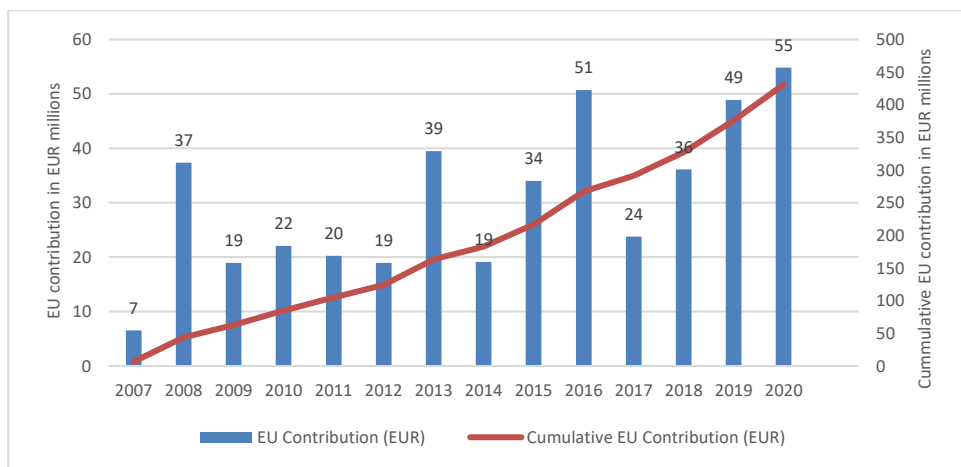
Romania’s participation in framework programmes fluctuated from year to year, and the EU contributions were correlated to the extent of the participation. Nevertheless, in 2013, 2016, and 2020 Romanian beneficiaries received the largest amounts of EU contributions; in 2020, it reached nearly €55 million.

Figure 7.7 Evolution of Romania’s participation in FP7 and H2020 (2007-2020)



Source: EC dashboard, Cordis data.

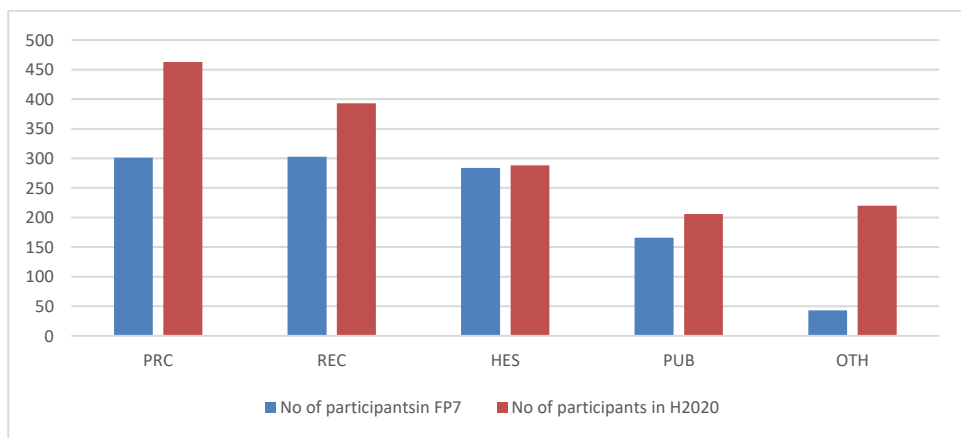
Figure 7.8 Evolution of EU contribution received by Romania in FP7 and H2020 (2007-2020)



Source: EC dashboard, Cordis data.

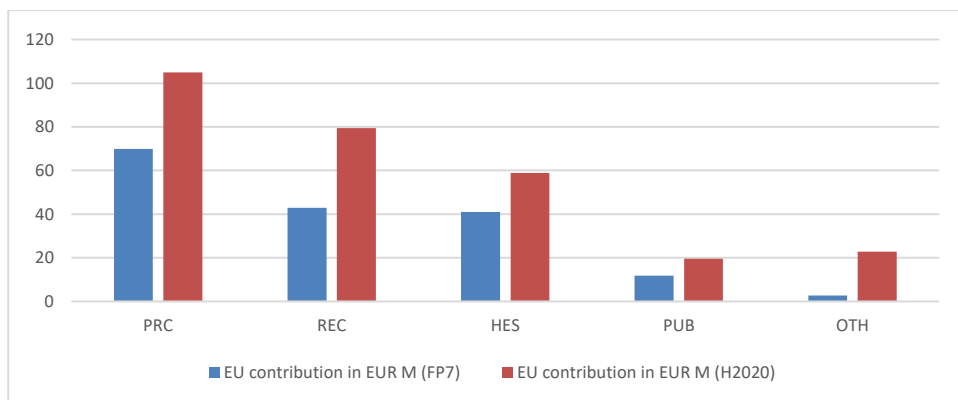
The most active participants in framework programme projects belonged to the private for-profit (PRC) sector and research organisations (excluding education) (REC). The participation of the higher education (HES) sector and public organisations (PUB) was slightly less extensive. The EU contributions according to the organisation type were distributed accordingly, they correlate with the number of participations.

Figure 7.9 Participation by organisation type



Source: EC dashboard, Cordis data.

Figure 7.10 EU contribution by organisation type



Source: EC dashboard, Cordis data.

Although the majority of participants were PRC and REC organisations, the most active single organisations are higher education institutions (e.g. Politehnica University of Bucharest).

Table 7.2 Top 10 Romanian participants in FP7 and H2020

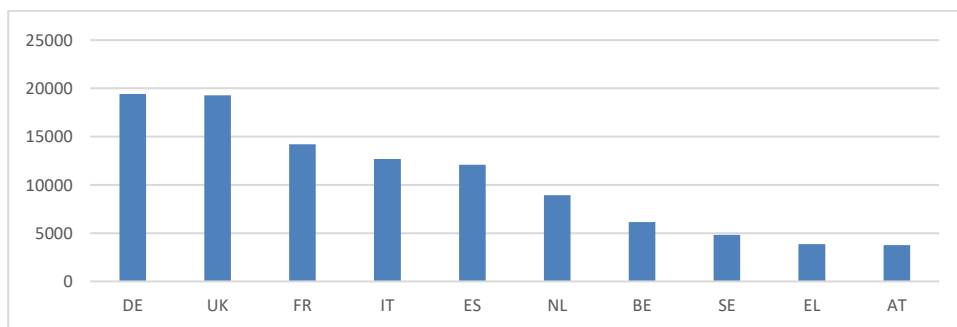
FP7			H2020		
Organisation name	Number of participations	EU contribution in € million	Organisation name	Number of participations	EU contribution in € million
Politehnica University of Bucharest	45	9.36	Executive Unit for Financing Higher Education, Research, Development and Innovation	68	12.59
Ministry of National Education	44	1.29	Politehnica University of Bucharest	50	12.29
Executive Unit for Financing Higher Education, Research, Development and Innovation	36	3.35	Software imagination & vision SRL	38	13.69
Technical University of Cluj-Napoca	33	5.68	Siveco Romania SA	31	5.2
The Technologies for Nuclear Energy State	33	1.52	University of Bucharest	29	3.62

FP7			H2020		
Organisation name	Number of participations	EU contribution in € million	Organisation name	Number of participations	EU contribution in € million
Owned Company (RATEN)					
University of Bucharest	32	2.93	Technical University of Cluj-Napoca	27	6.55
Babes-Bolyai University	24	3.51	Babes-Bolyai University	24	6.37
Horia Hulubei National Institute of Physics and Nuclear Engineering	22	1.84	Horia Hulubei National Institute of Physics and Nuclear Engineering	21	6.4
National Institute for Research and Development in Microtechnologies	16	3.22	Institutul National De Cercetare-Dezvoltare Pentru Geologie Si Geoecologie Marina-Geoecomar	20	4.8
Alexandru Ioan Cuza University	14	1.99	Siemens SRL	17	3.92

Source: EC dashboard, Cordis data.

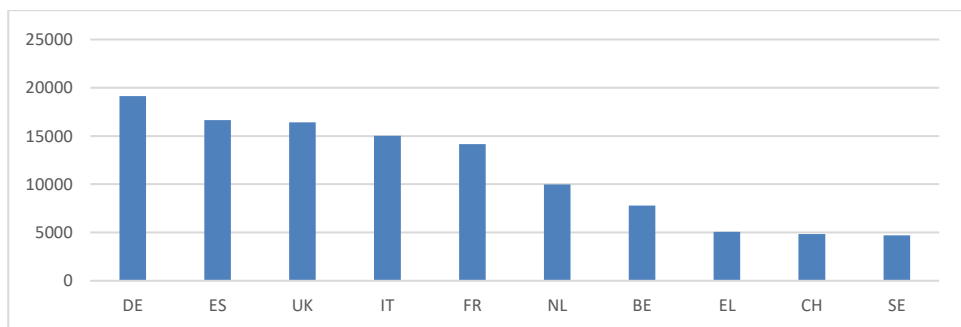
Romanian FP7 beneficiary organisations mostly collaborated with partners from Germany and the UK (for the top 10 list, see a figure below). The network of partner countries did not significantly change from PF7 to H2020.

Figure 7.11 Top 10 partner countries in FP7 projects



Source: Cordis data.

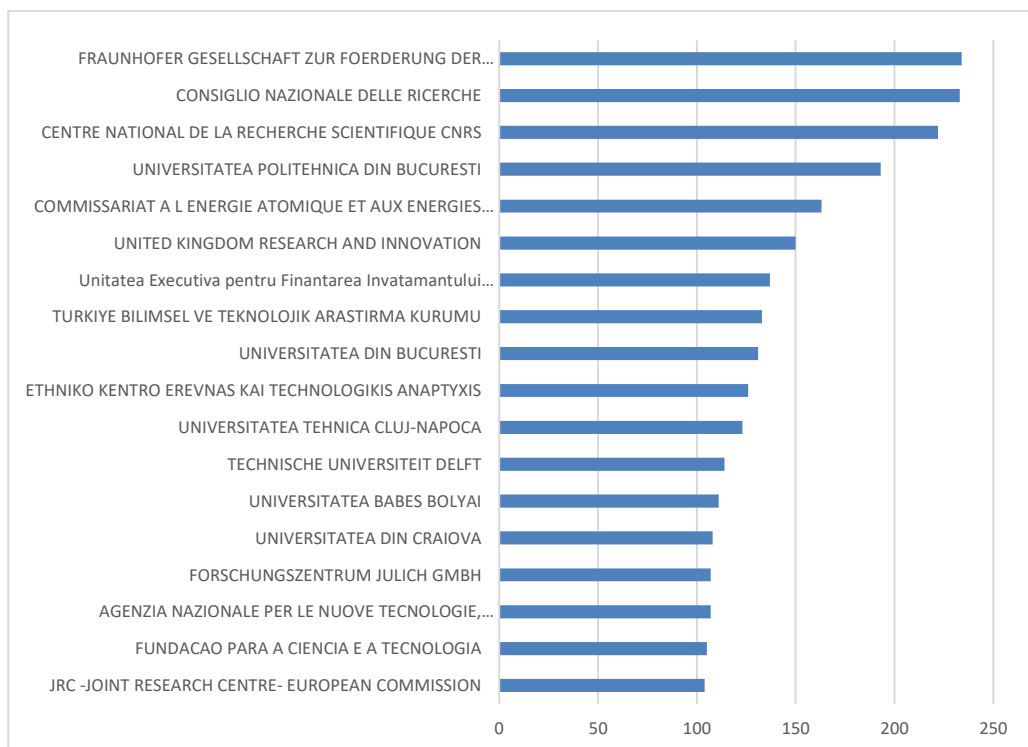
Figure 7.12 Top 10 partner countries in H2020 projects



Source: Cordis data.

The figure below presents the organisations that Romanian framework programmes participants collaborated with the most. Fraunhofer Institute and the Italian National research council are the most linked foreign institutions to Romanian beneficiaries.

Figure 7.13 Collaboration links in R&I projects (FP7 and H2020)



Source: EC dashboard, Cordis data.

7.2 Participation in ERA and other relevant international initiatives

Until 2020, ERA had six priorities (P):

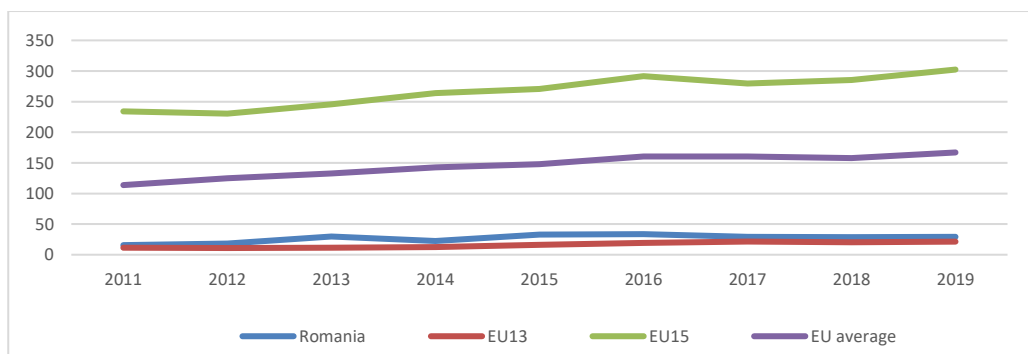
- (P1) More effective national research systems.
- (P2) Optimal transnational cooperation and competition, including 'jointly addressing grand challenges' and 'research infrastructures'.
- (P3) An open labour market for researchers.
- (P4) Gender equality and gender mainstreaming in research.
- (P5) Optimal circulation, access to and transfer of scientific knowledge, including 'knowledge circulation' and 'open access'.
- (P6) International cooperation.

While a part of these priorities is covered through this report, in this section we particularly focus on the Priority 2 "Optimal transnational cooperation and competition, including 'jointly addressing grand challenges' and 'research infrastructures'; and the Priority 6 "International cooperation".

Priority 2a. Jointly addressing grand societal challenges

Romanian national funding to transnationally coordinated R&D projects was rather low and has not significantly changed since 2011. While it is well below the EU average, it is in line with the overall EU13 average.

Figure 7.14 National public funding to transnationally coordinated R&D (2011-2019)



Note: Data for France is not included in calculations; it is missing in the raw dataset.

Source: Eurostat.

The amount of funding to transnationally coordinated R&D projects is a part of one of ERA headline indicators. The government budget for R&D allocated to transnational cooperation indicator ranks Romania in the third cluster along countries such as the UK, Denmark, and Czechia. The amount of such spending in Romania increased by 15.6% in the period of 2012-2016.

Table 7.3 GBARD (€) allocated to Europe-wide transnational, as well as bilateral or multilateral, public R&D programmes per FTE researcher in the public sector (2007–2016)

Country	Score	Change over 2012-2016
Cluster 1	11152.7	2.6%
Cluster 2	3712.9	4.1%
Cluster 3	1197.5	13.7%
UK	2741.2	7.7%
DK	2501.1	-0.1%
RO	1839.9	15.6%
CZ	1546.7	1.7%
SI	1430.1	-1.5%
IE	1330.4	-14.0%
EE	1293.1	6.7%
PT	1130.8	11.8%
PL	1085.5	94.0%
HR	938.9	3.9%
HU	875.2	18.0%
LV	856.0	11.0%
EL	676.1	-17.2%
MT	379.7	4.7%
LT	271.5	24.7%
SK	263.2	51.6%
Cluster 4	82.2	3.2%

Source: ERA progress report 2018.

Romania is an active participant in public-to-public (P2P) cooperation. As of June 2018, Romania participated in 41 cooperation projects. This is well above the EU13 average (22 participations) and the EU28 average (34 participations).

Table 7.4 Participations in H2020 P2Ps, cut-off date June 2018

	Romania	EU13 average	EU15 average	EU28 average
P2P participation	41	22	44	34
P2P coordination	0	0	4	2
Call participation	81	47	73	61
Supported projects	101	54	253	175

Source: ERA-LEARN: enabling systematic interaction with the P2P community (Poland country report 2019).

Such active participation in P2P cooperation projects put Romania in the second cluster of countries in the headline ERA indicator “Participation in public-to-public collaborations”. In terms of this indicator, Romania ranks among such EU member states like the Netherlands, Denmark, and Belgium.

Table 7.5 Member State participation (€) in Public-to-Public collaborations per FTE researcher in the public sector (2012–2016)

Country	Score	Change over 2012-2016
Cluster 1	2361.5	54.1%
Cluster 2	1152.8	21.4%
NL	1265.6	34.3%
RO	1237.4	33.2%
DK	1221.5	33.2%
BE	1157.2	27.1%
LU	1123.2	-14.0%
SI	912.0	14.6%
Cluster 3	347.1	32.7%
Cluster 4	113.0	15.9%

Source: ERA progress report 2018.

Another ERA headline indicator assesses the intensity of co-publications with partners from ERA countries. As discussed under section 4.2, only around 36% of publications were co-authored with researchers from other universities (in 2018). Hence, Romania belongs to the third cluster of countries with somewhat lower rates of cooperation. It ranks among such countries as Portugal, the UK and Greece.

Table 7.6 Co-publications with ERA partners per 1000 FTE researchers in the public sector (2007–2016)

Country	Score	Change over 2012-2016
Cluster 1	168	5.6%
Cluster 2	99	3.3%
Cluster 3	59	3.1%
CZ	76	4.3%
HU	73	2.4%
ES	67	7.0%
HR	66	6.1%
DE	63	0.5%
FR	63	2.0%
IE	60	-5.3%
PT	57	6.7%
UK	56	4.5%
RO	53	3.4%
EL	51	-0.9%
MK	45	6.0%
SK	42	3.1%
Cluster 4	31	4.2%

Source: ERA progress report 2018.

All in all, in terms of Jointly addressing grand societal challenges, Romania has a strong lead in public-to-public cooperation. However, the number of co-publications and public financing to transnational R&D projects could be increased to catch up with other EU countries.

Priority 2b. Research infrastructures

According to the data in ERA progress report¹⁹⁹, in total, in 2018, there were 18 ESFRI projects and 37 landmarks. Romania has participated in 12% of them. Hence, it is ranked in the third cluster along with other countries such as Slovakia, Israel and Bulgaria.

199 EC (2019) ERA progress report, retrieved from: <https://op.europa.eu/en/web/eu-law-and-publications/publication-detail/-/publication/5641328c-33f8-11e9-8d04-01aa75ed71a1>

Table 7.7 Share of developing ESFRI Projects and operational ESFRI Landmarks in which a Member State/Associate Country is a partner (2018)

Country	Score			Change over 2016-2018		
	Projects + Landmarks	Projects	Landmarks	Projects + Landmarks	Projects	Landmarks
Cluster 1	60%	54%	64%	9.7%	11.8%	9.1%
Cluster 2	36%	24%	42%	19.8%	16.2%	15.0%
Cluster 3	12%	12%	11%	48.1%	23.0%	34.3%
RO	22%	33%	16%	16.8%	32.3%	8.4%
SK	22%	22%	22%	65.1%	52.8%	77.1%
IL	22%	22%	22%	16.8%	52.8%	2.2%
BG	18%	22%	16%	50.8%	52.8%	53.3%
IE	18%	11%	22%	34.8%	-11.8%	77.1%
CY	18%	28%	14%	201.5%	-	98.0%
EE	15%	11%	16%	10.1%	-	-11.5%
LV	13%	17%	11%	-	-	-
HR	7%	6%	8%	90.7%	-	53.3%
LT	7%	6%	8%	10.1%	-	-11.5%
LU	7%	0%	11%	90.7%	-	77.1%
RS	7%	6%	8%	34.8%	-	8.4%
TR	7%	11%	5%	34.8%	52.8%	25.2%
MT	4%	0%	5%	-4.7%	-	-11.5%
IS	4%	0%	5%	34.8%	-	-
MD	4%	11%	0%	34.8%	100.0%	-
UA	4%	6%	3%	-	-	-
Cluster 4	0%	1%	0%	-	-	-

Source: ERA progress report 2018.

Priority 6. International cooperation

The international cooperation aspect in ERA is measured by co-publications with non-ERA partners, a number of foreign doctorate students, funding allocated to transnational R&D programmes and exports of medium and high technology products and of knowledge-intensive services.

Similar to the figures for co-publications with ERA partners, Romania is put in the third cluster of countries with relatively fewer collaborations. Nevertheless, in the

period of 2007-2016, the number of such collaborations grew by 6.3%, which is among the faster growth rates in ERA.

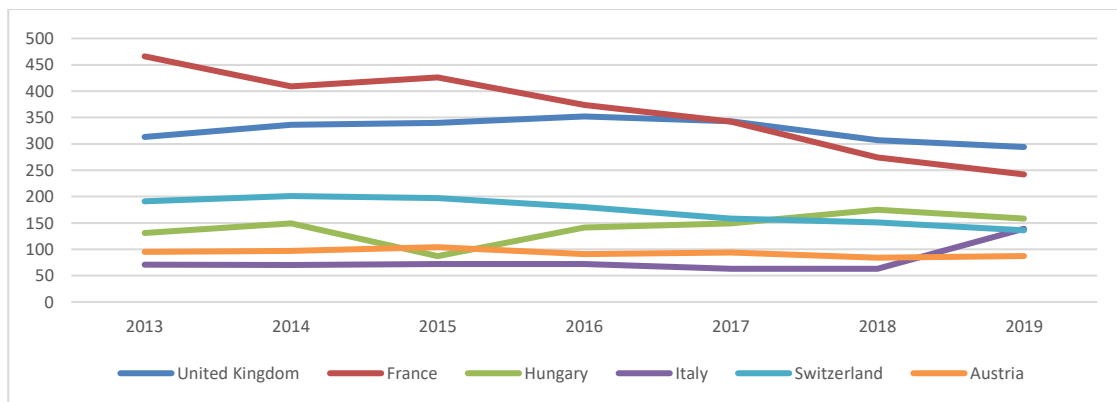
Table 7.8 Co-publications with ERA partners per 1000 FTE researchers in the public sector (2007–2016)

Country	Score	Change over 2007-2016
Cluster 1	92.9	3.7%
Cluster 2	59.2	4.9%
Cluster 3	31.5	6.2%
SI	43.6	7.2%
IE	42.9	-3.1%
LU	39.0	14.8%
CZ	37.3	7.1%
MT	37.1	14.2%
PT	35.8	9.8%
HU	35.7	2.5%
EE	27.7	9.3%
RO	24.4	6.3%
EL	24.3	-1.5%
TR	23.4	4.6%
HR	20.6	5.6%
PL	17.7	3.9%
Cluster 4	13.3	5.1%

Source: ERA progress report 2018.

As suggested by the ERA progress report, international cooperation can be measured in terms of doctorate students studying abroad and foreign doctorate students in the country. The majority of Romanian PhD students choose to study in the UK, France, Hungary, Italy, Switzerland, and Austria. On the other hand, over time, the popularity of these destinations is decreasing; the largest drop was visible in the UK.

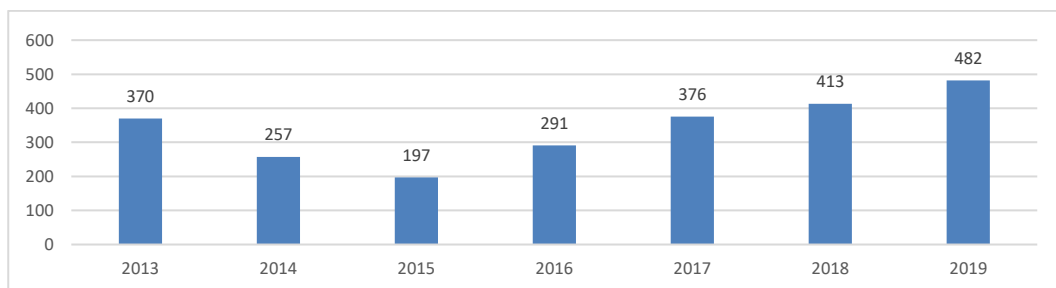
Figure 7.15 Number of Romanian doctorate students in six most popular destinations for Romanian students



Source: Eurostat.

The balance between Romanian PhD students abroad and foreign students in Romania is negative, meaning that Romania receives fewer foreign PhD students than there are Romanians studying abroad. Nevertheless, the number of foreign doctorate students in Romania has grown since 2015. In 2019 there were nearly 500 foreign PhD students.

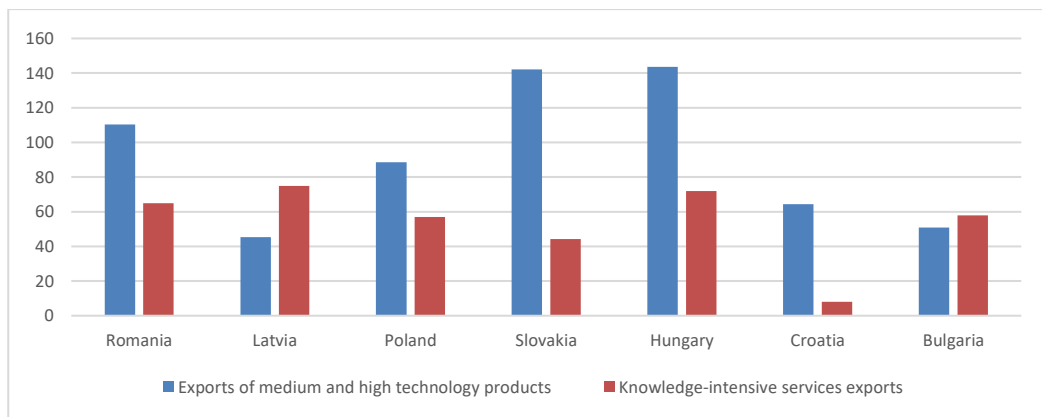
Figure 7.16 Number of foreign doctorate students in Romania



Source: Eurostat.

Another medium for international cooperation is through exports. According to the data of the European Innovation Scoreboard, among the ERA countries, Romania takes 10th place in terms of exports of medium and high technology products; among the emerging innovators, Romania is third. Romania's position in terms of the exports of knowledge-intensive services is worse; Romania is ranked 23rd in the ERA and is behind Latvia and Hungary among emerging innovator countries.

Figure 7.17 Scores on exports of medium and high technology products and of knowledge-intensive services, as evaluated by the European Innovation Scoreboard (2021)



Source: European Innovation Scoreboard, 2021.

7.3. Policies and measures supporting internationalisation - key challenges

“Internationalisation” is a cross-cutting action of SNCDI, which envisages the necessary support for Romania’s participation in projects under Horizon 2020, as well as in European initiatives (i.e. Joint Programming Initiatives (JPIs), Joint Technology Initiatives (JTIs), European Innovation Partnerships (EIPs) etc.), in international organisations (CERN, ESA etc.), or in bilateral/ multilateral calls.

The Romanian ERA Roadmap 2015-2020²⁰⁰ was developed as a follow-up of the adoption of ERA Roadmap (2015-2020) and proposes objectives and measures in line with the National Strategy for R&D&I and its implementing instruments. Under Sub-priority 2A (Optimal transnational cooperation), the main measures envisaged are the elaboration of an Action Plan for a coordinated participation in joint programming process and JPIs and the alignment of Romanian research programmes with joint strategies built together at the European level, while for the Sub-priority 2B (European Strategy Forum on Research Infrastructures), the objective is to foster the active participation in ESFRI research infrastructures and processes. Strengthened cooperation, networking and policy dialogue with third countries and regions is envisaged under Priority 6. With regard to the participation in ESFRI projects, the ERA Monitoring Report 2018 notices a small growth for Landmark participation and pronounced growth in participation for developing Projects. Romania’s participation in ERICs is summarised in the box below.

200 Ministry of National Education and Scientific Research (2016) Romanian ERA Roadmap, May 2016, Bucharest https://era.gv.at/public/documents/2901/Romanian_ERA_Roadmap.pdf

Romania's participation in ERICs

Romania is a member of a number of some ERICs, i.e.: **CERIC** - the Central European Research Infrastructure Consortium (dedicated to materials science facilities); **EMSO-ERIC** - the European Multidisciplinary Seafloor and Water Column Observatory — a network of observatory nodes installed in European seas providing key data on marine ecosystems, natural hazards and climate change, **EPOS ERIC** - the European Plate Observing System (EPOS), a research infrastructure that will provide a better understanding of the physical processes controlling geohazards.²⁰¹

In 2020, Danubius-RI applied for designation as an ERIC.

On 30 April 2021, the Commission granted the legal status of ERIC to Extreme Light Infrastructure. **While hosting one of the three pillars of the ELI distributed research infrastructure, Romania was to be a founding member of ELI ERIC, but it was omitted from the consortium,** following a dispute over equipment contract and operational autonomy. ELI ERIC currently includes two laser facilities in the Czech Republic and Hungary that were built with support from the ERDF. Italy and Lithuania are also founding members, while Bulgaria and Germany signed up as founding observers. There is hope that ELI-NP could join the ERIC as soon as the gamma beam is delivered and fully installed and that "Romania will be back on board at some point".²⁰²

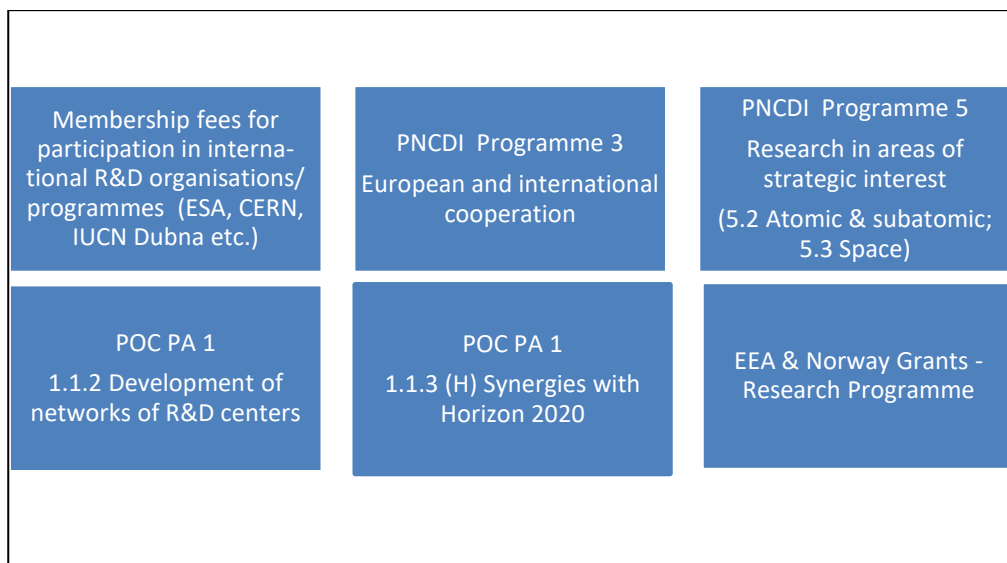
Romania is represented in almost all ERA Committees and has actively participated in Mutual Learning Exercises (MLE) on R&I internationalisation and alignment and interoperability of National Research Programmes. On this occasion, the introduction of a dedicated sub-programme in the National R&D&I Plan to support the Joint Programming Process has been identified as a good practice at the EU level.²⁰³ Figure 7.18 displays the main public instruments supporting international collaboration (including capacity building), participation in Horizon 2020 and in other international organisations and programmes.

201 EC – ERIC Landscape: https://ec.europa.eu/info/research-and-innovation/strategy/strategy-2020-2024/our-digital-future/european-research-infrastructures/eric/eric-landscape_en

202 Science I Business (2021) European laser research consortium marches on without Bucharest facility <https://sciencebusiness.net/news/european-laser-research-consortium-marches-without-bucharest-facility>; EU research chief calls for global coordination of research infrastructures <https://sciencebusiness.net/news/eu-research-chief-calls-global-coordination-research-infrastructures>

203 EC (2017) MLE Alignment and Interoperability of National Research Programmes https://ec.europa.eu/research-and-innovation/sites/default/files/rio/report/MLI-AI_final%2520report_KI-AX-17-010-EN-N.pdf

Figure 7.18 Main instruments supporting internationalisation and international collaboration



Instruments, beneficiaries, (expected) results

- Romania participates in a number of international R&D organisations and programmes, the highest participation fees being paid to the European Space Agency (ESA; Law 262/2011), the European Organisation for Nuclear Research (CERN, Law 203/2010), the Facility for Antiproton and Ion Research (FAIR, Law 307/2013) and the Joint Institute for Nuclear Research – Dubna (IUCN DUBNA) (GO 41/1994).

Participation in ESA programmes is based on the “fair return” principle, i.e. the amounts paid are used exclusively by the Romanian companies and research institutions, which are selected on a competitive basis by ESA. There are more than 170 R&D public and private entities involved in ESA programmes (more than 185 contracts in the last four years). As of 2017, Romania has not paid the contribution for the optional ESA optional programmes and lost the voting right, which jeopardises the participation in the European space programmes. The Government is taking action to ensure the staggered payment of the debts.²⁰⁴

Romania’s participation to CERN is managed by the Institute of Atomic Physics. At present, there are more than 100 Romanian scientists and engineers contributing to nine CERN experiments (i.e. four INCDs and six universities).

204 GD 870/2020 ON on the partial payment of Romania's financial contribution to optional programmes of the European Space Agency (ESA)
https://www.edu.ro/sites/default/files/Nota%20de%20fundamentare%20proiect%20HG_plata%20ESA_2_2020.pdf

The participations are evaluated by the International Scientific Advisory Board.²⁰⁵ Romania also participates in FAIR²⁰⁶, IUCN - DUBNA²⁰⁷ etc.

- PNCDI, Programme 5: Research in areas of strategic interest aims at supporting the participation of the Romanian research institutions in the international scientific programmes, to increase the national scientific capacity in fields of strategic interest. Sub-programme 5.2 – Participation in international research bodies and programmes - comprises the following modules: EURATOM-RO (Fusion & Nuclear fission/radiation protection programmes), CERN-RO (nuclear physics), CEA-RO (nuclear energy, alternative energies and applications), FAIR-RO (nuclear physics); Sub-programme 5.3 STAR – R&D&I Programme for Space Technology and Advanced Research - supports participation in ESA programmes/ space research. 59 unique institutions were involved in the 151 R&D projects supported within PNCDI 5.2 and 5.3 sub-programmes.²⁰⁸ The list of projects can be consulted on the webpage of the funding bodies (IFA²⁰⁹, ROSA²¹⁰).
- PNCDI Programme 3 - European & International Cooperation - supports the participation of Romanian researchers to international R&I programmes that facilitate the circulation of knowledge and ideas, the access to transnational research networks and to research resources that are not available in Romania. The following types of sub-programmes and instruments are funded: bilateral/multilateral projects, ERANET, ERANET Cofund, Joint Technology Initiatives.

205 CERN (2021) Country Profile - Romania <https://international-relations.web.cern.ch/stakeholder-relations/states/romania>

206 FAIR – Romania in FAIR <https://fair-center.eu/partners/ro-romania.html>

207 Joint Institute for Nuclear Research (JINR) Dubna: Country profile Romania http://www.jinr.ru/posts/map_maps/romania/

208 Research Registry Outputs - <https://www.brainmap.ro/index.php>

209 https://www.ifa-mg.ro/programe_IFA.php

210 <http://www2.rosa.ro/index.php/ro/strategie-spatiala/programul-star>

Participation in ERANET/ ERANET Cofund Actions

Through UEFISCDI, Romania participates in 42 transnational collaboration partnerships, i.e. Geotermica, Flag-ERA-II, QuantERA, MANUET III, EuroNanoMed III, ERA4CS, ACT, Prosafe, Neuron, FACCE-Surplus, CoBioTech, Susfood 2, Biodiversa 3, CORE Organic Cofund, ERA-GAS, WaterWorks 2015, ERA-NET SG+RegSYS, BiodivHealth, ERA-Gas 2, BlueBio, FLAG-ERA III, BiodivClim, CHIST ERA-IV Cofund, ICT-AGRI-FOOD, Aquatic Pollutants.

Between 2014-2020, the Romanian scientific community had the opportunity to participate in 123 transnational calls. 1,057 project proposals were submitted, out of which 277 project proposals had a coordinator from Romania. Following the international evaluations, 304 projects were funded.

The national budget contracted for the ERANET/ ERANET Cofund projects between 2015-2020 amounted 46 Million lei (about €10 million). €4.8 million is the budget attracted from other sources (i.e. the EC) in ERANET projects, which represents about half of the national budget allocated to this sub-programme.

Source: UEFISCDI (2020) Raport anual 2020 PNCDI

- POC 1.1.2 Development of networks of R&D centres coordinated at national level and connected to European and international networks is aimed at increasing the capacity of the Romanian R&D system and its connections to international research. There are three types of actions supported under POC 1.1.2: GRID projects, the development of development of RoEduNet platform and of ANELIS Plus, that promotes access to scientific literature for research organisations.
- EEA & Norway Grants – Research Programme supports collaborative research projects in basic and applied research in six thematic areas: Energy, Environment, Health, Social Sciences and Humanities, ICT and Biotechnology. The budget allocated to the Research Programme – Collaborative Research Projects was fully contracted through the two calls organised in 2018 and 2019.²¹¹
- POC 1.1.3 Synergies with RDI actions of the EU's Horizon 2020 framework programme and other international RDI programmes was aimed at giving support to R&D&I projects that participate directly in Horizon competitions (ERA Chairs, Teaming, SME Instrument etc.). The creation of support centres for R&D&I projects has also received financing from these calls.

As shown in the introductory part of this chapter, participation in the Framework Programme remains a challenge for Romania, which is also valid for other EU13 countries. There were different studies investigating the causes of the under-performance of the EU13 countries in the FP. The insufficient number of qualified project managers, the poor quality of the National Contact Point support or the preference for national calls are some of the factors that explain the low

211 UEFISCDI – EEA & Norway Grants - <https://uefiscdi.gov.ro/eea-norway-grants>

participation of Romanian researchers in the FP schemes, according to evaluations carried out under the “Stairway to Excellence” initiative of the EC/JRC²¹². At the same time, there is evidence that the low participation rates in the FPs reflect the relative weaknesses of the R&I systems²¹³ and that the low national research investment remains a key cause for low performance in FP.²¹⁴

The interim evaluation of the interventions supported under POC PA1 1.1.3 – Synergies with RDI actions of the EU's Horizon 2020 framework programme has shown the very positive effects of the interventions and recommended an increase of allocations for these types of actions. In this direction, the National Recovery and Resilience Plan proposes many interventions with a bearing on internationalisation and increase of participation to ERA, i.e. a mentoring programme for Horizon Europe, creation of five national competence centres to enhance participation in Horizon Europe missions, grants supporting participation in R&D&I partnerships and missions, grants for the holders of the MSCA seals of excellence, establishment of regional career guidance centres – in synergy with Talent Platform Era.

212 Curaj A. and Chioncel, M. (2015) Stairway to Excellence. Country Report: Romania. Luxembourg (Luxembourg), Publications Office of the European Union. JRC97667. Available here: <https://publications.jrc.ec.europa.eu/repository/handle/JRC97667>

213 European Parliament (2018) Overcoming innovation gaps in the EU-13 Member States [https://www.europarl.europa.eu/RegData/etudes/STUD/2018/614537/EPRS_STU\(2018\)614537_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2018/614537/EPRS_STU(2018)614537_EN.pdf)

214 EC (2018) Spreading Excellence & Widening Participation in Horizon 2020 - Analysis of FP participation patterns and research and innovation performance of eligible countries

CONCLUSIONS

This report has provided background information on the Romanian research and innovation system and has highlighted its structural characteristics, as well as the key needs and challenges it faces today. The analysis was organised around the five sub-topics of the PSF review and the main messages have been emphasised at the beginning of each chapter. Overall, our findings are consistent with the conclusions of previous studies that have reviewed the Romanian R&D&I system (e.g. RIO Reports) and add to the existing knowledge the following main messages:

- **Governance of the Romanian R&I system.** The R&I system is poorly coordinated. There have been frequent institutional changes in the Central Authority for R&D, which have impacted strongly on the quality of governance. The governance framework of the National R&D&I Strategy has not been operationalised, with negative consequences in terms of the elaboration, implementation and evaluation of R&D&I policies. Alignment of priorities between different ministries with R&I agendas, but also between national and regional levels remains a challenge. The development regions are not administrative units and have no formal competences for R&I policies. Synergies between SNCDI and complementary strategies need to be better exploited and coordinated in terms of results.
- **Public funding for R&I is critically low, unstable and unpredictable.** The Law of Research and SNCDI committed an official 1% of GDP for public R&D expenditures, but this target has never been attained. Romania has the lowest R&D intensity in the EU and there are large disparities in R&D expenditure between the capital region and the other seven NUTs regions. By the end of 2019, government budget allocations for R&D (GBARD) accounted only 0.19% of GDP. This translates into a poor scientific performance as compared to the European standards and a poor innovation performance. Finance and public support for R&D are the most problematic areas for the Romanian R&I system in the European Innovation Scoreboard.
- **The efficiency and efficacy of public funding for R&D is under question.** Although universities are considered important actors in the national research system, they do not benefit from institutional funding from the R&D budget. No official statistics exist about the shares of institutional vs project funding in Romania, but there is evidence that the competitive funding based on rigorous institutional evaluations is limited. Actions are needed to clarify the conditions and performance-based criteria for institutional funding. There is a generalised lack of regular reporting, monitoring and evaluations of the efficiency of R&D investments.
- **ESIF funding for R&I.** ESIF has an important share in the Romanian R&D funding mix, despite the fact that the country has the lowest share of ESIF allocated to research and innovation. Similarly to other EU13 countries, ERDF investments in Romania mainly target investment in R&I infrastructure. In the 2007-2013 programming period, investments in infrastructure were nine times higher than planned. The interim evaluation of POC PA1, the main OP supporting R&I, shows positive, but modest impacts on the increase of the

Romanian contribution to the progress of knowledge or to the increase of private expenditures on research and development. The Regional OP supports technology transfer, but it is at risk of failure to meet the proposed targets due to delays and many difficulties in implementation. All 2021-2027 OPs are still in their implementation phase (until 2023).

- **Human resources is one of the weakest areas in Romania's R&I ecosystem.** The number of researchers is critically low and the number of PhD graduates is declining. All PROs have difficulties in attracting and retaining talent, given that research careers are not attractive. The incentive system is not sufficiently strong to face the brain drain phenomenon. A reform of the research career framework is planned under the National Recovery and Resilience Plan, which shall amend legislation on the conditions for promotion/ recruitment, assessment of professional performance, research ethics etc.
- **The public science base is fragmented and the scarce resources are dissipated across a large number of PROs.** The main R&I legislation dates back to the 2000s and needs alignment with Frascati and Oslo provisions, as well as with the EU regulatory framework for R&I. There is much room for improvement with regard to the reporting of the research results and the assessment of institutional performance. The evaluation of all research institutes and research infrastructures by a body of international experts is planned under the Government Programme 2020-2024.
- **Public-private partnerships for R&I are limited.** The demand for innovation is weak, given the structural composition of the economy and the large share of employment in agriculture and in less knowledge intensive services. SMEs are primarily interested in developing their production capabilities. University-business cooperation is hampered by the lack of awareness of the academic offer, as well as by bureaucracy and red tape. There are no sufficient formal incentives for university professors to involve themselves in academic entrepreneurship. Commercialisation of research results is weak and the diffusion of innovation is hampered by many obstacles. The National Network for Innovation and Technology Transfer needs to be supported and extended, to cover all smart specialisation areas and all territories. A legislative reform to simplify the cooperation procedures between science and research is envisaged in the National Recovery and Resilience Plan.
- **Participation in the Framework Programme and in ERA initiatives remain a challenge.** Similar to other EU13 countries, Romania underperforms in the Framework Programme; the insufficient number of qualified project managers, the poor quality of the NCP support network and the preference for national calls are some of the factors that explain the low participation rates. In addition, there is evidence that the low participation rates reflect the poor national investments in R&D and the relative weaknesses of the R&D&I system. On the positive side, Romania had a strong lead in public-to-public cooperation in Horizon 2020, thus taking the benefits of participation to ERA. On the other side, the non-inclusion in the European consortium ELI-ERIC - even if the country hosts one of the three pillars of the

pan-European distributed research infrastructure – was a major disappointment for the whole R&D&I community in Romania. With a view to the future, some interventions are planned under the National Recovery and Resilience Plan to increase participation in ERA/ Horizon Europe and to turn brain drain into brain gain.

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ANNEXES

Annex 1 Regional and national S3 priorities in Romania 2014-2020

Regional S3 Priorities (RIS3) \ National S3 priorities (SNCDI)	Bio-economy	ICT, space & security	Energy, environment, climate change	Econanotechnologies & Adv. materials	Health	Oth.
North East region: Agro-food, Forestry and wood industry, Biotechnologies, IT&C, Cyber-security, Industry 4.0, Environment & climate change, Energy, Textiles, New materials, Health & tourism	√	√	√	√	√	
South East region: Agro-food & fisheries, Clothing industry, Biotechnologies, Ecotechnologies, ICT, high-tech, nano-technologies & advanced materials, Tourism, Naval engineering & transportation	√	√	√	√	√	√
South Muntenia Agriculture & food industry, Bio-economy, tourism & cultural identity, High tech industry, Smart localities, Construction of vehicles, components & equipment	√	√	√	√		√
South West Agriculture & agro-food, Energy & environment, Industrial engineering & transport, Biotechnologies (including digital applications, ecotourism, health tourism, basic and experimental medicine)	√	√	√	√	√	√
West Agro-food, Textiles, leather and footwear, Health and quality of life, ICT, smart localities, Automotive components,	√	√	√	√	√	√

Regional S3 Priorities (RIS3) \ National S3 priorities (SNCDI)	Bio-economy	ICT, space & security	Energy, environment, climate change	Econanotechnologies & Adv. materials	Health	Oth.
Digitisation, industry 4.0, Constructions (including energy), Medicine, Tourism, Cultural & creative industries						
North West Agro-food, Cosmetics & food supplements, Health, Furniture, Paper, plastic & packaging, Metalworking technologies, production technologies, ICT	√	√	√	√	√	
Centre Agro-food, Forestry, woodworking & furniture, Sustainable built environment, IT & creative industries, Health & pharmaceuticals, Textiles & leather, Automotive & mechatronics, Aerospace industry	√	√	√	√	√	
Bucharest-Ilfov (Novel) Food & food safety, Smart components, Advanced materials, Cultural and creative industries, ICT	√	√	√	√	√	√

Source: Order 4003/2020 of the Ministry of Public Works, Development and Administration, Annex A: List of smart specialisation domains

Annex 2 Structure of PNCDI 2015-2020 by programmes and sub-programmes

Programme (P)	Sub-programmes (SP)	Funding body	Aims of the actions	Budget contracted (EUR Mil)
Programme 1 Development of the national RDI System	SP 1.1 Human resources	UEFIS-CDI	Increasing the number of researchers and the attractiveness of the research career, improving the performance of research groups	48
	SP 1.2. Institutional performance	UEFIS-CDI	Improving the institutional performance of public research organisations; concentrating resources on public research organisations in strategic areas of development of Romania	87
		MCID		N/A
	SP 1.3 R&D Infrastructures	UEFIS-CDI, MCID	Supporting investments in research infrastructures, in synergy with ESIF	-
	SP 1.4 Support	UEFIS-CDI, MCID	Supporting indirectly the functioning of the national R&D&I system	-
Programme 2 Increasing the competitiveness of the Romanian economy through R&D&I	SP 2.1 Competitiveness through research, development and innovation	UEFIS-CDI	Increasing the productivity of the Romanian companies through R&D&I; creating a stimulating environment for the private sector initiative	93.1
	SP 2.2 Technology transfer	MCID	Supporting technology transfer (in synergy with ESIF funds)	-

Programme 3 European and international cooperation	SP 3.1 Bilateral/ multilateral; SP 3.2 Horizon 2020; 3.3 Joint Progra-mming Initiatives; SP 3.5 Other international initiatives; SP 3.6 Support	UEFIS- CDI	Strengthening the national R&D&I system through international cooperation, partici- pation in research pro-grammes and international organi- sations, access to resources that are not available in Romania	53
	SP 3.1 Programme AUF-RO	IFA	Supporting the participation of Romanian resear- chers to the R&D&I activities of the Agence Universitaire de la Francophonie	
	SP 3.4 Joint Technology Initiatives (JTI)	MCID	Supporting the participation of Romanian researchers to JTIs/ Joint undertakings	N/A
Programme 4 Basic and frontier research	SP Basic and frontier research	UEFIS- CDI	Supporting basic research in areas in which Romania has comparative advantages and critical mass of researchers and where there is potential for international collabo- rations in frontier scientific activities	57.5
Programme 5 Research in strategic fields	SP 5.1 ELO- RO; SP 5.2 CERN-RO, EURATOM-RO, FAIR-RO, F4E- RO, CEA-RO	IFA	Creating and developing research and competencies in the fields of strategic interest for Romania	33.7
	SP 5.3 STAR	ROSA		N/A
	SP 5.4 DANUBIUS	MCID		
	SP 5.5 ALFRED	MCID		

Note: Official average exchange rates used to convert Romanian Lei into Euro (2016-2020) – 1 euro = 4.7 lei; Sources: PNCDI 2015-2020; UEFISCDI Annual implementation reports 2016-2020; IFA, MCID

Annex 3 Planned interventions under POC PA1 2014-2020

Investment priority	Specific objectives	Actions	Instruments	Planned allocations (EUR Mil)
1a - Enhancing research and innovation (R&I) infrastructure and capacities to develop R&I excellence, and promoting centres of competence, in particular those of European interest	OS1.1 Increasing R&D&I capacity in the smart specialisation areas and health	1.1.1 Large R&D infrastructures	A: Investments for R&D departments of enterprises	27,8 + 25,5 (Reserve list)
			B: Innovative clusters	91,2
			F: Investments for R&D in PROs/ HEIs	106,7 + 153,2 (Reserve list)
			Pan-european RI: ELI-NP, Phase 2 (major project)	167,6
			Pan-european RI: Danubius RI	5,1
	1.1.2 Development of networks of R&D centers	Cloud-type networks & massive data infrastructures	11,7	
		RoEduNet	5,7	
		Access to scientific publications	39,7	
	OS1.2 Increasing the participation of Romanian R&D&I actors in Horizon 2020	1.1.3 Synergies with Horizon 2020 and other international programmes	H: Synergies with ERA Chairs, Teaming, RO - ESFRI - ERIC, RO-EIT, JTIs (i.e ECSEL) SME Instrument, Support Centres for international R&D&I projects	32,7
			1.1.4 Attracting high-skilled personnel from abroad	E: Attracting personnel with advanced skills from abroad, to foster R&D capacity

Investment priority	Specific objectives	Actions	Instruments	Planned allocations (EUR Mil)
1b - Promoting business investment in R&I, developing links and synergies between enterprises, research and development centres and the higher education sector	OS1.3 Increasing business investment in R&I	1.2.1 Stimulating enterprises' demand for innovation	C: Innovative start-ups and spin-offs	24,5
			D. Newly established innovative enterprises Innovative technological projects	22,7
	OS1.4 Developing knowledge, technology transfer and mobility of R&D&I personnel	1.2.2: Credits, guarantees and risk capital measures	Financial instruments for innovative enterprises	60
			1.2.3: Knowledge transfer partnerships (KTPs)	G: KTPs Consultancy, access to R&I&I facilities, R&D&I services for enterprises, collaborative partnerships

Note: Official average exchange rates used to convert Romanian Lei into Euro (2016-2020): 1 euro = 4.7 lei;

Sources: OP Competitiveness 2014-2020 (V6.2, September 2020); MA POC

Annex 4 POR PA1 2014-2020 planned interventions

Investment priority	Specific objectives	Actions	Planned allocations (EUR Mil)
1b - Promoting business investment in R&I, developing links and synergies between enterprises, research and development centres and the higher education sector	OS1.1. Increasing innovation in businesses by supporting innovation and technology transfer entities in areas of smart specialisation	1.1.A Technological transfer infrastructure	33.5
		1.1.B - Scientific and technological parks	19.5
		1.1. C - SMEs in partnership with TTO	28.96
	OS1.2 Increasing innovation in companies by supporting multisectoral approaches resulting from the implementation of the "Lagging Behind Regions Initiative" in Romania	1.2 Lagging Behind Regions Initiative	74.87

Source: POR (V6.1), 2020

Annex 5 PNDR 2014-2020: Planned allocations for R&I

Investment priority	Intervention areas	Measures (Actions)	Planned allocations (EUR Mil)
P1: Knowledge transfer and innovation in agriculture, forestry, and rural areas	1A) Fostering innovation, cooperation, and the development of the knowledge base in rural areas	<i>M01 Knowledge transfer (Art. 14 of the EAFRD)</i>	<i>Not included under the R&I heading²¹⁵</i>
	1B) Strengthening the links between agriculture, food production and forestry and research and innovation, including for the purpose of improved environmental management and performance	M02 – Advisory services (Art. 15 of the EAFRD)	3.6
		M16 Cooperation (Article)	81.3 (of which 50 EUR Mil from EURI)
	<i>1C) Fostering lifelong learning and vocational training in the agricultural and forestry sectors</i>	<i>M01 Knowledge transfer (Art. 14 of the EAFRD)</i>	<i>Not included under the R&I heading</i>

Source: PNDR, V13, June 2021

²¹⁵ <https://cohesiondata.ec.europa.eu/themes/1>

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This report provides background information on the Romanian research and innovation system with a specific focus on the public science base and its interface with the private sector. The report first provides a brief overview of the Romanian economy and its current R&I performance. This is followed by an analysis of the R&I governance, the policy mix and the framework conditions for public research. Emphasis is placed on the efficiency, effectiveness and impact of R&I funding and the use of the European Structural and Investment Funds in connection with the National R&D&I Plan. Public-private partnerships and the internationalisation of the R&I system, including participation in the EU Framework Programmes, are also reviewed in detail.

Studies and reports

