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# NOTE WITH THE ASSESSMENT OF INDUSTRY-ACADEMIA LINKAGES, GOOD-PRACTICE EXAMPLE(S) OF ESTIMATION OF RESOURCES, AND RECOMMENDATIONS ON KEY FEATURES OF A POTENTIAL PROGRAM TO SUPPORT COLLABORATIVE RESEARCH

February 2024

Ministerul Cercetării, Inovării și Digitalizării

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# Abbreviations and Acronyms

| | |
|---|---|
| **BERD** | Business expenditure on R&D |
| **CEE** | Central and Eastern Europe |
| **CIGP** | Collaborative Innovation Grant Program |
| **DG REGIO** | European Commission's Directorate General for Regional and Urban Policy |
| **DiD** | Difference-in-differences |
| **EU** | European Union |
| **FTE** | Full-time equivalent |
| **GDP** | Gross domestic product |
| **GERD** | Gross domestic expenditure on R&D |
| **HEIs** | Higher education institutions |
| **ICT** | Information and communication technology |
| **INCDs** | National R&D institutes |
| **IP** | Intellectual property |
| **ISP** | Independent selection panel |
| **IVCGP** | Innovative Value Chain Grant Program |
| **KPIs** | Key performance indicators |
| **M&E** | Monitoring and evaluation |
| **MCID** | Ministry of Research, Innovation and Digitalization (*Ministerul Cercetarii, Inovarii și Digitalizării*) |
| **MIPE** | Ministry of European Investments and Project |
| **MNCs** | Multinational corporations |
| **MP** | Matchmaking Program |
| **NE** | Northeast |
| **NRRP** | National Recovery and Resilience Plan |
| **NW** | Northwest |
| **OECD** | Organization for Economic Cooperation and Development |
| **OP** | Operational Program |
| **PN3** | National Plan for RDI III (2015-2020) |
| **PN4** | National Plan for RDI IV (2022-2027) |
| **POC** | Operational Program Competitiveness (2014-2020) |
| **POCIDIF** | Operational Program Smart Growth, Digitization and Financial Instruments (2021-2027) |
| **PRIs** | Public research institutes |
| **PSF** | Policy Support Facility |
| **PTE** | Transfer to economic actors program |
| **R&D** | Research and development |
| **R&I** | Research and innovation |
| **RCT** | Randomized controlled trial |
| **RDAs** | Regional development agencies |
| **RDD** | Regression discontinuity design |

| | |
|---|---|
| **RDI** | Research, development, and innovation |
| **ROPs** | Regional Operational Programs |
| **SMEs** | Small and medium enterprises |
| **SNCISI** | National Strategy for Research, Innovation and Smart Specialization 2022-2027 |
| **ToC** | Theory of Change |
| **TRL** | Technology readiness level |
| **TTO** | Technology transfer office |
| **UEFISCDI** | The Executive Agency for Higher Education, Research, Development, and Innovation Funding |
| **WB** | World Bank |

# Executive summary

**This report provides an analysis of private sector innovation and public-private collaboration in Romania and details a set of recommendations to support Romania's efforts to enhance cooperation between business and research.** It represents a deliverable under Component 1 within the Reimbursable Advisory Services Agreement (RAS) on Research Modernization in Romania, which is a joint engagement of the Ministry of Research, Innovation, and Digitalization (MCID) and the World Bank (WB) to support MCID's research modernization efforts included in the National Recovery and Resilience Plan (NRRP). This report includes an analysis of resources, incentives, and challenges in public private collaboration, assessment of Romania's support for private sector innovation and collaboration in the 2014-2020 and 2021-2027 programming periods, and recommendations for improving innovation and public-private collaboration outcomes.

**Romania's national research and innovation (R&I) system lags well behind its European peers**. Romania ranks last among European Union (EU) member states across multiple key indicators related to R&I. For example, the European Innovation Scoreboard, which provides a comparative analysis of the innovation performance in EU countries, ranked Romania as the lowest performer in the EU in 2023 with a performance level of only 33 percent of the EU average. This poor innovation performance is due in part to challenges in the public sector, including chronically low investments in R&I; inconsistent and unpredictable public support for R&I activities; fragmentation in governance and implementation of R&I policies; a lack of resources, skills, and incentives for technology transfer and commercialization; and limited capacity to design and implement R&I support policies. These public sector challenges are compounded by a lack of innovation capacity in the private sector; business expenditure on R&D (BERD) as a share of GDP was less than 20 percent of the EU 27 average in 2020, and a much smaller share of Romanian firms reported engaging in innovation activities than did firms in all peers in 2020.

**Public-private collaboration activities in R&I are lower in Romania than in most peer countries and tend to be ad hoc, rather than systematic, in nature**. Public-private collaborations in R&I are a critical part of national innovation systems, fostering knowledge spillovers that positively affect technological change, leading to improved productivity, economic growth, and better-quality jobs. Yet from 2014 to 2020, less research in the public sector was funded by the private sector, as a share of gross domestic product (GDP), than among all peers but Poland. In 2020, only 5.5 percent of innovative enterprises in Romania collaborated with universities (compared to the EU 27 average of 10.5 percent) and only 4.1 percent collaborated with public or private research institutions (compared to the EU 27 average of 5.1 percent). Romania also had fewer public-private co-publications than all peers but Bulgaria between 2014 and 2020. For knowledge and technology transfer to effectively take place within an innovation ecosystem, collaboration activities between the public and private sectors must be systemic and deep, but previous analyses have found that public-private collaborations in Romania tend to be ad hoc, short-term engagements largely driven by the availability of external funding.

***Challenges***

**Collaboration between public- and private-sector actors is limited by several key challenges**:

- **Weak capacity for innovation from the private sector, particularly among small and medium enterprises (SMEs)**. Innovation activities are highly concentrated among large

firms (particularly multinationals), while Romanian SMEs have relatively weak capacities to engage in innovation— 2020, SMEs performed just 10 percent of BERD in Romania, compared to 26 percent performed by SMEs in Czechia, 30 percent in Poland, 36 percent in Croatia, and 40 percent in Bulgaria. By contrast, large firms (those with 250 or more employees) performed 87 percent of BERD in Romania, compared to 47 percent performed by such firms in Estonia, 55 percent Bulgaria, 61 percent in Croatia, and 67 percent in Poland. Firms have limited incentives to invest in research and development (R&D) – for example, Romania's corporate R&D tax deduction is underutilized due to the very high administrative burden required to certify R&D projects.

- **Limited financial support for innovation activities among SMEs**. There are few Romanian SMEs that engage in innovation activities, and for those that do, these activities appear highly contingent on the availability of public financing. As in the rest of the world, traditional financing sources, such as bank loans, are generally not available for innovation activities due to their high-risk nature. Public funding is therefore needed to address these financing gaps. However, Romania's support for private sector innovation and public private collaboration in the 2014–2020 programming period was more than three times lower than the support provided in Croatia and almost eight times lower than in Poland on an annual basis when adjusted for size differences across economies.
- **Information barriers between R&I actors**. Key R&I actors lack information about the capabilities and interest of potential collaboration partners. Even multinational corporations (MNCs), which have resources to actively scout higher education institutions (HEIs) for research talent, have limited information about the activities and capabilities of Romanian public research institutes (PRIs). Other actors, such as SMEs, HEIs, and PRIs, do not have the resources to scout potential collaboration partners and have very limited information about other public and private research organizations.
- **Very low market orientation of public research**. The private sector is generally not consulted in the definition of public organization research agendas, and public institutions and researchers have few incentives to engage in market-oriented research or technology transfer activities.
- **Limited research capabilities in the public sector due to limited and unpredictable budgets**. Institutional funding to HEIs and PRIs are often insufficient to maintain core institutional capacities, such as salaries, maintenance of R&D equipment, and other overhead costs. Competitive funding, in the form of national grant programs, is highly unpredictable. The limited and unpredictable funding environment makes it extremely difficult for public sector organizations to build research capacity or plan for long-term R&D projects.
- **Very limited technology transfer capacity in the public sector**. HEIs, PRIs, and their technology transfer offices (TTOs) often lack dedicated technology transfer staff and fail to follow best practices for the most basic TTO functions. Most lack the knowledge needed to interpret national intellectual property (IP) legislation, support commercialization activities, or develop new relationships with potential partners.
- **Different mindsets between the public and private sectors**. Many firms feel that public sector researchers are highly focused on their own research and have limited experience, understanding, or interest in working with industry or in developing products and services for the market. Firms and public sector actors also have different objectives and incentives related to R&I activities, with firms focused on developing new products, services, and processes for the market, and public researchers focused on winning public grants and publishing in academic journals. In developed innovation systems, TTOs and other

innovation brokers can play a key role in breaking down cultural differences between the public and private sectors, but at present there is limited support for addressing this challenge.

***Policy mix supporting private sector innovation and public-private collaboration***

**In the face of these challenges, Romania's R&I policy mix the 2014–2020 programming period provided significantly less funding to support private sector innovation and public-private collaboration than Croatia and Poland on a per GDP basis, while support for industry-led public private collaborative R&D was limited**. When adjusted for the size of the economies, Romania's support for innovation and public private collaboration was only 13 percent of that provided by Poland and 30 percent that provided by Croatia annually during the 2014–2020 programming period. Additionally, the policy mix provided minimal support for technology transfer and innovation skills or for intermediaries, such as TTOs, incubators, or accelerators. Almost all Romanian instruments that supported public-private collaboration in R&D utilized a "technology push" approach, focusing on taking research that has already been developed at a public institution and pushing into the market via a private sector collaboration, while global experience has shown that innovative firms have little incentive to engage in such collaborations if they are unable to set the research agenda (Becker, 2015). Additionally, many firms found national R&I instruments to be administratively burdensome—particularly in their financial reporting requirements—which likely deterred private sector uptake.

**In addition to limited funding for private sector innovation and public-private collaboration, R&I instruments suffer from unpredictable and uncertain budgets.** MCID is not one of the ministries where Romania is piloting multi-annual budgeting, so R&I instrument budgets are generally set at the beginning of each fiscal year once the national budget has been decided. Implementers therefore do not know the budgets for instruments for future fiscal years and cannot issue calls for proposals regularly but instead issue them ad hoc when sufficient budget is available. This, in turn, means innovation actors in the public and private sectors do not know when R&I calls for proposals will be issued in advance, hindering their ability to plan for long-term R&I project and investments (World Bank, 2023a).

**The 2021–2027 programming period will likely see a large increase in planned instruments and funding targeting public-private collaboration and private sector innovation in Romania**. The large increase in allocated funding in the current period is largely driven by planned investments in the eight new Regional Operational Programs (ROPs) and the Operational Program for Smart Growth, Digitization and Financial Instruments (POCIDIF). The 2021–2027 programming period will likely see at least a 400 percent increase in planned funding across all objectives related to innovation and public-private collaboration relative to the previous period, but funding for private sector innovation or early-stage companies will still likely be significantly lower than Poland's investments toward those objectives in the 2014–2020 programming period.

**While funding for R&I will increase, uncertainty remains regarding availability and predictability of public funding—particularly for instruments under the National Plan for Research, Development, and Innovation IV (PN4).** Unless reforms to the budgetary process are made, challenges related to the predictability of funding will remain, with implementers unable to know the budgets for instruments for future fiscal years and issue calls for proposals regularly. Additionally, PN4 includes 35 instruments supporting collaboration and innovation, but only five of those instruments have announced allocations and calls for proposals as of the writing of this

report (February 2024). In the current fiscal environment, it seems unlikely there will be sufficient budget to fund the entire portfolio of PN4 instruments.

**An analysis of instruments supporting innovation and public private collaboration in the 2021–2027 programming period identified several gaps and areas of overlap in Romania's support**:

- The NRRP includes several reforms relevant to institutional and researcher incentives for public-private collaboration, but they are very limited in scope with few resources for implementation.
- There appears to be overlapping support between POCIDIF instruments and regional instruments for initial investments in production lines and for collaborations between SMEs and large firms.
- The new period will see a large increase in instruments and allocated funding supporting public-private collaboration, but there is limited support for industry-led collaborations or forming linkages between the public sector and large firms.
- There are apparent overlaps between instruments supporting public-private collaboration within the PN4 portfolio.
- While the policy mix includes two instruments supporting private sector access to public R&D facilities, which was a clear gap in the 2014–2020 policy mix, funding has not yet been allocated at the national level.
- Support for TTO operations and activities is included in several ROPs, but there are gaps in TTO support at the national level and several key regions—including Bucharest-Ilfov.
- Support to intermediaries has increased in the new programming period, but there are apparent overlaps in PN4 instruments and regional support to incubators, accelerators, and clusters.
- The new policy mix includes increased funding for innovation-related skills, but funding for developing technology transfer skills in the public sector is extremely limited.

***Recommendations***

**These findings inform a set of recommendations aiming to improve the quality and consistency of public support for private sector innovation and public-private collaboration in Romania**. Recommendations include:

- Address gaps and overlaps in the planned portfolio of private sector innovation and public-private collaboration instruments;
- Ensure the predictability and stability of funding for key R&I instruments through multi-annual budgeting and regular calls for proposals for key R&I instruments;
- Revise the incentive system for public R&D institutions and researchers to include key performance indicators (KPIs) related to private sector collaboration, technology transfer, and commercialization;
- Revise Romania's corporate tax deduction to spur private sector R&D investment;
- Provide capacity building support to improve the innovative performance of PRIs and HEIs;
- Reduce the administrative burden of R&I instruments to improve private sector uptake;
- Provide support for lowering information barriers between public and private sector R&I actors;

**In addition to these recommendations, this report details three pilot interventions aimed at improving innovation and public-private collaboration in Romania**:

- Collaborative Innovation Grant Program (CIGP), targeting the gap in support for industry-led R&D collaborations;
- Innovative Value Chain Grant Program (IVCGP), targeting gaps in support for industry-led R&D collaborations and for linking large firms with public sector R&D actors; and
- Matchmaking Program (MP), targeting information barriers between public and private sector R&D actors.

| **Collaborative Innovation Grant Program (CIGP)** |
|---|
| **Objective:**<br>Foster collaborative, industry-driven research by incentivizing private sector companies and public sector R&D organizations to engage in joint applied R&D and innovation projects with the goal of creating new or improved commercially viable products and services. |
| **Target beneficiaries:**<br>Romania-based private sector firms in partnership with at least one PRI and/or at least one HEI |
| **Approach:**<br>The CIGP builds on and scales up the design of the existing ***Transfer to economic actors*** program (PTE), which is one of the few programs in Romanian portfolio that supports industry-led collaborations. CIGP provides matching grants up to €400,000 for collaborative R&D projects of up to 30 months in duration. Supported activities include personnel costs, external services, training and travel, equipment purchases, and overhead as required for the project.<br><br>**Annual budget:** €40 million. Calls for proposals each year from 2024–2028. |
| **Expected outcomes:**<br>• Increased R&D investments and activities in beneficiary firms<br>• Increased R&D collaborations among beneficiaries<br>• New products, services, and processes<br>• Increased competitiveness (revenues, exports, productivity, and employment) among beneficiary firms |

| **Innovative Value Chain Grant Program (IVCGP)** |
|---|
| **Objective:**<br>Enable Romanian innovation seeking firms and PRIs/HEIs to collaboratively engage in European and global value chains, with the aim of creating new or improved commercially viable products, services, and processes in European and/or global value chains. |
| **Target beneficiaries:**<br>Consortia composed of one large company connected to global supply chains and with official presence in Romania (representing the demand side of the supply chain), and at least one SME and at least one PRI/HEI (representing the supply side of the supply chain). |
| **Approach:**<br>IVCGP supports consortia consisting of one large company connected to global supply chains and at least one SME and at least one PRI/HEI with a matching grant of up to €2.5 million to engage in one or more collaborative R&D projects. Supported activities include personnel costs, external services, training and travel, equipment purchases, and overhead as required for the project. Depending on feedback from stakeholders and beneficiaries, the maximum grant size may be increased in subsequent years.<br><br>**Annual budget:** €50 million. Calls for proposals each year from 2024-2028. Depending on demand for the program, the budget and project size may in increased in subsequent years. |
| **Expected outcomes:**<br>• Increased R&D investments and activities in beneficiary firms |

- Increased R&D collaborations among beneficiaries
- Increased number of products/services stemming from SMEs integrated into larger companies' supply chains
- Increased competitiveness (revenues, exports, productivity, and employment) among beneficiary firms

**Matchmaking Program (MP)**

**Objective:**
Build relationships between Romanian private sector companies and public sector R&D organizations with the goal of increasing joint private/public sector engagement in applied R&D and innovation projects.

**Target beneficiaries:**
Qualified matchmaking and event organizations are the direct beneficiaries of MP funding.
Private sector firms, PRIs, and HEIs are the target participants of the matchmaking events funded by the program and are thus indirect beneficiaries of the program.

**Approach:**
One grant of up to €200,000 to design and implement a pilot matchmaking initiative that brings together private sector firms and relevant PRIs with the purpose of fostering long term, trust-based relationships that may lead to joint private/public sector engagement in applied R&D and innovation projects to create new or improved commercially viable products and services. Applicants to MP are free to propose their own approach that they believe will achieve the desired outcomes, although they must include several key activities that allow for impact evaluation of the program. The matchmaking support will be directly linked to CIGP and IVCGP (or other grant programs as needed) by supporting the formation of new partnerships and collaborative projects that can be funded by CIGP and IVCGP.

**Annual budget:** €200,000. Calls for proposals each year from 2024-2028.

**Expected outcomes:**
- New collaborations formed among matchmaking participants.
- Successful collaborative applications for national and European grant funds by participants

SECTION 1

# INTRODUCTION

# 1. Introduction

**Romania has experienced rapid economic growth in recent decades, but productivity growth will need to be increased to achieve convergence with the EU average**. GDP per capita in purchasing power standards has risen from 30 percent of the EU average in 1995 to 77 percent in 2022 (Eurostat, 2023). Over this period, Romania's economy has gradually been transitioning from labor-intensive low-technology sectors, such as garments and footwear and metals, to more advanced sectors like automotive and machinery and electronic equipment (World Bank, 2018). While labor productivity has been growing, the rate of growth slowed significantly after the 2007–2012 global financial crisis and aggregate productivity remains well below the EU average. Moreover, from 2018, the growth of within-productivity in manufacturing and services sectors—productivity that results from innovation, adoption of new technologies, and better managerial skills—has been slowing down (World Bank, 2023b).

**Increasing productivity growth will require improvements in Romania's innovation performance, which ranks among the worst in the EU across multiple indicators.** The European Innovation Scoreboard, which provides a comparative analysis of the innovation performance in EU countries, ranked Romania as the lowest performer in the EU in 2023 with a performance level of only 33 percent of the EU average. This poor performance is driven in part by a lack of investment in R&D—gross domestic expenditure on R&D (GERD) as a percentage of GDP are lower than all peers and grew only slightly from 2015 to 2021, from 0.3 percent to 0.4 percent, and current R&D spending remains well under half of Romania's 2020 target of 1 percent of GDP. While the business sector is the largest funder and performer of R&D in Romania, BERD as a share of GDP is also low relative to peers and was less than 20 percent of the EU 27 average in 2020. R&I activities are concentrated in multinational firms, while domestic firms have weak capacities to engage in innovation activities or absorb new technologies (OECD, 2022). Romanian firms underperform their EU peers in R&D innovation expenditures, implementing innovations, patent applications, and information and communication technology (ICT) training.

**Increasing linkages and collaboration between Romania's public- and private-sector R&I actors could have positive impacts on the country's innovation performance and economic growth**. Policymakers globally are increasingly embracing the triple helix of industry, academia, and government working together to generate economic growth. Indeed, numerous studies have demonstrated the benefits of public-private collaboration in R&I through the transfer of knowledge, skills, IP, and technologies from the public to private sectors (Fan et al, 2015; Correa and Zuniga, 2013; Zuniga, 2020), leading to economic growth at the regional level (Mueller, 2006; Mark et al, 2014; Lehmann and Menter, 2016). However, for knowledge and technology transfer to effectively take place between the public and private sectors, collaboration activities must be extensive and systemic, as opposed to rare and occasional (Audretsch et al. 2010).

**Previous analyses have shown that public-private research collaboration in Romania is not systemic and limited by weak industry demand and a lack of resources and incentives in the public sector**. The recent EU Policy Support Facility report (2022) found that public-private collaborations in Romania tend to be ad hoc, rather than systematic, and are largely driven by the availability of external funding, while public programs supporting R&D collaborations are limited and inconsistent. The Organization for Economic Cooperation and Development (OECD) Romania Economic Survey (2022) found that industry demand for innovation is low due to the low capacity of domestic firms to engage in innovation activities (OECD, 2022). An EU Joint

Research Centre report (2024) on technology transfer in Romania found PRIs lack incentives to engage in commercialization and technology transfer activities and suffer from a lack of resources for such activities. The Joint Research Centre report also found that there is a lack of detail and consistency among the laws, statutes, and regulations that govern the IP landscape, and public institutions lack the expertise to interpret these regulations or develop their own IP policies. WB work in Romania's regional innovation systems found that public researchers and TTO staff lack IP resources and expertise (e.g., IP guidebooks, online resources, etc.) and have few opportunities for formalized knowledge and tech transfer training (World Bank, 2022).

**As part of the RAS on Research Modernization in Romania, MCID has requested WB technical support for the development of new instruments supporting public-private collaboration**. This document provides a set of recommendations and inputs for the design and implementation of three pilot instruments aimed at improving public private collaboration in Romania. The report consists of four sections:

1. Introduction;
2. An analysis of public-private collaboration in R&I in Romania;
3. An estimation of the resources Romania should commit toward private sector innovation and public-private collaboration and analysis of Romania's support for public-private collaboration in the 2014–2020 and 2021–2027 programming periods;
4. Recommendations and inputs to the design and implementation of three pilot instruments: CIGP, IVCGP, and MP.

The data sources used for this report include stakeholder interviews, a workshop on public-private collaboration with participants from MCID and the Executive Agency for Higher Education, Research, Development, and Innovation Funding (UEFISCDI), data on Romania's R&I support portfolio drawn from the *Policy Effectiveness Review of Romania's Research and Innovation Support* report (World Bank 2023), and desk research.

SECTION 2

# ANALYSIS OF PUBLIC-PRIVATE COLLABORATION ON RESEARCH & INNOVATION IN ROMANIA

# 2. Analysis of public-private collaboration on research & innovation in Romania

**Summary of findings**:

- Public-private collaboration in R&I activities is lower in Romania than in most peer countries, including less private-sector funding for public research, fewer innovative enterprises collaborating with the public sector, and fewer public-private co-publications.
- The public sector faces challenges related to unpredictable and insufficient funding, a lack of technology transfer capacity and resources, and limited incentives for engaging in market-oriented research or collaborating with the private sector.
- Many PRIs are active in collaborating with SMEs, with engagements generally focused on non-R&D innovation activities. They generally do not collaborate with large companies or MNCs. PRIs also face a particular challenge related to interpretation of State Aid rules regarding income from private sector sources and lack guidance on how to navigate this issue.
- HEIs perform relatively little research and are not well integrated into Romania's R&I system. They receive much less institutional funding for R&D compared to PRIs, and university professors have little time or resources to devote to research due to teaching commitments.
- The private sector is the largest funder and performer of R&D in Romania, but business R&D investments as a share of GDP are still much lower than in most peer countries and the EU 27 average. Innovation activities are highly concentrated among large firms (particularly multinationals), while Romanian SMEs have weak capacities to engage in innovation.
- Large firms—primarily the branch offices of global MNCs—are the main drivers of innovation activity in Romania, accounting for 84 percent of business R&D in the country. MNCs are active in collaborating with Romanian universities to develop a pipeline of skilled labor but have little to no engagement with PRIs due to negative perceptions of PRI capabilities, information gaps, and mismatched incentives.
- There are few Romanian SMEs that engage in research, and SMEs collaborations with the public sector are limited by low firm investments in R&D and a lack of information about potential partners.

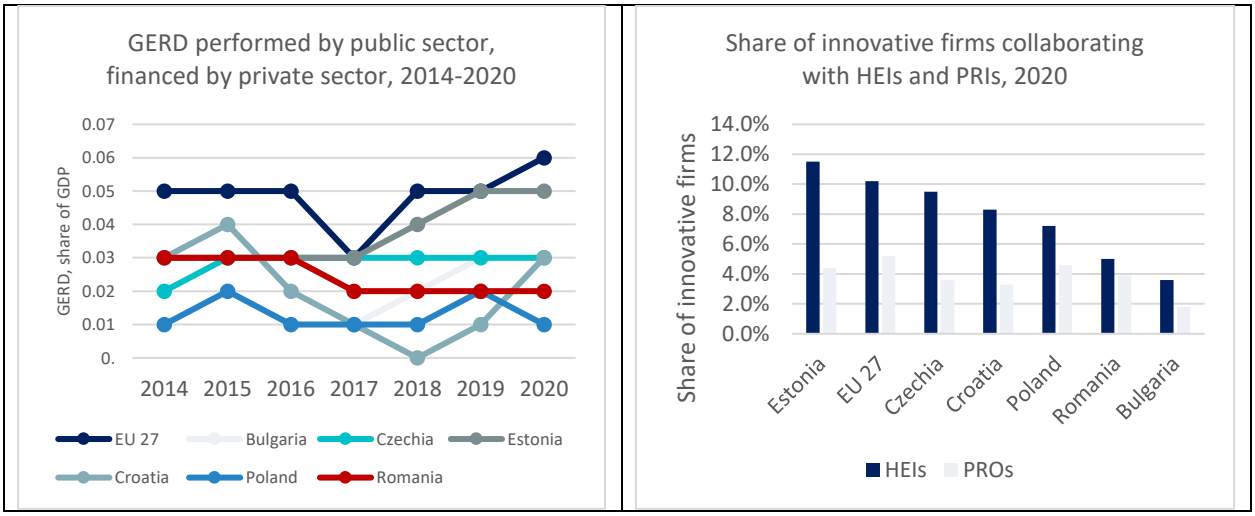
**Public-private collaboration in research and innovation can improve innovation outcomes and boost economic growth, but R&I collaboration activities are lower in Romania than in most peer[1] countries**. Public-private collaborations in R&I are a critical part of national innovation systems, fostering the transfer of publicly-funded knowledge and research into the private sector—knowledge spillovers that positively affect technological change and economic growth (Varga and Schalk, 2004; Plummer and Acs, 2005). From 2014 to 2020, less Romanian research in the public sector was funded by the private sector, as a share of GDP, than all peers but Poland (Figure 1a), indicating a relatively low level of industry-sponsored research in public sector institutions. In 2020, only 5.5 percent of innovative enterprises[2] in Romania collaborated with

[1] Throughout this report, Romania is benchmarked against the following set of peer countries: Bulgaria, Croatia, Czech Republic, Estonia, Poland, and the EU 27 average.

[2] Innovative firms are defined as those firms that have had innovation activities during 2020. Innovation activities include all scientific, technological, organizational, financial, and commercial steps which actually lead to the implementation of innovations (or are intended to), such as R&D activities and/or the adoption of technologies.

universities (compared to the EU 27 average of 10.5 percent), and only 4.1 percent of them collaborate with public or private research organization (compared to the EU 27 average of 5.1 percent) (Figure 1b). Romania also had fewer public-private co-publications than all peers but Bulgaria from 2014 to 2020.

**Figure 1 a.) GERD performed by public sector, financed by private sector, 2014–2020; and b.) Share of innovative firms collaborating with HEIs and PRIs, 2020**



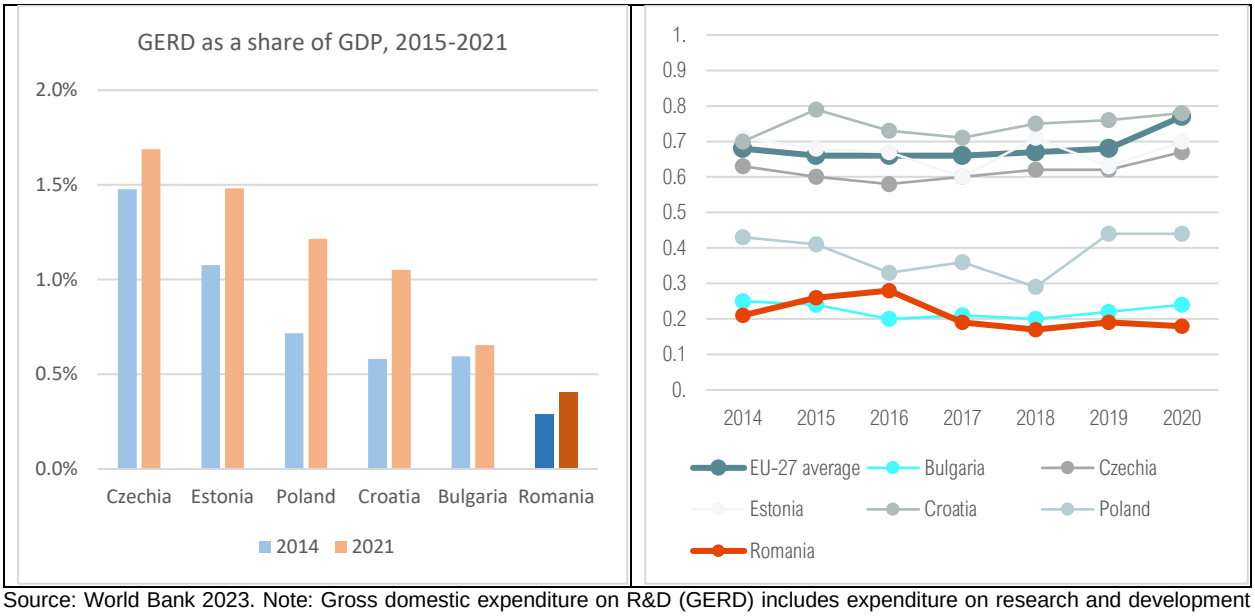

Source: Eurostat. | Note: Innovative firms are defined as those firms that had innovation activities during 2020. Innovation activities include all scientific, technological, organizational, financial, and commercial steps that actually lead to the implementation of innovations (or are intended to), such as R&D activities and/or the adoption of technologies.

**This section provides an analysis of collaboration activities, incentives, resources, and challenges in the Romanian public and private sectors.** The analysis of the public sector includes a focus on PRIs and HEIs. The analysis of the private sector includes a focus on large firms (those with more than 250 employees), small and medium sized firms (SMEs—those with 10 to 250 employees), and startups (firms under five years of age).

# 2.1 Public Sector R&D Collaboration Activities

**A key factor in the low levels of public-private collaboration in Romania is limited public support for R&I activities**. Romania has historically spent less on R&I relative to its regional peers and current spending is well below its 2020 GERD targets of 1 percent of GDP, mainly due to low public spending and a low share of EU structural funds spent on R&I (Figure 2a). Government budget appropriations on R&D (GBARD) as a share of GDP have been decreasing since 2014 and were significantly smaller than its peers and only 23 percent of the EU 27 average in 2021 (Figure 2b). Romania also uses the lowest share (2.7 percent) of structural funds for R&I investments among EU member states, well below peers Estonia (14.5 percent of structural funds used for R&I), Czechia (12 percent), Poland (8 percent), and Croatia (5.8 percent).

**Figure 2 a) GERD as a share of GDP, and b) Government budget allocation for R&D as a share of GDP**




Source: World Bank 2023. Note: Gross domestic expenditure on R&D (GERD) includes expenditure on research and development by business enterprises, HEIs, as well as government and private non-profit organizations.

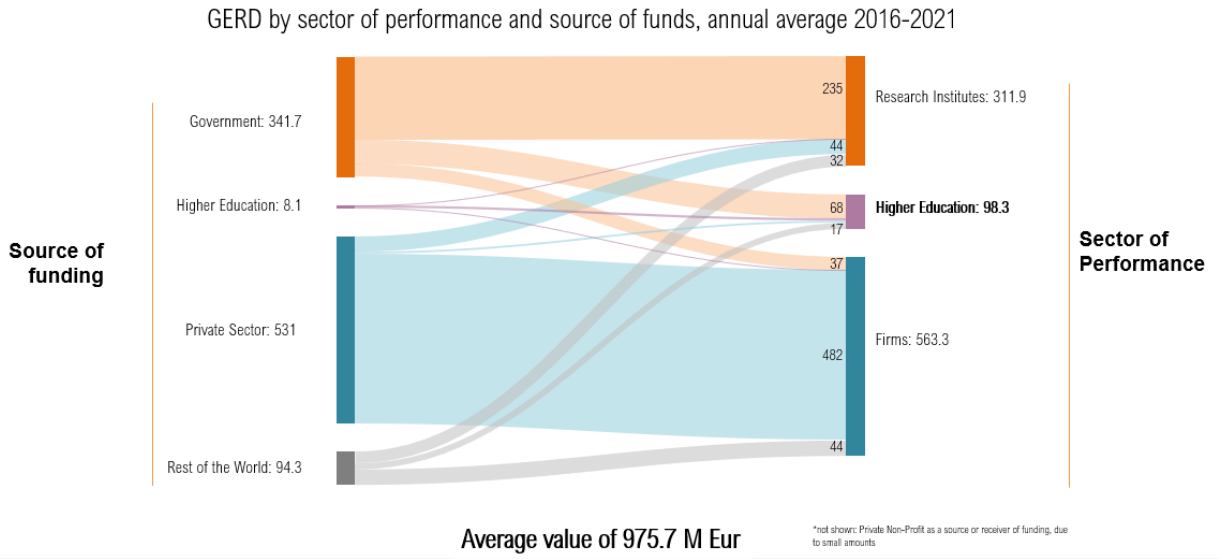
**Romania's public funding for R&I has also been characterized by a lack of continuity and predictability in financial support**. The lack of budget continuity for R&I support instruments on an annual basis inhibits Romania's R&I support. The overall National Plan for RDI is financed in a multiannual system, and annual expenses for the realization of the National Plan (e.g., expenses to carry out programs under the national plan) are approved by the state budget at the beginning of each year. As of the writing of this report, MCID has not established budgets or scheduled calls for proposals for the vast majority of instruments under PN4 (see Section 3.2 for more information on this issue), so implementers of PN4 instruments do not know the budgets for their programs for the current of future fiscal years, making it difficult to issue calls for proposals on a regular (or predictable) basis. Under current legislation, ministries are now able to implement program-based budgeting (the practice of setting program budgets two-to-three fiscal years in advance through credit commitments), and MCID has piloted the use of program-based budgeting with the CORE/NUCLEU program, which has set budgets each year until FY2026. Broader use of program-based budgets would greatly help to reduce the lack of predictability for R&I program budgets on an annual basis; however, program-based budgeting has not been widely adopted by MCID and currently no other instruments under PN4 use this budget practice. Because of the lack of multiannual programming, almost no R&I support instruments issue calls for proposals on a predictable schedule, and there were a number of examples in the previous programming period of R&I actors being caught unprepared as a call for proposals was launched without advance notice. At times, the recipients of multi-year R&D grants and institutional funds have been left with gaps in funding while implementers waited for the national budget to be approved at the beginning of the fiscal cycle.

**Low levels of institutional funding create challenges for HEIs and PRIs**. The recent EU Policy Support Facility report (2022) found that the level of institutional funding provided to HEIs and PRIs is often insufficient to maintain core institutional capacities, such as salaries, maintenance for R&D equipment, and other overhead costs. These challenges, coupled with the

unpredictability of R&I grant programs, have created a large degree of uncertainty among R&I performers and have hindered long-term planning and projects (World Bank, 2023a).

**PRIs are the largest performers of public sector R&I, while universities play a very limited role**. Public research is primarily done by PRIs, which performed 30 percent of GERD in 2021, well above the EU average of 12 percent, while the higher education sector only performed 9 percent of GERD in 2021, less than half of the EU 27 average and lower than all peers except Bulgaria (Figure 3). This is largely because HEIs historically did not play a large role in the performance of R&D in Romania's communist period, and Romania's higher education sector has not yet been well integrated in the national research sector.

**Figure 3 GERD by sector of performance and source of funds, annual average 2016–2021.**




Source: World Bank 2023.

**The following subsections include analysis of key R&I performers in the Romanian public sector, including their activities, incentives, and challenges related to public-private collaboration**. As shown in Table 1, Romania has two types of PRIs: National R&D Institutes (INCDs) and academies. There are 46 INCDs, most of which (42) are under the coordination of MCID, while the others are under the coordination of other ministries. There are also more than 200 academies, including institutions under the Romanian Academy, Academy of Agricultural and Forestry Sciences, and Academy of Medical Sciences. Moreover, there are also 87 HEIs in Romania, 53 public universities and 34 private universities. This analysis primarily focuses on HEIs and INCDs among Romanian PRIs because they are more focused on applied research than the institutions of the Romanian Academy and are therefore more likely to engage in collaborations with the private sector.

**Table 1 R&I Institutions**

| | |
|---|---|
| National R&D Institutes (INCDs) | 42 INCDs under MCID |
| | 4 INCDs under other ministries |
| Academies | 50 research institutes and 20 centers under the Romania Academy |
| | 70 institutes under the Academy of Agricultural and Forestry Sciences |
| | 95 research bodies under the coordination of Academy of Medical Sciences |
| HEIs | 53 public universities |

| | |
|---|---|
| | 34 private universities |

Source: World Bank compilation.

## 2.1.1 Public Research Institutes (PRIs)

- PRIs operate under insufficient and unpredictable funding conditions and are highly dependent on competitive grants to make up for limited institutional funding.
- PRIs face a particular challenge related to interpretation of State Aid rules regarding income from private sector sources, which acts as a disincentive to engage in more economic activities.
- Institutions and researchers lack incentives and resources to engage in market-oriented research, industry collaborations, or technology transfer activities.
- PRIs are active in collaborating with SMEs, although many of these engagements were focused on non-R&D innovation so far.
- PRIs have very limited engagements with large companies or startups.

**Like much of the public research sector in Romania, PRIs operate under insufficient and unpredictable funding conditions**. As noted above, this analysis of PRIs is primarily focused on the National Research Institutes for R&D (INCDs) among Romanian PRIs because they are more focused on applied research than the institutions of the Romanian Academy. Institutional funding for the INCDs is provided by the NUCLEU national funding program[3] (administered by MCID under PN4). The funding received under NUCLEU generally provides enough funding equivalent to 25–60 percent of each institute's annual budget (enough to cover 3–7 months of operations, depending on the size and costs of the INCD)[4]. INCDs must cover the rest of their budget budgets by winning competitive research grants—largely from national grant programs—or from economic activities. As discussed above, national grant programs have highly unpredictable schedules for calls for proposals, and this budget uncertainty makes it difficult for INCDs to build and maintain research teams or plan long-term projects. Some INCDs report needing to take out bank loans in order to cover their fixed costs while waiting for funding to be released.

**INCDs are active in participating in grant programs as the main source of competitive funding to cover their costs**. INCDs are active participants in Romanian national grant programs, including those funded under the national plans for RDI (national plan for RDI III (PN3) and PN4), operational programs for competitiveness (Operational Program Competitiveness (2014-2020) (POC) and POCIDIF), and regional operational programs and use these grant funds to cover operational costs not covered by institutional funds. INCDs have varying degrees of success in winning European grants (such as from Horizon or EUREKA) – some of the more successful institutes have developed internal teams specialized in writing European proposals, although this practice is not widespread across institutes and many lack training on writing European grant proposals. Many INCDS also report challenges in finding international partners when applying for EU funds.

**INCDs also face a particular challenge related to the interpretation of State Aid rules regarding income from private sector sources.** Should an institute receive 20 percent or more

[3] The NUCLEU program is a performance-based funding (PBF) instrument and is the sole source of institutional funding for INCDs. Funding allocations are based on a formula that takes into account each institution's research budget and a set of performance metrics, including institutional rankings and publication and patent outputs. For more information, see World Bank (2023a).
[4] The NUCLEU programme saw an increase in funding in 2023 (about 65 percent higher than the 2022 funding level), which is expected to put the INCDs on a more sustainable development path in the coming years.

of its income from economic activities (e.g., non-research activities, such as training, consulting, and testing services), its institutional funding becomes subject to State Aid regulations which likely require the implementation of a "claw-back" mechanism to return funding that was originally not considered State Aid in proportion to the economic activity undertaken[5]. Institutes lack clear national methodologies and internal procedures on how to register, monitor, and report on their economic and non-economic activity to comply with these State Aid regulations. Up until now, public funds only have KPIs related to research activities (and not economic activities), so INCDs have generally not tried to grow their economic activities to maintain compliance with State Aid (See Box 1 for additional discussion of this issue).

**There are few formal pathways for the private sector to provide inputs into PRI research agendas**. The private sector generally does not provide inputs or guidance to institutional research agendas—firms, industry associations, and cluster organizations cannot sit on PRI governing committees per current legislation, although a few INCDs have steering committees which invite industry representatives to discuss their research needs. Most INCDs feel their role is to inform SMEs on which technologies and processes they should adopt, rather than to develop research projects around existing or emerging market needs.

**INCDs and their researchers have few incentives to engage in market-oriented research or collaborate with the private sector**. INCDs' key funding sources (NUCLEU and national grant programs) emphasize publications as KPIs and do not consider the exploitation of research results, such as patents, in the market. Similarly, patents are considered in researcher career incentive frameworks, but the exploitation and use of those patents within the market is not. Public sector researchers can receive some monetary benefits from patenting, because they are entitled to at least 30 percent of the income made from licenses or sales of their patents, as stipulated in the Law of Employees Inventions. Additionally, some INCDs provide their researchers with monetary incentives for attracting private sector research funding, but this is not a standard practice across INCDs. As discussed above, INCDs lack guidance on how to navigate the State Aid 20 percent threshold, and this likely acts as a negative incentive for the institutes to engage in more "economic activities" (such as providing training, incubation, and consulting services to SMEs) than they do currently.

**Institutes and their researchers face challenges and lack skills and resources for knowledge and technology transfer activities**. All INCDs have TTOs (many of which were created with support from structural funds in previous programming period), but few have TTOs with dedicated budgets or staff—instead many are staffed by researchers who work in the TTO part time and have limited expertise in IP regulations or processes. As a result, most TTO staff have limited knowledge of national IP legislation or on commercialization and technology transfer practices. TTOs generally lack the capacity to conduct market research, properly value their research outputs, develop licensing agreements, and engage in broader research valorization activities. For this reason, most TTOs serve as project implementation offices, while only a few are active in finding potential research partners, marketing existing IP, etc. Third party organizations, such as technology brokers, cluster organizations, and industry associations, do not play any role in facilitating technology transfer from PRIs to industry. In developed innovation

[5] For instance, if an institute receives 23% of their funding from economic activities in a given year, they need to return a portion of NUCLEU funding according to the following formula: first, they need to calculate the maximum allowed amount of state aid for that given year (Share of funds from economic activities (e.g., 23%) x Maximum intensity of State aid [which can vary between programs] x Annual allocation of from public grant funding), the second step is a calculation of the amount of public support for the non-economic activity for that given year (Share of funds from non-economic activities [e.g., 77% *Maximum intensity of support, which is 100% for non-economic activity * Annual allocation of from public grant funding) and finally subtract the two values from the annual allocation of public grant funding. The difference will represent the amount to be returned.

systems, TTOs and other innovation brokers can play a key role in breaking down cultural differences between the public and private sectors, but at present there is limited support for bridging the gap between PRI researchers and potential industry partners. Public institutions must set prices for the sale or licensing their IP according to a formula developed by MCID and the national tax authorities, and interviewed stakeholders noted that the formula resulted in sales or licensing costs that were prohibitively high and deterred private sector interest.

**Most INCDs are active in collaborating with SMEs, although many of these engagements do not have incentives to go beyond non-R&D innovation (such as technology adoption or improved operational practices)**. Most INCDs maintain databases of traditional partner SMEs they work with. SME research collaborations generally begin with the launch of a new call for proposals for a collaborative grant—once launched, one of the partners will reach out to the other to develop a new project proposal. These collaborations appear to be almost wholly driven by the availability of public funding and likely would not happen without the availability of public grants. Contract research agreements financed by the private sector are uncommon, with few INCDs experiencing success in attracting such funds. INCDs will also provide a range of services (such as consulting services and access to testing and pilot manufacturing equipment), as well as training to SMEs. These are considered "economic," rather than research activities, and are generally more focused on non-R&D innovation (e.g., technology adoption and upgrading). Thus, these economic activities are not considered part of the institutes' core mission. As a result, INCDs have few formal incentives to engage in such activities, even if they represent knowledge transfer from the public to private sector. While all interviewed INCDs worked with SMEs, they all reported challenges finding new SMEs to work with outside of their established partners.

**The WB team observed several good practices in engagement with SMEs, particularly among INCDs in the agriculture, agrifood, and biosciences fields.** These include regional workshops where INCD researchers can meet new SMEs and discuss their current research projects, food showcases where partner SMEs can demonstrate their food products to each other and the public, and training programs to educate SMEs on new techniques or technologies. Because these practices are not standard or widespread, there is likely significant opportunity for sharing of good practices in SME engagement across institutes.

**There are very few examples of INCDs collaborating with MNCs**. One key reason for this lack of collaboration is that INCDs are highly focused on winning national research grants to survive, but most MNCs have little interest in participating in national grant schemes due to their high administrative burden and other issues (see Section 2.2.1, p. 30, for more information). Additionally, MNCs generally have a negative perception of the quality of research done by the institutes.

**INCDS have essentially no collaboration with startups or any role in Romania's startup ecosystem**. While some INCDs have incubators (established using structural funds in past programming periods) that provide services for fees to tenant firms, the companies that use these incubators do not appear to be knowledge-based startups, but rather brick-and-mortar type of businesses that need access to the INCDs facilities.

**Box 1 Methodology on registering, monitoring, and reporting on the economic activity of PRIs**

**One of the main barriers to private-sector use of publicly research infrastructure in Romania is the lack of clarity concerning the applicability of State Aid rules and regulations**. Underutilized public research infrastructure is a cost burden on many public institutions, which do not receive funding for the operation and maintenance of the infrastructure

after the initial public funding for construction is exhausted. Most institutes lack the capacity to compile and understand all relevant legislation and observe the State Aid rules in registering, monitoring, and reporting on their economic activities (described above). This lack of clarity hinders the public institutions from leveraging their physical research infrastructure and research capacity to generate private-sector income streams and reduce their dependency on public funding sources.

**In response to this issue, the WB undertook a legal analysis to clarify the relevant regulatory framework and developed a methodology for public organizations to use as a template to ensure compliance with legal requirements**. *Methodology on registering, monitoring, and reporting of the economic and non-economic activity* was developed under "Supporting innovation in catching up regions in Romania" project with funding from the European Commission's Directorate General for Regional and Urban Policy (DG REGIO) and piloted by four PRIs in the North-East and North-West regions of Romania.

**The methodology clarified the State Aid requirements and regulations, provided templates for providing access to infrastructure and various services and step-by-step calculations for different scenarios**. This effort translated into an increased utilization of public research infrastructure among the pilot PRIs—nearly a 350 percent increase in some cases—generating additional funds to cover the operating costs and provided access to quality research services to private actors active in the domestic and regional markets. The Medfuture study case was showcased in one of the WB's blogs *"How commercialization is helping unlock the innovation potential of research infrastructure in Romania".*

**This methodology is publicly upon request from the WB, incorporating lessons learned and feedback from the pilot institutions**. However, its application will require actions from national or regional institutions in charge of financing research infrastructure and of monitoring the compliance of PRIs with State Aid regulations. Its official endorsement should be considered essential because it allows for the design of relevant instructions/documents to be universally used for obtaining the result of releasing the infrastructure for economic objectives.

Source: World Bank 2022.

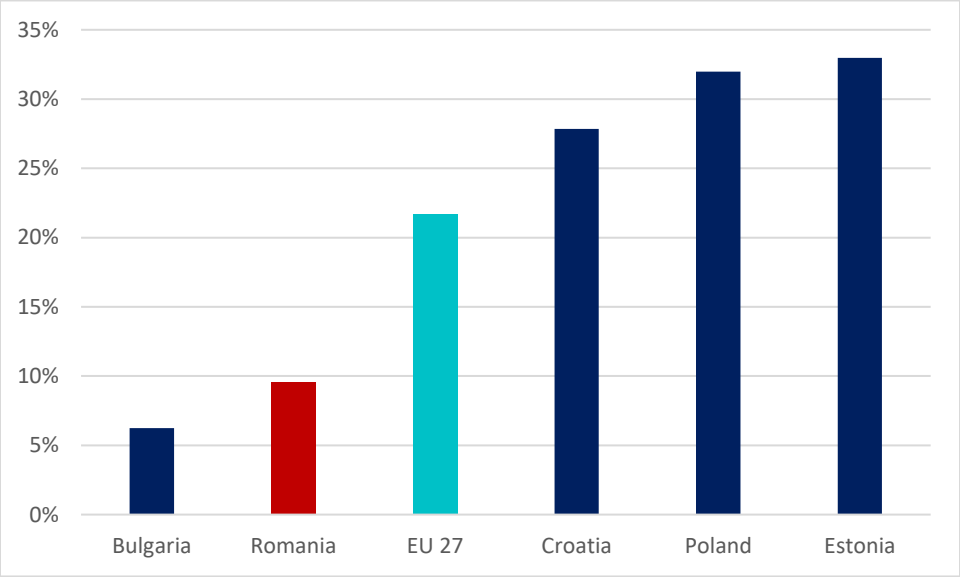
## 2.1.2 Higher Education Institutions (HEIs)

- HEIs play a very limited role in performing research in Romania, performing just ten percent of GERD in 2022 (less than half the EU average).
- Like PRIs, HEIs and researchers lack incentives and resources to engage in market-oriented research or technology transfer activities.
- Larger Romanian HEIs have established relationships with large, MNCs, which are largely driven by the MNCs efforts to build their talent pipeline in Romania.
- HEI collaborations with industry are generally limited in size and scope, due in part to the high teaching commitments of university researchers.
- HEIs play a larger role in the startup ecosystem than INCDs, although resources for supporting startups and spinouts are limited.

**HEIs play a very limited role in performing research in Romania**. The higher education sector only performed 10 percent of GERD in 2022, which is less than half of the EU 27 average and lower than all peers except Bulgaria (Figure 4). Romanian HEIs have historically been viewed as teaching institutions and did not play a role in the performance of research in the communist era.

While this has changed somewhat in recent decades, HEIs still play a much smaller role in Romania's R&I system than in most peers.

**Figure 4 Share of GERD performed by HEI sector, 2022**




Source: Eurostat.

**Romanian HEIs receive much less institutional funding for R&D than other public R&D actors**. Institutional funding for R&D in HEIs was only recently introduced and provides very limited funding; in 2023, just €23 million in institutional funding for R&D was shared across 53 public universities (World Bank, 2023a). HEIs research is further constrained by understaffed faculties due to low salaries, meaning professors have larger teaching burdens, and thus less time to perform research, to make up for vacant teaching posts.

**Like PRIs, HEIs and researchers are not well incentivized to engage in market-oriented research**. Several key universities do have steering committees where MNCs and other firms provide inputs to curricula based on their skills needs, but their inputs into university research agendas appear limited. University professor career incentive frameworks and institutional funding formulas emphasize publication outputs and do not track the exploitation of research results in the market. As with PRIs, university researchers can receive some monetary benefits from patenting, as they are entitled to at least 30 percent of the income made from licenses or sales of their patents, as stipulated in the Law of Employees Inventions.

**HEIs also lack resources and skills for technology transfer**. Many HEIs have TTOs, but most of these TTOs lack dedicated budgets or full-time staff. Like PRIs, most university TTO staff have limited knowledge of national IP legislation or on commercialization and technology transfer practices (see Box 2 for more information on this issue). Additionally, most HEIs (similarly to PRIs) suffer from unclear institutional policies for the licensing and commercialization of university IP, and there are almost no examples for official spinouts based on university-owned IP, in part due to the pricing formula for public-owned IP discussed earlier, as well as unclear institutional IP policies. Like INCDs, HEIs must set prices for the sale or licensing their IP according to a formula developed by MCID and the national tax authorities, and using this formula results sales or licensing costs that were prohibitively high and deterred private sector interest. Like PRIs, third

party organizations, such as technology brokers, cluster organizations, and industry associations, do not play any role in facilitating technology transfer of HEIs' IP.

**Larger Romanian HEIs have established relationships with large MNCs, which are largely driven by the MNCs' efforts to build their talent pipeline in Romania**. MNCs are very active in not only recruiting from HEIs, but also growing the available talent pool within HEIs through funding scholarships, providing guest lecturers, and providing inputs into curricula.[6] These relationships, initially built around access to talent, often then lead to research collaborations—the MNCs already active on campus will learn about a professor that meets their needs and contract with them for research projects. MNCs also actively scout HEIs for researchers and research teams that meet their needs. MNC-HEI research collaborations are generally in the form of contract research—the MNC contracts with a researcher to perform a project that meets a specified need. These collaborations are generally engagements with individual researchers, and the MNCs generally provide the contractual framework and IP agreements for such collaborations because HEIs lack the resources to develop them themselves.

**HEIs also collaborate with SMEs on research**. However, several SMEs interviewed by the WB team preferred to work with INCDS because they found that university researchers were not as productive or timely in performing research due to their teaching requirements. HEIs generally do not engage in the types of economic activities (e.g., training and consulting services) with SMEs that INCDs do.

**HEIs play a larger role in the startup ecosystem than INCDs, although resources for supporting startups and spinouts are limited**. Bucharest Polytechnic University has an accelerator program that provides non-financial support to student- and faculty-founded startups, as well as a very small pre-seed grant program—but most Romanian HEIs have little to no resources to support startups. In Bucharest, there are at least a few startups founded by professors who retained their position at the university while running their company.

**Box 2 Technology Transfer and IP Support**

In the 2018-2022 Supporting Innovation in Catching-up regions in Romania activity, funded by the DG REGIO and implemented by the WB in the Northeast (NE) and Northwest (NW) regions of Romania, a technology transfer capacity building program was designed to address the skills and knowledge gaps of select TTOs. During the initial analysis, the TTOs and researchers expressed a widespread lack of certainty and awareness in terms of the national policies and regulatory frameworks that establish the authority, incentives, and prioritization of technology transfer and innovation-based economic development activities. In some cases, researchers or others expressed confusion over whether pursuing the commercial exploitation of their research might be viewed as problematic in terms of their compliance with their primary responsibilities to their employing institution or the legality of such activities.

Moreover, analyzed TTOs failed to follow best practices for the most basic TTO function, patent filing. Romanian patents are being filed on inventions by most TTOs – but with no strategic basis for doing so, and with no ability to develop an international patenting strategy for those inventions. Patents that were being filed were typically written by the researchers themselves

[6] Examples include MNCs with branch offices in Romania, such as Continental, Renault, and Bosch, all of which have developed relationships with at least 10 Romanian universities targeted toward developing and attracting skilled talent. Relationships vary in size and scope, but may include the provision of scholarships and guest lecturers, sponsoring events and hackathons, sitting on university boards or advisory panels, and providing inputs into curricula.

– even though researchers had no training or experience in development patent strategies related to the commercial potential of their inventions. The TTOs were monitoring the patent filings but typically were not engaged in developing or overseeing a patent strategy driven by assessed high potential for market penetration and commercialization.

Many researchers and TTO personnel noted that there was very little to no experienced invention assessment, marketing, and engagement activity, or even capacity, in their TTOs. The TTOs complained about their limited number of staff and the multitude of functions they were asked to undertake. In some cases, departments that perform the role of a TTO are de facto offices of management of research projects, whose staff are competent in the management of research applications but not in commercialization. Lack of transactional capacity was the most serious deficiency across all institutions encountered by the WB team.

To address these challenges, the WB issued an IP Landscape Analysis Report in 2021, the Technology Transfer Handbook to serve as reference texts for TTO personnel and run a series of training sessions on basic TTO functions.

**The IP Landscape Analysis report includes**:

- A comprehensive overview of the national legislation around IP, including but not limited to any laws on innovation, R&D activity, patent law, laws on copyright and related rights, and laws regulating governments contracts;
- Identification of inconsistencies, unclear provisions, or ambiguities in the national legislation that may create a lack of clarity over IP ownership of public universities, institutes and R&D organizations, and practical recommendations on how to clarify identified ambiguities;
- Analysis of IP statutes and regulations of PRIs regarding IP ownership, revenue sharing, etc. and assessment of whether their provisions regarding IP ownership are correlated with the primary and secondary legislation and whether their content regarding IP ownership is clear;
- Assessment of any missing legal frameworks not correlated with primary and secondary legislation, as well as any inconsistencies or ambiguities;
- Presentation of current operating procedures regarding the commercialization of IP between R&D organizations, universities, and TTOs and identification of areas where they are in conflict or not correlated with national laws and recommend options for resolving these issues;
- Assessment of current IP legal framework of the TTOs and practical recommendations on how the TTOs and relevant R&D organizations can effectively operate under the current legal framework;
- Options that lead to clear, unambiguous, and uniform national policy on ownership of intellectual assets arising out of research from public institutes and universities; and
- An overview of international legislation on the topic (particularly Bayh Dole Act of the US and relevant European model) to compare/contrast good practices/laws with the Romanian legislation.

The report highlighted the fact that legal framework governing the ownership of IP derived from public R&D activities remains scattered and unclear, despite several legislative efforts to address it. This is likely a consequence of the fact that Romanian IP legislation is often vaguely worded, lacks clear cross-references, and requires correlation and deep familiarity with a significant body of laws and legislation across multiple legal fields, which makes it difficult to understand and apply them without access to specialized expertise. In absence of any

guidance, the confusion concerning the IP legal framework has proven to be a serious obstacle for technology transfer activity.

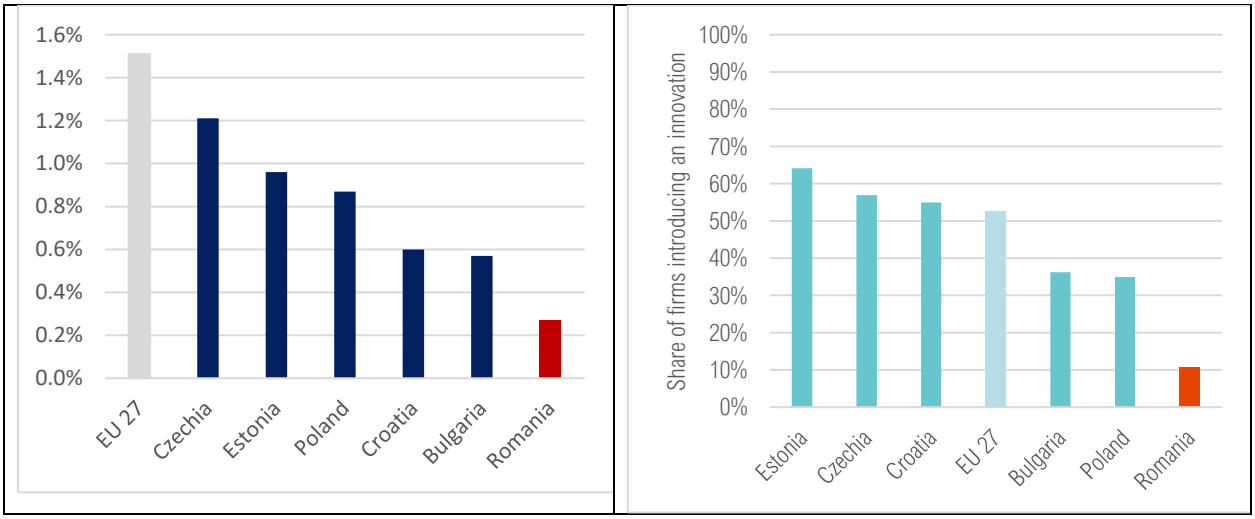
**The *Technology Transfer Handbook*** provides guidance on TTO roles, strategies, business plans, and business processes. It also includes references to best practices and additional resources on each of these topics. Annexes include a guide on Intellectual Property Policy Design, templates for standard documents (non-disclosure agreement, work for hire and employment contract clauses), and a business model canvas.

Additionally, a series of training sessions covering the main TTO functions were delivered: the basics of IP, how to design and implementation of an effective IP policy, innovation management practices, and building and connecting with innovation ecosystems.

## 2.2 Private Sector R&D Collaboration Activities

**Although the private sector is the largest funder and performer of R&D in Romania, BERD as a share of GDP remains low relative to peers and was less than 20 percent of the EU 27 average in 2020** (Figure 5a). A much smaller share of Romanian firms reported engaging in innovation activities than did firms in all peers in 2020 (Figure 5b). Private-sector innovation activities are concentrated in MNCs—particularly in the automotive and ICT sectors, where several major multinationals have relocated R&D activities to Romania—while domestic firms have weak capacities to engage in innovation activities or absorb new technologies (OECD, 2022).

**Figure 5 a.) BERD as a share of GDP, 2021; and b.) Share of firms introducing an innovation, 2020.**



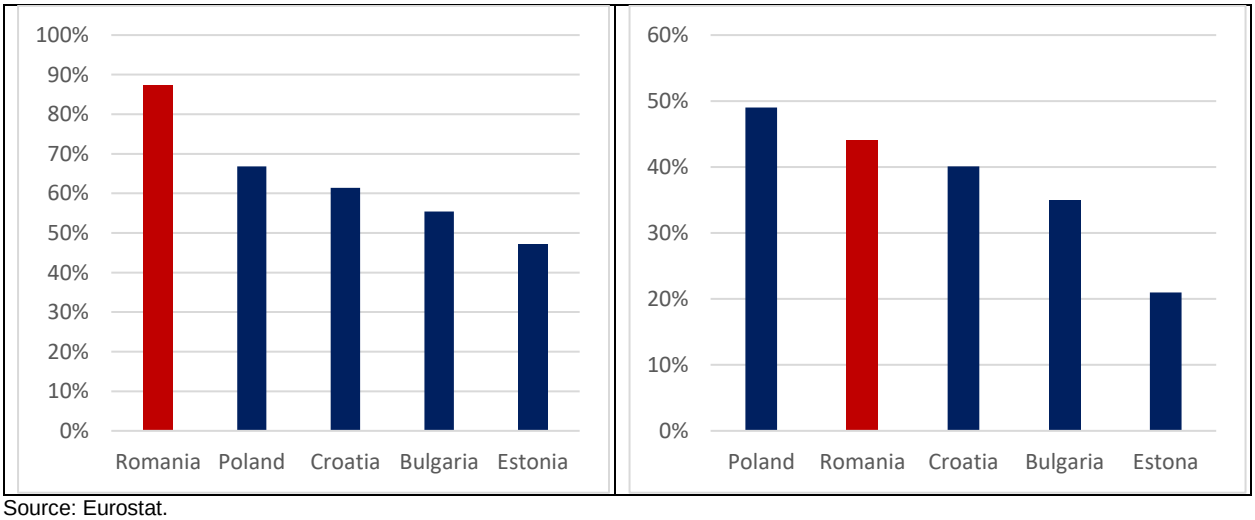

Source: Eurostat. | Note: BERD measures business expenditures on R&D. Innovations include product and process innovations. A product innovation is the market introduction of a new or a significantly improved good or service. A process innovation is the implementation of a new or significantly improved production process, distribution method or support activity for goods or services.

## 2.2.1 Large firms

- Large firms—primarily the branch offices of global MNCs—are the main drivers of innovation activity in Romania, accounting for 87 percent of BERD in Romania—well above the BERD performed by large firms in peer countries.
- MNCs generally do not participate in national grant programs or fiscal incentives aimed at promoting R&D investments due to administrative burden and issues with instrument design.
- MNCs generally see limited value in R&D collaborations with the public sector in Romania due to mindset differences, a lack of market orientation of public research, and a perceived lack of quality of public research capabilities.
- MNCs are very active in collaborating with Romanian HEIs to develop a pipeline of skilled labor.
- Romanian MNC offices have little to no engagement with PRIs due to a lack of information and mismatched incentives.

**Large firms—primarily the branch offices of global MNCs—are the main drivers of innovation activity in Romania**. In 2020, large firms (those with 250 or more employees) performed 87 percent of BERD in Romania, compared to 47 percent performed by such firms in Estonia, 55 percent Bulgaria, 61 percent in Croatia, and 67 percent in Poland (Figure 6a). Large Romanian firms have an outsized contribution in innovation activity relative to their contribution to the Romanian economy: large firms contributed 44 percent of value added in 2020, which is less than the 49 percent contributed by large Polish firms the same year (Figure 6b). Many Romanian MNC offices, particularly those in the automotive and testing sectors, are focused on innovating to become more efficient—looking for ways to reduce costs, either in their production processes or in skills acquisition. There are only a few MNCs, such as Orange Romania or Renault, that are innovating to develop new products and services for the Romanian market.

**Figure 6 a.) Share of BERD performed by large firms, 2020; and b.) Share of value added at factor cost by large firms, 2020**




Source: Eurostat.

**MNCs generally see limited value in R&D collaborations with the public sector due to mindset differences, a lack of market orientation of public research, and a perceived lack of quality of public research capabilities**. Many MNCs perceive that many public researchers are highly focused on their own research and have limited experience or understanding of working with industry or in developing products and services for the market. While many MNCs engage with universities for contract research, they find that their university partners are unable to build and maintain research capabilities due to funding challenges, which acts as a deterrent to developing deeper, more strategic collaborations with those partners. MNCs have limited information about the activities and capabilities of Romanian PRIs, and generally have a negative perception of the quality of research done in those institutions.

**MNCs generally do not participate in national grant programs or fiscal incentives aimed at promoting R&D investments due to administrative burden and issues with instrument design**. Several MNCs interviewed by the WB team had participated in national programs in the past and had negative experiences, finding the programs too burdensome in their application and reporting processes, with too little funding provided to justify the burden. A recent survey of beneficiaries of Romanian R&I instruments found that many public and private sector beneficiaries were dissatisfied with key aspects of their programs—particularly financial reporting requirements (see Appendix 4 for more information). Additionally, most national grants supporting collaboration utilize a “technology push” model (see the Romania’s Support for Public-Private Collaboration section), and MNCs have little interest in commercializing existing research done by Romanian INCDs and HEIs. Romania’s R&D tax incentives are also underutilized due to the very high administrative burden involved in certifying R&D projects (see Box 3 for more information).

**MNCs are very active in collaborating with Romanian HEIs to develop a pipeline of skilled labor**. As discussed above, many MNCs interviewed by the WB team had established relationships with at least one, and usually up to 10, HEIs in Romania. MNCs invest heavily in building talent pipelines at HEIs, including providing scholarships, guest lecturers, and inputs to curricula at partner universities (in effect, partially making up for insufficient public funding for higher education). MNCs also scout universities for research capabilities and will engage professors in contract research and consulting projects. These collaborations are generally done directly with the professor, and R&D collaborations with universities are generally small in scale and scope because professors generally have high teaching burdens and lack resources to develop large research teams.

**However, Romanian MNC offices have little to no engagement with PRIs due to a lack of information and mismatched incentives**. According to the Community Innovation Survey, only 10 percent of innovative large enterprises collaborated with PRIs in 2022, compared to 18 percent that collaborated with HEIs. As discussed previously, MNCs have little information about the activities and capabilities of PRIs and generally have a negative perception of the quality and market orientation of the research done in the institutes. MNCs do not see PRIs as a source of skilled labor, and thus do not feel the need to develop a skill pipeline to these institutions (as they do with HEIs). PRIs are also highly focused on participating in national grant programs to cover their costs; however, as discussed above, MNCs have no interest in participating in these programs.

### Box 3 Revisions to Romania's corporate tax deduction to spur private sector R&D investment

**Romania has a tax deduction scheme aimed at incentivizing private sector investments in R&D, but uptake has been limited by the administrative burden required to attain the deduction**. A corporate tax deduction of 50 percent for eligible expenses related to R&D activities was introduced in 2009 and most recently revised in 2022. The 2022 revision to the tax deduction from the Ministry of Finance and MCID aimed to better clarify which projects and activities qualify as R&D activities and also established a National Register of Experts for the Certification of R&D Activities, which companies must use in order to certify their R&D activities to qualify for the deduction. All large companies are obliged to request certification of their R&D activities, while all other entities can voluntarily ask for guidance.

**Uptake of the tax deduction has been limited by high reporting burden and challenges with contracting of experts from the National Register**. To attain a deduction for qualified R&D expenses, firms must contract with (and pay for the services of) an expert from the National Register of Experts for the Certification of R&D Activities and have them certify *each* R&D project as a qualified expense—and firms may have multiple R&D projects in a given year to certify. Certification requires a large amount of paperwork on the part of the firm, as for each project the firm must show evidence of the field of activity (e.g., bioeconomy, energy and mobility, advanced manufacturing, etc.), innovative category (e.g., new product development, product modernization, technology modernization, etc.), financing sources, number of employees and hours worked on the project, and total expenses. Depending on the size and complexity of the R&D project, the fee for certification from the expert may range up to several thousand euros. If firms have multiple R&D projects in a given year, certification can represent a large upfront cost. Stakeholders noted that experts from the National Registry varied significantly in the time required (and thus cost, as experts are paid by the day) to certify projects, as well as their interpretations of what constitutes a qualified R&D expense. Several large MNCs interviewed by the World Bank team said that they do not bother to apply for the R&D tax deduction because they feel the time and cost required to certify projects is not worth the benefit to their companies.

**The use of R&D tax incentives is low in Romania relative to EU and OECD peers**. R&D tax incentives can be valuable compliments to a country's direct support for R&D—while direct support for R&D is subject to State Aid restrictions, tax incentives are not so long as they apply without distinction to all firms and to the production of all goods and services (European Commission, 2007). Yet use of R&D tax incentives is relatively low in Romania; indirect government support through R&D tax incentives in Romania equaled 0.008 percent of GDP in 2021, more than 10 times less than the EU average of 0.097 percent of GDP and OECD average of 0.123 percent of GDP (OECD 2023). Romania's R&D tax incentives include the R&D corporate tax deduction, discussed above, as well as a personal income tax exemption for R&D personnel, accelerated depreciation of machinery and equipment used in R&D activities, and an exemption from profit tax for the first 10 years of operations for firms that solely perform R&D activities.

## 2.2.2 SMEs

- There are relatively few SMEs in Romania that perform research or develop new products and services, with SMEs accounting for just 10 percent of BERD in 2020.
- SMEs collaborations with the public sector are limited by low firm investments in R&D and a lack of information about potential partners.
- SME's collaborations with the public sector are highly contingent on the availability of public funding, yet public support for innovation and collaboration is highly unpredictable.
- SMEs engage with INCDs in a range of non-R&D innovation activities.

**Private sector innovation activities are highly concentrated in MNCs in Romania, and there are few SMEs that perform research or develop new products and services**. In 2020, SMEs (those with 10 to 249 employees) performed just 10 percent of BERD in Romania, compared to 26 percent performed by SMEs in Czechia, 30 percent in Poland, 36 percent in Croatia, and 40 percent in Bulgaria.

**SMEs collaborations with the public sector are limited by low firm investments in R&D and a lack of information about potential partners**. As discussed, there are relatively few SMEs that invest in R&D or engage in innovation activities, limiting the potential pool of SMEs that could collaborate with the public sector. Those SMEs that do engage in innovation activities lack information about potential partners outside of their established partners, both in public and private sectors.

**SME's collaborations with the public sector are highly contingent on the availability of public funding and likely would not occur without public support**. There are a small number of Romanian SMEs that have been fairly successful in winning national R&D grants and collaborating with public sector partners—the WB team interviewed to two such SMEs, but their experience may not be representative of innovative SMEs in the country. These SMEs collaborated with both INCDs and universities as part of national and European grant programs, including several repeat collaborations. These SMEs reported no collaborations outside of public grants (e.g., contract research projects), and it appears that the SMEs would lack resources and incentives to collaboration with public partners without public co-financing.

**Both innovative and non-innovative SMEs engage with INCDs in a range of non-R&D innovation activities**. As discussed above, INCDs engage in a range of "economic" activities (e.g., training, testing, and consulting services) to help firms improve their operational practices and adopt new technologies and techniques. These services are accessed both by innovative SMEs and non-innovating SMEs and likely represent an important form of knowledge transfer from the public to private sectors.

## 2.2.3 Startups

- While Romania has a relatively high rate of new business creation, Romanian startups tend to innovate at lower rates than those in peer countries.
- Startup collaborations with the public sector (PRIs and HEIs) appear very limited.

**Although Romania has a relatively high rate of new business creation, new firms tend not to innovate or grow at the same rates as those in peer countries**. Romania had a high birth

rate of firms (new firms entering the market as a share of all firms) relative to peers in 2020; however, a recent analysis of startups in Romania by World Bank (2022b) found that few young Romanian firms are innovating or have ambitions to significantly scale up their businesses or enter external markets.

**Stakeholders report that most knowledge- or technology-based startups in Romania are founded by experienced IT professionals or university researchers**. In Bucharest, there are at least a few "unofficial spinouts" founded by university researchers where the researcher has retained their position in the university while still running their company. However, due to unclear policies for the licensing and commercialization of university IP, there are almost no examples of official spinouts based on university-owned IP.

**Startup collaborations with the public sector appear very limited**. As in most places, Romanian startups are highly focused on developing their own products and services and do not engage in much collaboration with public (or private) sector actors. Universities do play a role in the startup ecosystem, although most universities have very limited resources available to support student- and professor-led startups and spinouts. INCDs do not have any significant role in supporting or collaborating with startups.

SECTION 3

# ROMANIA'S SUPPORT FOR PUBLIC-PRIVATE COLLABORATION

# 3. Romania's support for public-private collaboration

**This report provides an estimate of the resources Romania should commit towards private sector innovation and public-private collaboration in the 2021–2027 programming period**. This estimate was created by analyzing public support for innovation and R&D collaborations by other EU peer countries—particularly those countries that have higher scores in the European Innovation Scoreboard than Romania. Most economic and innovation statistics do not separate national support for private sector innovation or public private collaborations from other types of R&I support, so this analysis relies on data from several recent Policy Effectiveness Reviews (PER) in Romania (World Bank, 2023a), Croatia, and Poland. The PER methodology includes a comprehensive assessment of a country's investments in research and innovation. It consists of cataloging every policy instrument supporting R&I within the country and analyzing their characteristics, including objective(s), target beneficiaries, eligible activities, annual budget (allocated and disbursed), projects supported, implementer, and funding source. By using PER data, one can compare R&I support portfolios (in terms of budget and number of instruments) across objectives and beneficiary types—allowing for a direct comparison of national support for private sector innovation and public-private collaboration on an annual basis.

**The data used in this estimation cover three countries and over €12 billion in funding for instruments supporting private sector innovation and public-private collaboration.** The Polish PER data cover budget years 2014–2019 and includes 102 instruments targeting private sector innovation and public-private collaboration with €10.9 billion in disbursed funding. The Croatia PER data cover budget years 2014–2019 and include 15 instruments with €497 million in disbursed funding. The Romania PER data cover budget years 2016–2021 and include 22 instruments with €689 million in disbursed funding. To analyze planned investments for the current programming period (2021–2027), the WB team also mapped all planned allocations targeting private sector innovation and public-private collaboration, including 118 instruments and €2.8 billion in allocations.

**To allow for a direct comparison, country investments were annualized (to account for the different budget years covered) and adjusted for the size differences across economies**. The Polish and Croatia investments were adjusted based on relative GDP PPS 2014–2019 to scale to the size of the Romanian economy (as shown in Table 2).

**Table 2 Cross-country comparison of investments and allocations in innovation and collaboration**

| Country | Budget years covered | Innovation & collaboration investments (Total) | Innovation & collaboration investments (Annual average) | Innovation & collaboration investments (GDP adjusted) |
|---|---|---|---|---|
| Romania | 2016–2021 | €689 million | €114.8 million | €114.8 million |
| Romania | 2023–2028 | €2,834 million | €472 million | €472 million |
| Poland | 2014–2019 | €11,963 million | €1,993 million | €900 million |
| Croatia | 2014–2019 | €497 million | €83 million | €382 million |

Note: Data for Romania investments in the 2023-2028 budgetary period are allocations (rather than disbursed funds) and actual disbursements may be different than the figures indicated here.

**R&I investments were broken down into support for seven key objectives related to private sector innovation and public private collaboration**. These objectives cover a range of R&I and

knowledge transfer activities related to public and private sector interactions in the innovation space, covering direct support for private and collaborative R&D projects, shared R&D infrastructure (and access to infrastructure), TTOs and infrastructure, intermediaries (such as incubators, accelerators, clusters, industrial parks), skills for innovation and technology transfer, and startups. Table 3 describes each of these objectives and their definitions.

**Table 3 Innovation and collaboration objectives definitions**

| Objective | Definition |
|---|---|
| Private Sector Innovation | Innovation support to firms that does not require collaboration with the public sector |
| Public-Private R&D Projects | Support for R&D projects where collaboration between public- and private-sector actors is required |
| Shared R&D infrastructure | Support for infrastructure explicitly for use in public-private R&D collaborations or support for private access to public infrastructure |
| Tech transfer offices | Support for the construction and operation of new or existing TTOs and facilities. |
| Support to intermediaries | Direct financial support for the operation and activities of intermediary organizations (other than TTOs), such as incubators and accelerators; cluster organizations; and science, technology, and industrial parks |
| Innovation Skills | Support to PRIs, HEIs, researchers, firms, intermediaries, and/or training providers for the development of technology transfer and innovation-related skills and capacity |
| Startup Support | Support to early-stage companies (e.g., startups and spinoffs) or support to funds that will make investments in early-stage companies |

**This estimate complements the analysis in Section 2 of this report, which analyzes R&D spending and performance in the public and private sectors, capabilities of R&I actors, and key barriers to collaboration.** Although benchmarking Romania's investments in public-private collaboration and private sector innovation against peers in important, it is important to look at R&I investments in the context of a country's innovation performance to ensure that a country is making investments in areas of need.

## 3.1 2014–2020 Policy Mix

- In the 2014–2020 programming period, Romania provided significantly less funding for programs supporting private sector innovation and public-private collaboration than peers Croatia (almost 4 times less) and Poland (more than 9 time less) on a per GDP basis.
- In addition to limited funding, Romania's R&I instruments suffer from a lack of continuity and predictability in their budgets.
- Almost no support was provided for technology transfer and innovation skills or for intermediaries in the 2014–2020 programming period.
- Private sector uptake of innovation and public private collaboration instruments was likely limited by administrative burden.
- Most 2014–2020 instruments supporting public-private R&D collaborations were not industry led in their design and many suffered from challenges in design and implementation. Almost all instruments that supported public-private collaboration utilized a "technology push" approach, focusing on taking research that has already been developed at a public institution and pushing into the market via a private sector collaboration—but global experience has shown that firms have little incentive to

engage in such collaborations if they are unable to set the research agenda or own the project results.

**Over the 2014–2020 programming period, Romanian public support for private sector innovation and public private collaboration was far lower than the support provided by Poland or Croatia on a per GDP basis**. In the 2014–2020 programming period, the Romanian policy mix included 22 instruments supporting private sector innovation and public private collaboration that provided a total of €689.3 million in disbursed funding, with an annual average of €114.8 million in funding—when adjusted for the size of the economy (based on GDP PPS 2020), on an annual basis this is almost three times lower than the private sector innovation and public private collaboration support provided in Croatia[7] and almost eight times lower than in Poland (Table 4).

**Table 4 Annual funding for private sector innovation and public-private collaboration, 2014–2020 programming period, adjusted to the size of Romanian economy.**

| **Romania (2016–2021 annual average)** | **€114.8 million** |
|---|---|
| Poland (2014–2019 annual average) | €899.7 million |
| Croatia (2014–2019 annual average) | €382.3 million |

Source: World Bank 2019; World Bank, 2020a; World Bank, 2023a. | Note: Poland and Croatia funding levels have been adjusted to the size of the Romanian economy based on relative GDP PPS 2014–2020.

**Romania's public funding for R&I is characterized by a lack of continuity and predictability in financial support.** In the 2014–2020 programming period, Romania only spent 58 percent of what was planned to spend on R&D through the National RDI Strategy 2014–2020 due to under allocation of funds, and many planned R&I support instruments were canceled or only issued a single call for proposals due to budget limitations. Unrealistic planning is likely a key contributor to R&I budget unpredictability. The budget for the National RDI Strategy (the key strategy for funding R&I in Romania) was set based on the goal of spending of publicly funding 1 percent of GDP for R&D, but the strategy did not include details on where this money would come from. The lack of multiannual funding for R&I support instruments further inhibits Romania's R&I support, as R&I implementers rarely know the budgets for their programs for the coming fiscal year, making it difficult to issue calls for proposals on a regular (or predictable) basis. At times, the recipients of multi-year R&D grants and institutional funds have been left with gaps in funding while implementers waited for the national budget to be approved at the beginning of the fiscal cycle. This unpredictability has created a large degree of uncertainty among R&I performers and has hindered long-term planning and projects. While operational programs do have budgets set in advance, OP instruments also suffer from unpredictability in support. Many operational program instruments have suffered from numerous delays due to high levels of bureaucracy, technical delays for in the preparation of guidelines, delays in project selection due to difficulties in finding expert evaluators, long contracting and procurement procedures, and other implementation issues.

**The largest source of funding for private sector innovation and public private collaboration in the 2014–2020 programming period was POC, followed by the PN3 and Regional OP (ROP)** (Table 5). In the previous period, seven instruments from POC targeted private sector innovation and public private collaboration, for a total of over €400 million in disbursed funding.

[7] Data on private sector innovation support and public private collaboration in Poland and Croatia are drawn from recent World Bank Policy Effectiveness Reviews of the R&I policy mixes of both countries. For more information on Poland's policy mix, see World Bank 2020a. For more information on Croatia's policy mix, see World Bank 2019.

PN3 had 10 instruments, which disbursed over €200 million in funding and the ROP had 5 instruments for a total of €67 million.

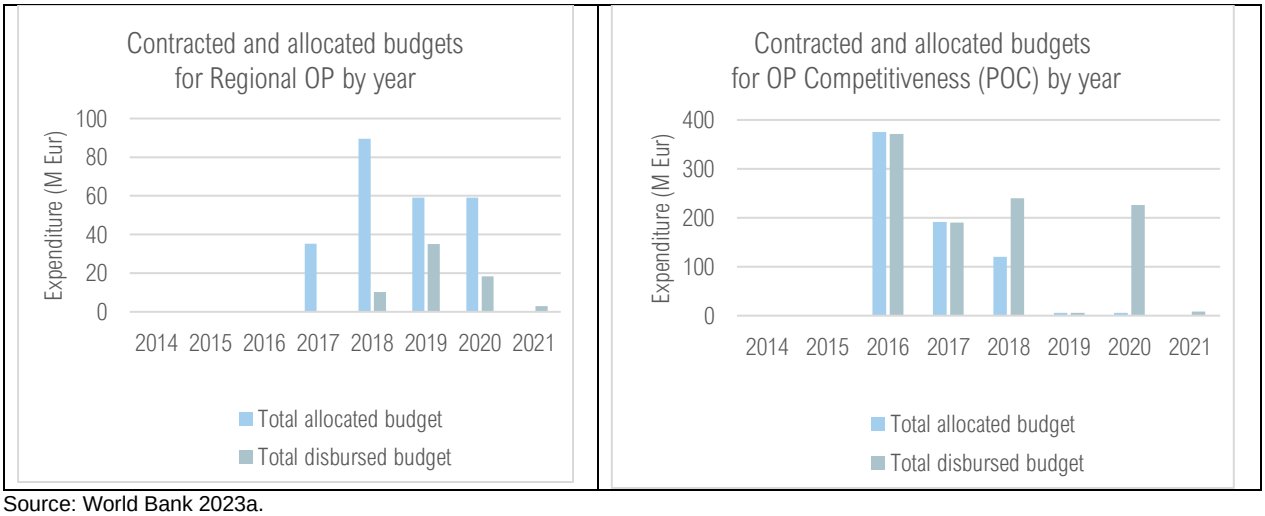
**Table 5 Sources of funding for private sector innovation and public-private collaboration, 2014–2020 programming period, actual amounts**

| Total funding | PN3 | POC | ROP |
|---|---|---|---|
| €689.3 M | €202.5 M | €419.9 M | €67.0 M |

Source: World Bank 2023a.

**In the 2014–2020 programming period, ROP instruments had severe challenges with absorption of funds, while POC contracted far more funding than was allocated**[8]. For instruments supporting R&I from the ROP, only 28 percent of allocated funds were contracted by 2021 (Figure 7a), indicating severe challenges in the absorption of funds by regional innovation actors. ROP instruments also had challenges in implementation of some instruments, several calls being launched without advanced notice to target beneficiaries, leading to applicants missing key deadlines for applying. POC instruments, by contrast, tended to award and contract far more funding than was allocated in their budgets, contracted funds exceeded funding allocations by 49 percent for some R&I instruments (Figure 7b). Over-contracting of funds appears to be a general practice among Romanian operational programs: for all European Structural and Investment Funds (ESIF) operational programs in the 2014-2020 programming period in Romania, the contracted rate of funds exceeded the initial allocations by 62 percent, while the effective absorption rate was 77 percent (MIPE, 2023). The absorption rate of overall POC funding was only 70 percent by the end of 2022. By contrast with ROP and POC, PN4 instruments had few challenges with disbursement of funds.

**Figure 7 a) Allocated and contracted funding for R&I for ROP instruments, 2016–2021, and b) Allocated and contracted funding for R&I for POC instruments, 2016–2021**




Source: World Bank 2023a.

**Looking at support by objectives, Romania's provided minimal support for technology transfer and innovation skills or intermediaries** (such as TTOs, incubators, and accelerators,

[8] For instruments funded by operational programs, data for the disbursement of funds at the instrument level are only released after project closing, so for active projects this analysis relies on those funds that were contracted to beneficiaries. Contracted funds are typically higher than actual disbursements because some contracted projects may be cancelled or terminated prior to or during implementation.

defined in Table 6). Instruments under POC largely focused on private sector innovation, public-private collaboration, and support to early-stage companies. Many PN3 instruments focused on public-private collaboration, with small support for non-collaborative private sector R&D and intermediaries. The ROP instruments were largely focused on technology transfer infrastructure and shared infrastructure (e.g., science and technology parks). Notably, no Romanian instruments in the 2014–2020 programming period provided support for building technology transfer or innovation skills in the public or private sectors.

**Table 6 Innovation and public-private collaboration support by source of funds (2014–2020 programming period)**

| Funding Source | Private Sector Innovation | Public-Private R&D Projects | Shared R&D infrastructure | Tech transfer offices | Support to intermediaries | Innovation Skills | Startup Support |
|---|---|---|---|---|---|---|---|
| **Total** | **237.4 M** | **303.3 M** | **38.2 M** | **18.1 M** | **14.7 M** | **-** | **62.3 M** |
| PN3 | 15.9 M | 185.6 M | - | - | 0.9 M | - | - |
| POC | 221.4 M | 112.3 M | - | - | 8.4 M | - | 62.3 M |
| ROP | - | 5.4 M | 38.2 M | 18.1 M | 5.4 M | - | - |

Source: World Bank 2023a.

**Compared to peers, Romania provided significantly less funding for private sector innovation, support for intermediaries, or early-stage companies on an annual basis than Poland and Croatia when adjusted for GDP** (Table 7)**.** Romania also provided less support shared R&D infrastructure (e.g., support to make public R&D equipment and infrastructure accessible to the private sector) than Croatia or Poland and provided less support for collaborative R&D than Poland (note that several major Croatian collaborative grant programs launched in 2020, after the PER mapping was done, and thus that funding was not included in the Croatian analysis).

**Table 7 Annual funding by instrument objective, 2016–2021 programming period, adjusted to the size of Romanian economy.**

| Funding Source | Private sector innovation | Public-private R&D projects | Shared R&D infra-structure | Tech transfer offices | Support to intermediaries | Innovation Skills | Startup Support |
|---|---|---|---|---|---|---|---|
| Romania (2016–2021 annual average) | 33.9 M | 43.3 M | 5.5M | 2.6 M | 2.1 M | - | 9.0 M |
| Poland (2014–2019 annual average) | 597.2 M | 95.2 M | 78.5 M | 2.3 M | 32.1 M | 12.0 M | 82.4 M |
| Croatia (2014–2019 annual average) | 85.4 M | 10.7 M | 187.0 M | - | 77.2 M | - | 21.9 M |

Source: World Bank 2019; World Bank 2020a; World Bank 2023a. | Note: Poland and Croatia funding levels have been adjusted to the size of the Romanian economy based on relative GDP PPS 2014–2020

**While the 2016–2021 R&D policy mix included a sizeable share of funding for public-private collaborative research projects, most instruments were not industry led and many suffered from challenges in design and implementation**. The recent *Policy Effectiveness Review of*

*Romania's Research and Innovation Support* report (World Bank, 2023a) provided an analysis of all policy instruments supporting research and innovation in Romania in budget years 2014–2022. The analysis found that almost all instruments that supported public-private collaboration utilized a "technology push" approach, focusing on taking research that has already been developed at a public institution and pushing into the market via a private sector collaboration. There were only two instruments (POC *Innovative Technological Projects* and PN3 *Transfer to economic actors*) that supported collaborations where a private company was able to define a research project around their specific needs. As a result of this technology push-centric approach, many instruments targeted universities and PRIs as the primary beneficiaries of funding regardless of policy objectives, including instruments focusing on commercialization and product development. For these instruments, private firms are often secondary beneficiaries—in other words, they could collaborate with public institutions, but the public institutions set the research agenda and are the direct recipient of funds (World Bank, 2023a). Global experience has shown that firms have little incentive to engage in such collaborations if they are unable to set the research agenda or own the project results (Becker, 2015).

**Analysis also found that that uptake of collaborative R&I instruments was likely deterred by administrative burden**. Private sector stakeholders interviewed by the WB team reported finding national grant instruments overly burdensome in their application and reporting processes when compared to European programs, such as Horizon. Examples of this burden include the requirement to create a detailed (often more than 50 pages) business plan as part of their application for some programs funded under PN3/4 and financial reporting requirements that require payroll information on each worker that worked on a given R&D project. A recent WB survey of beneficiaries of several Romanian R&D programs, both public and private sector respondents also reporting being unsatisfied with aspects of application, contracting, and reporting processes of their programs. More than 60 percent of private sector survey participants needed some form of external services to complete their application, and less than 45 percent of both public and private sector beneficiaries were satisfied with the financial reporting requirements of the programs (see Appendix 4 for more findings from the beneficiary survey). Multiple MNCs interviewed by the WB team said they do not plan to participate in future national grant programs because of the administrative burden experienced in past programs.

**The 2014–2020 policy mix provided very limited direct support to intermediaries**. Most support to intermediaries was provided by the ROP and was directed toward science and technology parks and cluster organizations, with limited funding provided to incubators and accelerators.

## 3.2 Policy mix supporting collaboration 2021–2027

- The 2021–2027 programming period will likely see a huge increase in instruments and funding targeting public-private collaboration and private sector innovation in Romania. The large increase in allocated funding in the current period is largely driven by planned investments in the eight new ROPs and POCIDIF.
- PN4 includes 35 instruments supporting collaboration and innovation, but only five of those instruments have announced allocations and calls for proposals as of the writing of this report. In the current fiscal environment, it seems unlikely there will be sufficient budget to fund the entire portfolio of PN4 instruments.

- The 2021–2027 programming period will see dramatic increases in planned funding across all objectives related to innovation and collaboration relative to the previous period, but funding for private sector innovation or early-stage innovative companies will still likely be significantly lower than Poland's investments toward those objectives in the 2014–2020 programming period.
- The new ROPs have much larger allocations for innovation and collaboration than the previous ROP but may face similar challenges in the absorption of funds as the previous ROP.
- An analysis of instruments supporting innovation and public private collaboration in the 2021–2027 programming period identified several gaps and areas of overlap in Romania's support:
    - The NRRP includes several reforms relevant to institutional and researcher incentives for public-private collaboration, but they are limited in scope with few resources for implementation. The NRRP investments will also only issue a single call for proposals in 2023/24, with no sustained support over time.
    - There appears to be overlapping support between POCIDIF instruments and regional instruments for initial investments in production lines and collaborations between SMEs and large firms.
    - The new period will see a large increase in instruments and allocated funding supporting public-private collaboration, but there appear to be overlaps between instruments and limited support for industry-led collaborations or forming linkages with large firms.
    - While the policy mix includes two instruments supporting private sector access to public R&D facilities, which was a clear gap in the 2014–2020 policy mix, funding has not yet been allocated at the national level.
    - Support to intermediaries increases dramatically in the new programming period but support for TTO operations and activities is still extremely limited. There are apparent overlaps in PN4 and regional support to incubators, accelerators, and clusters.
    - The new policy mix includes significant funding for innovation-related skills, but funding for developing technology transfer skills in the public sector is extremely limited.
    - There are apparent overlaps in support in the POCIDIF portfolio of startup support instruments and between national and regional instruments supporting startups.

**The 2021–2027 programming period will likely see a huge increase in instruments and funding targeting public-private collaboration and private sector innovation in Romania, however many instruments do not have budget allocations yet**. In the 2021–2027 programming period, estimated public funding for private sector innovation and public private collaboration in Romania (for those programs that have announced budgets) is €2.8 billion in allocated funding to 118 instruments, which would represent a large increase in both funding and instruments in the 2014–2020 programming period (which included 22 instruments with €689.3 million in disbursed funding). This estimated total includes instruments supporting private sector innovation and public private collaboration from POCIDIF; eight ROPs; NRRP; OP Health; and announced 2023/24 allocations[9] for the National Plan for RDI 2022–2027 (PN4). However, this estimation does not include budget allocations for a large number of programs from PN4, which do not have budget allocations yet. Assuming this €2.8 billion in funds is indeed disbursed to

[9] At the time of the writing of this report, five instruments under PN4 supporting private sector innovation or public-private collaboration had announced allocations for 2023-2024 calls for proposals: Centers of Excellence, Demonstrative experimental projects, Transfer to the business entity, Innovation vouchers, and European partnerships & missions.

beneficiaries during budget years 2023–2028, Romania would spend approximately €476.3 million per year supporting private sector innovation and public private collaboration from 2023 to 2028. This would represent a more than 400 percent increase over the 2014–2020 programming period but would still be less than half of Poland's annual support for private sector innovation and public private collaboration in the previous programming period when adjusted for the size of the economy (Table 8).

**Table 8 Annual funding for private sector innovation and public-private collaboration, adjusted to the size of Romanian economy.**

| **Romania (2023–2028 estimated annual average)** | **€476.3 million** |
|---|---|
| Romania (2014–2021 annual average) | €98.5 million |
| Poland (2014–2019 annual average) | €899.7 million |
| Croatia (2014–2019 annual average) | €382.3 million |

Source: World Bank 2019; World Bank 2020a; World Bank 2023a, World Bank compilation. | Note: Poland and Croatia funding levels have been adjusted to the size of the Romanian economy based on relative GDP PPS 2014–2020.

**The large increase in allocated funding for private sector innovation and public-private collaboration in the current period is largely driven by planned investments in the eight new ROPs and POCIDIF** (Table 9). The new ROPs have allocations of over €1 billion in support for private sector innovation and public private collaboration, up from just €67 million in disbursed funds in the previous period. POCIDIF's planned investments for private sector innovation and public-private collaboration have more than doubled (over €900 million, compared to €400 million in the previous period), while the new OP Health has allocated more than €170 million toward public-private collaborations in R&D in the health sector.

**The new ROPs have much larger allocations for innovation and collaboration than the previous ROP but may face similar challenges in the absorption of funds**. Romania's ROPs vary in terms of the resources they have allocated toward supporting private sector collaboration and public-private collaboration; while the Bucharest-Ilfov region has the largest allocation in absolute terms and per capita, it devotes the fewest resources to innovation and collaboration on a per GDP basis. The South Muntenia ROP has the largest allocation per GDP, followed by the Northwest and Central ROPs (Table 9). Importantly, the 2014–2020 ROP faced severe challenges in the disbursement of funds, disbursing just €67 million of the €240 million in allocations for innovation and collaboration by the end of 2021. The Regional Development Agencies (RDAs), acting as implementers of the 2014–2020 ROP, encountered severe challenges in the capacity of regional actors to absorb the allocated funding. In the new period, the RDAs will act as both managing authorities and implementing bodies of ROP funds. Romania's RDA have varying capacities to design and implement R&I support instruments and may need support to tailor instruments to the needs and capacity of regional innovation actors (see Box 4 for more information on this issue).

**Table 9 ROP allocations for private sector innovation and public-private collaboration, 2021–2027 programming period**

| Region | Allocated funding for innovation and collaboration | Allocated funding per billion GDP (2022) | Allocated funding per capita (2022) |
|---|---|---|---|
| **Northwest** | €153 million | €5.1 | €60 |
| **Central** | €142 million | €5.1 | €62 |

| | | | |
|---|---|---|---|
| **Northeast** | €108 million | €4.2 | €34 |
| **Southeast** | €116 million | €4.9 | €49 |
| **South Muntenia** | €144 million | €5.3 | €50 |
| **Bucharest-Ilfov** | €195 million | €3.0 | €86 |
| **Southwest** | €87 million | €4.7 | €47 |
| **West** | €87 million | €3.9 | €51 |

Source: World Bank.

### Box 4 Building Capacity of Romania's RDAs

Romania's eight RDAs are non-profit institutions focused on the economic and social development of their respective regions. They are responsible for developing regional development plans and smart specialization strategies, implementing innovation initiatives, and fostering partnerships among regional and local actors. In the 2021-2027 programming period, they also act as Managing Authorities for European Union Cohesion Policy Regional Programmes for the ROPs of their respective regions for the first time.

However, the RDAs have varying capacities to design and implement research and innovation strategies and policies. Some, such as the Northeast RDA, have received technical assistance from the WB to build internal processes and systems and design new innovation programs, but there is still a need to develop and expand the capacities of the RDAs to support research and innovation. The OECD (2023) report provides a set of recommendations aimed at ensuring the effectiveness of regional development strategies and policies. These include (among others):

- Improving RDA capacity for innovation and innovation support by mapping and analyzing the skills, experience, and areas of expertise required to improve RDA capacity for regional innovation support.
- Providing more input on major projects of strategic significance for their regions (e.g., infrastructure and those that support innovation ecosystems) and playing a stronger co-ordination role among county and local authorities, such as initiating and facilitating cross-jurisdiction co-operation.
- Using the Regional Programmes to demonstrate regional-local synergies and encourage local actors to invest in projects that could complement regional ones.
- Enhancing the RDAs' position as network leaders and reinforce their position, improve connectivity, and strengthen existing innovation partnerships and collaborations.
- Developing and strengthening an innovation brand for the region through repeated, targeted and easily digestible messages. Doing so will require RDAs to pursue continuous interactions with innovation stakeholders to build and solidify productive relationships, as well as design, organize and facilitate events and discussions to help improve knowledge and trust across quadruple helix actors.

Source: OECD 2023.

**PN4 includes many new instruments targeting innovation and collaboration, but the vast majority have no budget allocations or scheduled calls for proposals**. The announced budget for PN4 is €12 billion, which would amount to a more than 700 percent increase over the actual spending from the previous national plan. However, it is unclear where these new funds would come from as Romania grapples with a budget deficit and widespread funding cuts. PN4 includes 35 instruments supporting collaboration and innovation, but only five of those instruments have announced allocations and calls for proposals as of the writing of this report. Based on past spending patterns of previous National Plans and the current fiscal environment, it seems unlikely there will be sufficient budget to fund the entire portfolio of PN4 instruments. For those five instruments that do have announced allocations, they include more than €350 million in

allocations have been announced in support of public-private collaboration (primarily from the new Centers of Excellence instrument).

**Table 10 Sources of funding for private sector innovation and public-private collaboration, 2014–2020 vs. 2021–2027 programming period**

| | PN3/4 | POC/POCIDIF | ROP/ROPs | NRRP | OP Health |
|---|---|---|---|---|---|
| 2014–2020 | €202.5 M | €419.9 M | €67.0 M | - | - |
| 2021–2027 | €353.0 M (Announced) | €969.6 M | €1,066.2 M | €31.0 M | €175.6 M |

Source: World Bank. | Note: The allocative funding for PN4 2021–2027 includes only those instruments with an announced budget; PN4 includes a large number of instruments targeting private sector innovation and public-private collaboration, but only five have budget allocations as of the writing of this report.

**The 2021–2027 programming period will see likely increases in funding across all objectives related to innovation and public-private collaboration relative to the 2014–2020 programming period** (Table 11). This includes dramatic increases in funding for shared infrastructure, support to intermediaries, and innovation and technology transfer skills, as well as moderate increases in funding for private sector innovation, public-private R&D projects, TTOs, and startup support.

**Table 11 Innovation and public-private collaboration support, 2014–2020 vs 2021–2027**

| Funding Source | Private Sector Innovation | Public-Private R&D Projects | Shared R&D infrastructure | Tech transfer offices | Support to intermediaries | Innovation Skills | Startup Support |
|---|---|---|---|---|---|---|---|
| 2014–2020 | 237.4 M | 303.3 M | 38.2 M | 18.1 M | 14.7 M | - | 62.3 M |
| 2021–2027 | 445.2 M | 514.8 M | 1,191.0 M | 83.4 M | 397.4 M | 79.1 M | 123.1 M |

Source: World Bank. | Note: The allocative funding for PN4 2021–2027 includes only those instruments with an announced budget; PN4 includes a large number of instruments targeting private sector innovation and public-private collaboration, but only five have budget allocations as of the writing of this report.

**Romanian funding programs (e.g., operational programs, PN4, NRRP, etc.) do not focus on particular R&I objectives, which has resulted in overlaps in their support portfolios.** Instruments under POCIDIF, PN4, and the ROPs target a range of objectives related to private sector innovation and public-private collaboration, with no clear delineation between their activities and beneficiaries, which has resulted in apparent overlaps in the support being provided by these funding programs (see the subsequent subsections on 2021–2027 support by objective for more analysis on this issue) (Table 12). By contrast, NRRP investments are focused on public-private collaboration projects and shared R&D infrastructure, while OP Health instruments focus on shared R&D infrastructure, public-private R&D projects, and private sector innovation in the health sector.

**Table 12 Innovation and public-private collaboration support by source of funds, 2021–2027**

| Funding Source | Private Sector Innovation | Public-Private R&D Projects | Shared R&D infrastructure | Tech transfer offices | Support to intermediaries | Innovation Skills | Startup Support |
|---|---|---|---|---|---|---|---|
| PN4 | Unknown | 33.0 M | 320.0 M | Unknown | Unknown | Unknown | Unknown |
| POCIDIF | 66.0 M | 226.0 M | 557.0 M | - | 12.0 M | 40.0 M | 68.6 M |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ROP | 314.2 M | 152.0 M | 79.0 M | 83.4 M | 385.4 M | 39.1 | 49.7 |
| NRRP | - | 6.0 M | 25.0 M | - | - | - | - |
| OP Health | 65.0 M | 97.8 M | 210.0 M | - | - | - | 12.8 |

Source: World Bank. | Note: The allocative funding for PN4 2021–2027 includes only those instruments with an announced budget; PN4 includes a large number of instruments targeting private sector innovation and public-private collaboration, but only five have budget allocations as of the writing of this report.

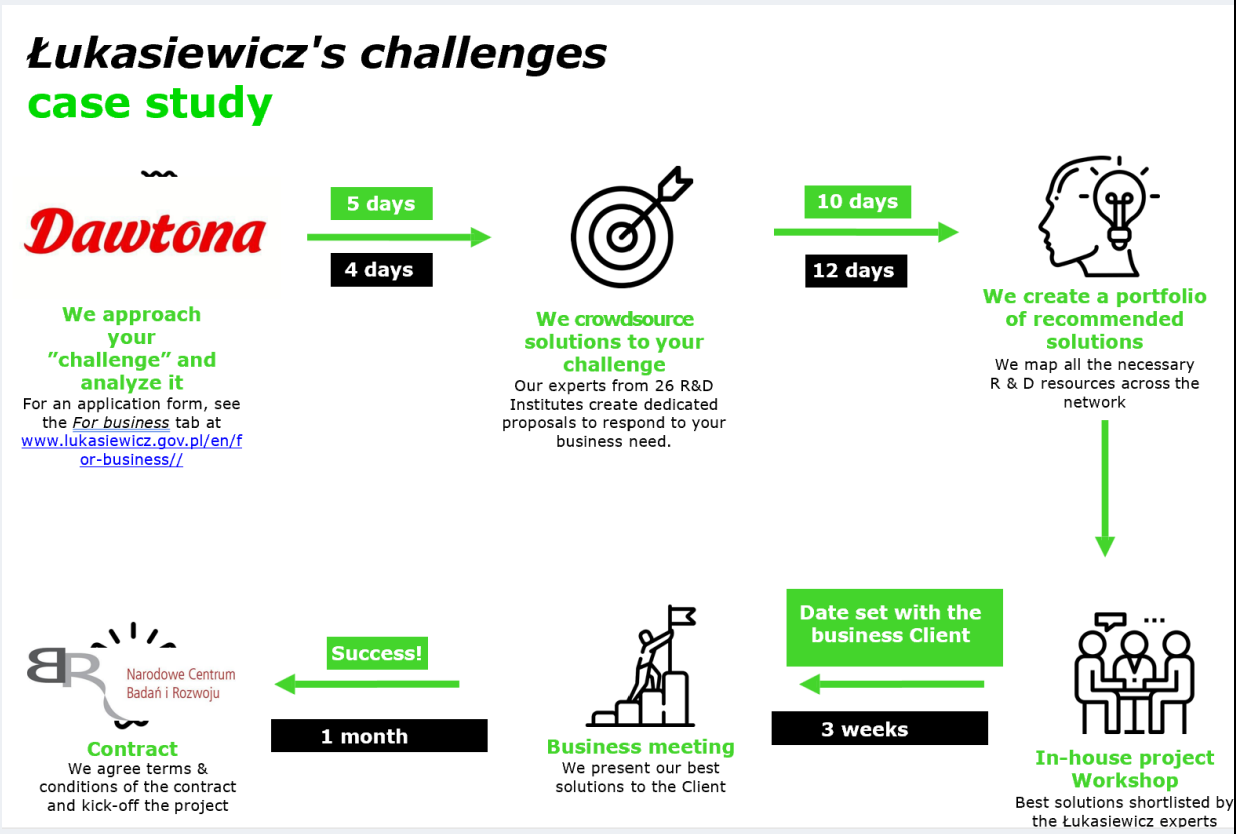
### Box 5 Support for lowering information barriers between the public and private sectors

**Romanian R&I actors, in both the public and private sectors, lack information about the capabilities and interests of potential collaboration partners**. Romanian PRIs and universities lack resources to identify new partners outside of their traditional partners. Similarly, smaller private sector actors, such as SMEs and startups, do not have the resources to scout potential collaboration partners and have very limited information about other public and private research organizations. Even MNCs, which have resources and actively scout universities for research talent, have limited information about the activities and capabilities of Romanian PRIs.

**There is limited support for lowering information barriers and forming new research connections**. The planned policy mix includes limited support for lowering information barriers between R&I actors and creating new R&I partnerships. PN4 includes a new Tech Transfer Festival instrument, but the objectives, beneficiaries, format, and budget of the proposed festival(s) is currently unknown. UEFISCDI also has several online platforms (e.g., Brainmap and Brokermap), which provide information on public sector research performers to help interested parties identify research partners for PN4 grants. However, few stakeholders interviewed by the WB team—including none from the private sector—had ever heard of or used these platforms.

**Romania's peers use varying approaches to address information gaps between innovation actors**. The Serbia Innovation Fund funds and organizes workshops and open houses as part of existing innovation grant programs to provide opportunities for public and private sector actors to come together, form new connections, and develop collaborative proposals. In Croatia, the WB, DG REGIO, and Nuqleus (a university-based innovation center) are partnering to implement a pilot matchmaking initiative that will actively match public and private sector R&D performers based on their capabilities and interests, with the aim of creating new and more lasting research partnerships. Poland's Łukasiewicz Network, a group of Polish PRIs, utilizes an online portal that provides information on the infrastructure, capabilities, and projects of network PRIs and allow firms to submit inquiries describing their innovation needs through a standard form. PRIs then respond within a set period of time (10 business days) with a proposal that responds to the firm's need (this process is shown in Figure 8).

**Figure 8 Łukasiewicz challenges process**




Source: Łukasiewicz Network.

**Despite increases in funding allocations over the previous period, the current programming period will likely see Romania spend significantly less annually in support for private sector innovation or early-stage companies than Poland did in the previous programming period** (Table 13). Romania's allocations in the 2021–2027 programming period will likely see dramatic increases across objectives related to innovation and collaboration, yet support for private sector innovation will be less than 15 percent of that provided by Poland in the previous programming period when adjusted for the size of the economies. Similarly, support for early-stage companies only 22 percent of that provided by Poland and 83 percent of that provided by Croatia, when adjusted for the size of the economies. This indicates that Romania should invest more in supporting private sector innovation and early-stage companies to keep up with its more innovative regional peers.

**Table 13 Annual funding by instrument objective, 2021-2027 programming period vs. 2014–2020 programming period**

| Funding Source | Private sector innovation | Public-private R&D projects | Shared R&D infrastructure | Tech transfer infrastructure | Support to intermediaries | Innovation Skills | Startup Support |
|---|---|---|---|---|---|---|---|
| **Romania (2023–2028 estimated average)** | 74.2 M | 85.8 M | 198.5 M | 13.9 M | 66.2 M | 13.2 M | 20.5 M |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Romania (2014–2021 annual average) | 33.9 M | 43.3 M | 5.5M | 2.6 M | 2.1 M | - | 9.0 M |
| Poland (2014–2019 annual average) | 597.2 M | 95.2 M | 78.5 M | 2.3 M | 32.1 M | 12.0 M | 82.4 M |
| Croatia (2014–2019 annual average) | 85.4 M | 10.7 M | 187.0 M | - | 77.2 M | - | 21.9 M |

Source: World Bank 2019; World Bank 2020a; World Bank 2023a, World Bank compilation. | Note: The allocative funding for PN4 2021–2027 includes only those instruments with an announced budget; PN4 includes a large number of instruments targeting private sector innovation and public-private collaboration, but only five have budget allocations as of the writing of this report. Croatian and Polish funding levels have been adjusted to the size of the Romanian economy based on relative GDP PPS 2014–2020.

### Box 6 Regulatory reforms to incentives for collaboration

**The NRRP includes several reforms relevant to incentives for public-private collaboration, but they are limited in scope with few resources for implementation**. The NRRP includes four reforms relevant to its R&I support, with only EU 3.4 million allocated for their implementation. The two reforms relevant to this report are Reform 3: Reformation of research careers and Reform 4: Enhanced cooperation between business and research.

**NRRP Reform 3 targets reforms to researcher career frameworks, but it is not clear if this reform will introduce new incentives for public-private collaboration or market-oriented research**. The reform aims to increase the attractiveness of public researcher careers and the performance of public researchers. The *Law on Statute of RDI Personnel* is under approval at the time of writing this report and will detail a set of KPIs to evaluate performance of Romanian researchers and provide standards for 'good conduct in scientific research' for better access to funding and scholarships. However, it is unclear if new KPIs will be developed to incentivize researchers to engage in market-oriented research, public-private collaboration, technology transfer, and commercialization activities.

**NRRP Reform 4 targets cooperation between business and research, but the reform seems limited in scope**. The reform aims to increase the cooperation between businesses and research, development and innovation PRIs and to create a favorable environment for public and private investments in the sector. It sets a target of 40 percent of R&I projects funded by MCID and its agencies to have at least one business entity active, including SMEs and startups, as a partner and will also seek to introduce legislation to simplify and digitize the contracting, financing, monitor and evaluation of research projects to incentivize more private sector uptake of public instruments. However, the reform does not address institutional incentives or the capabilities of public organizations and intermediaries (e.g., TTOs) to undertake technology transfer or commercialization activities.

### 3.2.1 Private sector innovation support

- Support for private sector innovation will increase compared to 2014–2020 programming period, but allocated funds are still significantly less than Polish support in the 2014–2020 programming period on a per GDP basis.
- There appears to be overlapping support between POCIDIF instruments and regional instruments for initial investments in production lines and private-private collaborations between SMEs and large firms.

**Support for private sector innovation will increase compared to 2014–2020 programming period, but allocated funds are still significantly less than Polish support in the 2014–2020 programming period on a per GDP basis.** Allocated funding for private sector innovation in the 2021–2027 period has more than doubled over the previous period, but Romania's planned support for private sector innovation will be less than 15 percent of that provided by Poland in the previous programming period when adjusted for the size of the economies.

**The largest source of funding for private sector innovation in the 2021–2027 period will be the ROPs, followed by POCIDIF and OP Health**. The eight ROPs have 15 instruments targeting private sector innovation for a total of €314 million in allocated funding. POCIDIF and OP Health each have allocations of around €65 million, PN4 has four instruments supporting innovation in the private sector (although none have any budget allocation as of the writing of this report), and no NRRP instruments target private sector innovation (Table 14).

**Table 14 Support for private sector innovation by funding source, 2021–2027 programming period**

| | PN4 | POCIDIF | ROPs | NRRP | OP Health |
|---|---|---|---|---|---|
| # of instruments | 4 | 3 | 15 | 0 | 1 |
| Allocated funding | Unknown (no funding announced) | €66.0 M | €314.2 M | €0 | €65.0 M |

Source: World Bank.

**In total, 24 instruments will target private sector innovation and may provide overlapping support in some areas** (see Table 15). Such overlaps in support will require attention to either consolidate instruments that are too similar in design or to alter the designs and objectives to differentiate the instruments. Potential overlaps include:

- **National and regional support for initial production of innovations in SMEs**. POCIDIF *Innovative technological projects* provides support for later-stage development of new or improved products in SMEs, including initial investments in production lines, which appears to overlap will several regional instruments (e.g., Northeast *RDI projects and investments in SMEs,* Bucharest Ilfov *Support for RDI activities in SMEs,* and Northwest *Projects in smart specialization areas -production component*) that provide similar support for later-stage commercialization and initial production lines. The POCIDIF Implementation Body should coordinate with these regions to understand how best to differentiate these instruments and reduce potential confusion among target beneficiaries.
- **National and regional support for collaborations between SMEs and large firms**. POCIDIF *Support for transfer of knowledge and technology between private actors* supports private-private R&D collaborations between SMEs and large firms, which

overlaps with support from two regional instruments (Central *Development of private RDI capacities at the enterprise level* and South Muntenia *R&I activities in SMEs to increase the level of technological maturity in areas of smart specialization*). As above, the POCIDIF Implementation Body should coordinate with these regions to understand how best to differentiate these instruments and reduce potential confusion among target beneficiaries.

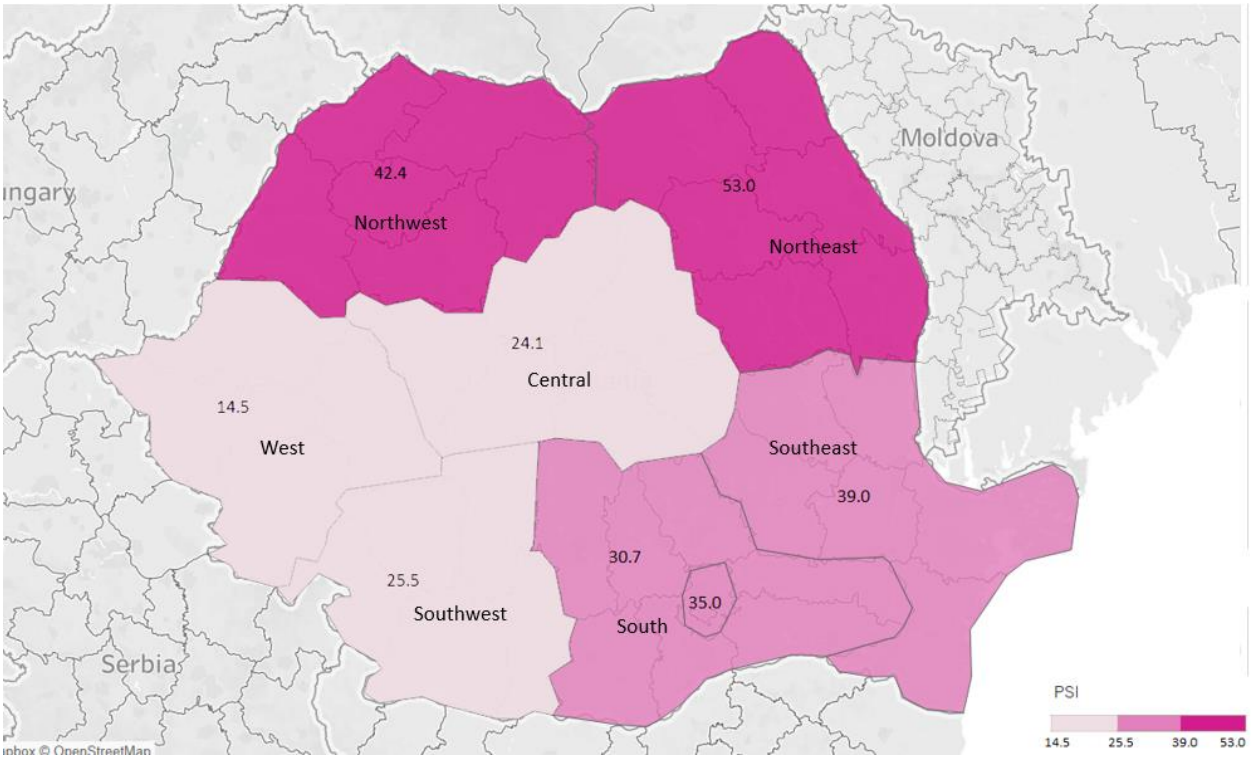
**Table 15 Planned support instruments for private sector innovation, 2021–2027 programming period**

| Instrument | Funding Program | Target beneficiaries | Budget |
|---|---|---|---|
| Pre-spin-off | PN4 | Firms (all sizes), PRIs | Unknown |
| Go-to-market | PN4 | SMEs, startups | Unknown |
| Enhancing innovation in firms operating in international markets | PN4 | Firms (all sizes) | Unknown |
| Patenting voucher | PN4 | Firms (all sizes), PRIs | Unknown |
| Innovative technological projects | POCIDIF | SMEs, PRIs, HEIs | €66 million |
| Support for transfer of knowledge and technology between private actors | POCIDIF | SMEs, large firms (partners only) | Unknown |
| New services/applications/products through innovation and adoption of advanced technologies | POCIDIF | SMEs (IT sector) | €50 million |
| Projects for the development and testing of innovative/advanced technologies with applicability in the clinical field | OP Health | Firms (all sizes) (Health sector) | €65 million |
| Proof of concept | ROP BI | SMEs | €5 million |
| Proof of concept | ROP NE | SMEs | €6 million |
| Proof of concept | ROP SE | SMEs | €2 million |
| Support for RDI activities in SMEs | ROP BI | SMEs | €30 million |
| Projects in smart specialization areas - production component | ROP NW | SMEs | € 11.1 million |
| Support for the innovation ecosystem—Transfer to the market | ROP NW | SMEs | € 7.5 million |
| Stimulating business demand for innovation | ROP SW | SMEs | € 25.5 million |
| Support for innovation | ROP W | SMEs | € 14.5 million |
| Seal of Excellence | ROP NE | SMEs | €6 million |
| Going from idea to market | ROP C | Firms (all sizes) | € 8.7 million |
| Supporting research and innovation activities | ROP SE | SMEs; PRIs; HEIs | €37 million |
| RDI projects and investments in SMEs | ROP NE | SMEs; PRIs, HEIs, TTOs, large firms (partners only) | €41 million |
| Projects for enterprises in smart specialization areas—the research component | ROP NW | SMEs; large firms (partners only) | €23.8 million |
| Development of private RDI capacities at the enterprise level | ROP C | SMEs, large firms (partners only) | € 15.4 million |
| R&I activities in SMEs to increase the level of technological maturity in areas of smart specialization | ROP SM | SMEs, large firms (partners only) | € 30.7 million |

Source: World Bank. | Note: NE = Northeast Region; SE = Southeast Region; W = West Region; C = Central Region; SM = South Muntenia Region; BI = Bucharest-Ilfov Region.

**All regions have at least one instrument supporting private sector innovation** (Figure 9). Regional investments in private sector innovation range from €14.5 million to €53 million for the upcoming programming period, with the Northeast (3 instruments with €53 million in allocated funding), Northwest (3 instruments and €42 million), and Southeast (2 instruments and €39 million) regions providing the most support.

**Figure 9 Support for private sector innovation in regional operational programs, by region, 2021–2027 programming period**




Source: World Bank.

## 3.2.2 Public-private R&D Projects

- The 2021–2027 programming period will see a large increase in instruments and allocated funding supporting public-private collaboration.
- There is limited support for industry-led collaborations or forming linkages between the public sector and large firms.
- There are apparent overlaps between instruments supporting public-private collaboration within the PN4 portfolio.

**The new period will see a significant increase in instruments and allocated funding supporting public-private collaboration compared to 2014–2020 programming period, but there appear to be overlaps between instruments and limited support for industry-led collaborations or forming linkages with large firms.** The 2021–2027 programming period will include instruments with over €500 million in allocations targeting public-private R&D collaboration projects, up from nine instruments and €300 million in disbursed funding in the previous period.

However, there appears to be limited support for industry-led collaborations and overlaps in support within the PN4 portfolio of instruments.

**POCIDIF and the ROPs have the most allocated funding supporting public-private collaboration, while PN4 has the most instruments targeting this objective**. POCIDIF includes two instruments with over €200 million in support of public-private collaboration projects, while the ROPs include nine instruments with over €159 million in allocations (Table 16). PN4 include 13 instruments targeting this objective, but only five (*Transfer to the business entity*, *Demonstrative experimental projects, Innovation vouchers, European partnerships & missions*, and *EUREKA projects*) have allocations as of the writing of this report.

**Table 16 Support for private sector innovation by funding source, 2021–2027 programming period**

| | PN4 | POCIDIF | ROPs | NRRP | OP Health |
|---|---|---|---|---|---|
| # of instruments | 13 | 2 | 9 | 1 | 2 |
| Allocated funding | €33.0 M (announced) | €226.0 M | €152.0 M | €6.0 | €97.8 M |

Source: World Bank.

**While the policy mix includes many instruments targeting public-private collaboration, there seems to be limited support for industry-led collaborations or consortia.** Only one instrument continued from the 2014–2020 programming period supports industry-led collaboration (PN4 *Transfer to economic agents*), and it is unclear if any of the newly introduced instruments will be industry led in their design. As discussed in the section on the 2014–2020 policy mix, firms have little incentive to engage in collaborations if they are unable to set the research agenda or own the project results. There also appears to be little support for industry-led consortia—the POCIDIF *Support for RDI projects for thematic consortia* will support public-private R&D consortia, but it is not known if the research agenda of these consortia will be set by the private sector partners.

**Large firms are the main drivers of innovation in Romania, but there are no instruments explicitly aimed at forming connections between PRIs, HEIs, and large firms**. As discussed in the *Private Sector R&D Collaboration Activities* section of this report, large firms are the largest performers of private sector R&D in Romania by a large margin, yet there are few examples of deep, strategic collaborations between large firms and the public sector in Romania. While several MNCs are active in collaborating with Romanian HEIs to develop a pipeline of skilled labor, collaborations in R&D tend to be small scale engagements with individual researchers at universities—and little to no engagement with PRIs. The Romanian public sector would benefit from collaboration and knowledge exchange with large, innovative firms, yet there are no instruments targeted toward this objective—multiple instruments supporting public-private collaborations list large firms as eligible to participate, but they are not explicitly targeted toward forming connections between the public sector and large firms.

**In total, 27 instruments will target public-private R&D collaborations, with apparent overlaps in support in several areas** (Table 17). Such overlaps in support will require attention to either consolidate instruments that are too similar in design or to alter the designs and objectives to differentiate the instruments. Potential overlaps include:

- **PN4 support for public-private R&D projects:** PN4 includes 13 instruments supporting public-private R&D projects, with several areas of apparent overlap within the portfolio. Two instruments—*Bridge grant* and *Demonstrative experimental projects*—are very

similar in their design, target beneficiaries, eligible activities, and project funding and duration. Additionally, the *"Idea-to-market"* instrument, which provides staged support for technology development from technology readiness level (TRL) 1-8, duplicates support available elsewhere in the PN4 portfolio. Given the budget uncertainty around PN4 instruments, consolidating these instruments into a smaller number of instruments with larger budgets and regular (e.g., annual calls for proposals) would improve the consistency of innovation support in Romania and reduce potential confusion among beneficiaries.

- **National and regional innovation vouchers:** The PN4 Innovation voucher appears to provide very similar support to the voucher planned in the West in Central regions. Given that the PN3 innovation voucher received many more qualified applications than funding was available, and the instrument was well regarded by beneficiaries, this duplication may not be a problem. However, UEFISCDI should work with the West and Central RDAs to make it clear to regional SMEs which instrument they should apply to.

**Table 17 Planned support for collaborative R&D, 2021–2027 programming period**

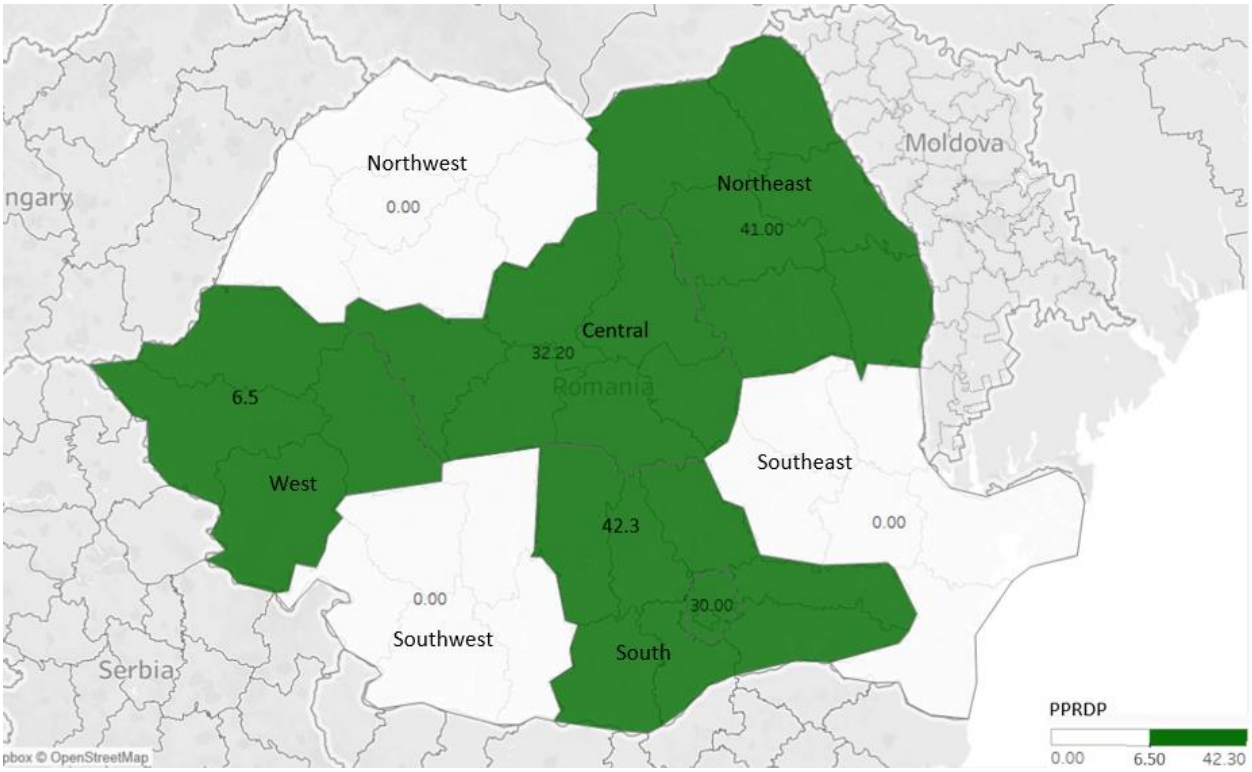
| Instrument | Funding Program | Target beneficiaries | Budget |
|---|---|---|---|
| Transfer to the business entity | PN4 | Firms (all sizes), PRIs, HEIs | €11 million (2023) |
| Bridge grant | PN4 | PRIs, HEIs, Firms (all sizes) | Unknown |
| Demonstrative experimental projects | PN4 | PRIs, HEIs, Firms (all sizes) | 11 million (2023) |
| "Idea-to-market" (Innovation funnel) | PN4 | PRIs, HEIs, Firms (all sizes) | Unknown |
| Challenges—Agile | PN4 | PRIs, HEIs, Firms (all sizes) | Unknown |
| Challenges—Change | PN4 | PRIs, HEIs, Firms (all sizes) | Unknown |
| National Missions | PN4 | PRIs, HEIs, Firms (all sizes) | Unknown |
| RDI for cybersecurity | PN4 | PRIs, HEIs, Firms (all sizes) (IT sector) | Unknown |
| RDI for personalized medicine | PN4 | PRIs, HEIs, Firms (all sizes) (Health sector) | Unknown |
| Innovation vouchers | PN4 | PRIs, HEIs, SMEs | 1 million (2023) |
| European partnerships & missions | PN4 | PRIs, HEIs, Firms (all sizes) | 10 million (2023) |
| EUREKA Projects | PN4 | PRIs, HEIs, Firms (all sizes) | 1.2 million (2024) |
| Synergies with other European and international programs | PN4 | PRIs, HEIs, Firms (all sizes) | Unknown |
| Support for RDI projects for thematic consortia (public-private) | POCIDIF | PRIs, HEIs, SMEs | 173 million |
| Support for synergies with Horizon Europe and other progs | POCIDIF | PRIs, HEIs, SMEs | 53 million |
| European partnerships & missions | NRRP | PRIs, HEIs, Firms (all sizes) | 6 million |

| | | | |
|---|---|---|---|
| Integration of the national RDI ecosystem in the European and international Research Area | OP Health | PRIs, HEIs, Firms (all sizes) (Health sector) | 20 million |
| Support for collaboration between RDI actors from the public system and the business environment | OP Health | PRIs, HEIs, Hospitals, SMEs (Health sector) | 78 million |
| Innovation vouchers | ROP NE | PRIs, HEIs, SMEs | €6 million |
| Innovation vouchers | ROP W | PRIs, HEIs, SMEs | €2.5 million |
| Support for effective collaboration between SMEs and RDI organisations | ROP BI | PRIs, HEIs, SMEs | €30 million |
| RDI projects in collaboration with the private sector | ROP NE | PRIs, HEIs, SMEs | €35 million |
| Partnerships between research organizations and SMEs | ROP SM | PRIs, HEIs, SMEs | €10 million |
| Partnerships for innovation | ROP W | PRIs, HEIs, Firms (all sizes), TTOs | €4 million |
| Partnerships for innovation | ROP C | PRIs, HEIs, Firms (all sizes) | €21.9 million |
| Participation of SMEs and RDI organizations in structures, partnerships and collaboration programs | ROP C | PRIs, HEIs, Firms (all sizes) | €10.3 million |
| RDI capacities of PRIs, companies, and local/central public authorities | ROP SM | PRIs, SMEs, Government | €32.3 million |

Source: World Bank. | Note: NE = Northeast Region; SE = Southeast Region; W = West Region; C = Central Region; SM = South Muntenia Region; BI = Bucharest-Ilfov Region.

**At the regional level, support for collaboration is concentrated in the Northeast, South Muntenia, Central, and capital regions, and three regions provide no targeted support for public-private collaboration** (Figure 10). The Northeast, South Muntenia, Central, and Bucharest Ilfov regions have over €30 million allocated toward public-private collaboration projects, while the West region has €6.5 million allocated. Three regions (Northwest, Southeast, and Southwest) provide no support. However, given that there are several national-level instruments supporting public-private collaboration projects, the lack of support in these regions may not be an issue.

**Figure 10 Support for public-private collaboration projects in regional operational programs, by region, 2021–2027 programming period**




Source: World Bank.

# 3.2.3 Shared R&D Infrastructure

- The 2021–2027 programming period includes over €1 billion in allocated funding for shared R&D infrastructure, mostly from POCIDIF, PN4 and OP Health.
- Over €550m is allocated for POCIDIFs instrument supporting creation of hubs between research organizations and SMEs, and €320m for PN4's Centers of excellence supporting mostly collaboration among PRIs/HEIs.
- At the moment of writing of this report (February 2024), the role of the private sector in these instruments is not clearly defined.

**The 2021–2027 programming period includes €1.2 billion in allocated funding for shared R&D infrastructure, primarily from POCIDIF, PN4, and OP Health** (Table 18). For the purposes of this report, shared R&D infrastructure is defined as support for infrastructure explicitly for use in public-private R&D collaborations or support for private access to public infrastructure. This includes grants for R&D projects where a significant portion of funding is expected to be used for R&D equipment and facilities.

**Table 18 Support for shared infrastructure by funding source, 2021–2027 programming period**

| | PN4 | POCIDIF | ROPs | NRRP | OP Health |
|---|---|---|---|---|---|
| # of instruments | 4 | 1 | 4 | 1 | 1 |

| | | | | | |
|---|---|---|---|---|---|
| Allocated funding | €320.0 M (announced) | €557.0 M | €79.0 M | €25.0 | €210.0 M |

Source: World Bank.

**Most of the funding allocated for shared infrastructure comes from three instruments: POCIDIF *Support for the creation of HUBS*, PN4 *Centers of Excellence*, and OP Health *Strategic Projects in the Health Sector*** (Table 19). The largest instrument by allocated budget, POCIFID *Projects in fields of advanced technologies and the Creation of HUBS*, has an allocated budget of over €550 million and supports collaborations between more research organization and SMEs with the aim of creating new products and services– however, the roles of participating organizations and business model of the hubs is not yet clear. The PN4 Centers of Excellence instrument has an allocated budget of €320 million, but primarily supports collaborations between PRIs/HEIs, while SMEs can potentially have access to center facilities. The final large instrument is the *OP Health Strategic* projects in the health sector, which supports collaborations between PRIs, HEIs, hospitals, and firms to develop facilities, products, and services in the health sector. For all three of these large instruments, the role of private sector partners is unknown—if the private sector is unable to help set the research agendas for these new centers and hubs, they may have limited incentive to participate in such partnerships.

**The 2021–2027 policy mix includes two instruments supporting private sector access to public R&D facilities, which was a clear gap in the previous policy mix, but funding has not yet been allocated at the national level**. As discussed in the recent *Policy Effectiveness Review of Romania's Research and Innovation Support* report (World Bank, 2023a), Romania has spent significant funds on the construction of new infrastructure, it has provided very limited support for access to existing infrastructure. The PN4 Experiment voucher is designed to provide vouchers that firms can use to pay for access to public research facilities, but this instrument has no budget allocation. Three ROPs provide support for shared R&D infrastructure: Bucharest Ilfov, West, and Northwest (Figure 11). The ROP for the Bucharest Ilfov region also includes €36 million in allocated funding for the construction of new shared public R&D facilities and access to those facilities by regional SMEs. However, until the PN4 instrument has an allocated budget, support for access to public R&D infrastructure will be limited to the capital region.

**Table 19 Planned support for shared R&D infrastructure, 2021–2027 programming period**

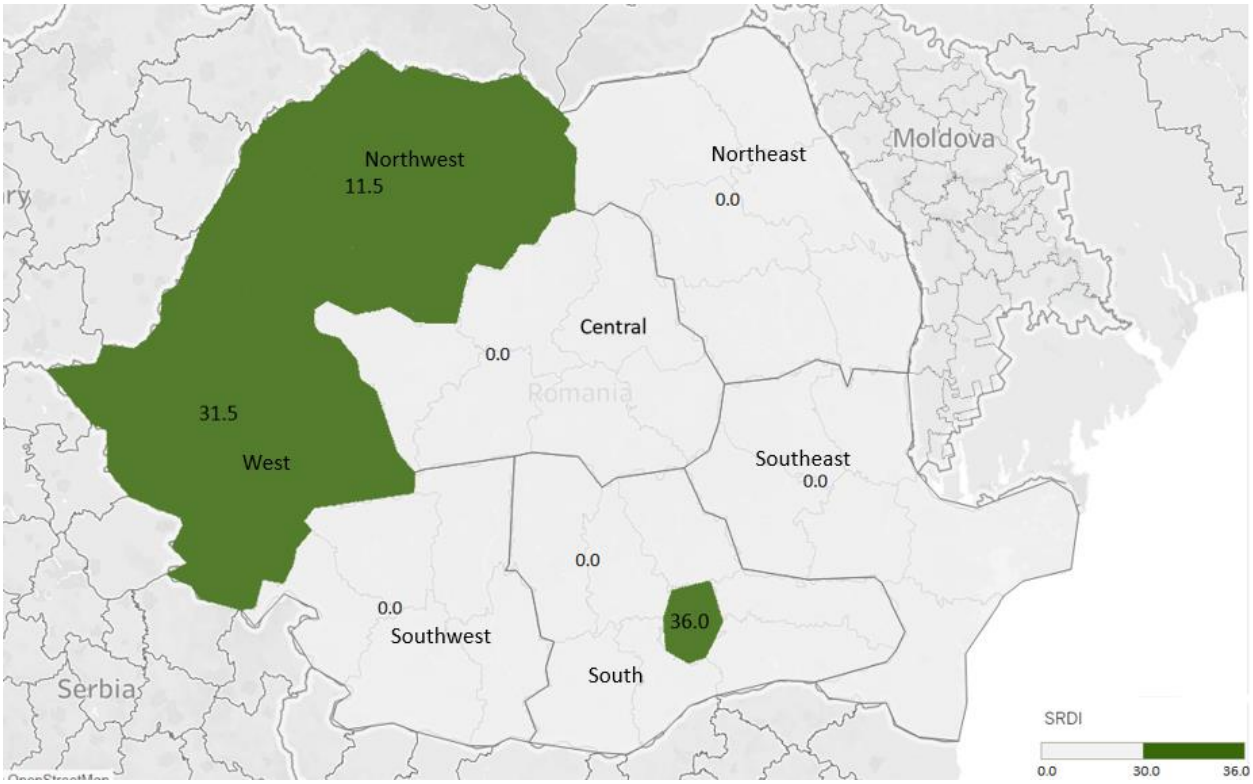
| Instrument | Funding Program | Target beneficiaries | Budget |
|---|---|---|---|
| Centers of Excellence | PN4 | PRIs | 320 million |
| Strategic programs & infrastructures - STAR, ALFRED, DANUBIUS RI; Blue growth | PN4 | PRIs, HEIs, Firms (all sizes) | Unknown |
| Strategic (sub-)programs: (1) Quantum technologies; (2) Artificial Intelligence; (3) Autonomous systems | PN4 | PRIs, HEIs, Firms (all sizes) | Unknown |
| Experiment voucher | PN4 | PRIs, HEIs, Firms (all sizes) | Unknown |
| Projects in fields of advanced technologies and the Creation of HUBS | POCIDIF | PRIs, HEIs, SMEs | 557 million |
| Centers of Competence | NRRP | PRIs, HEIs, Firms (all sizes) | 25 million |
| Strategic projects in the health sector | OP Health | PRIs, HEIs, Hospitals, Firms (all sizes) | €221 million |

| | | | |
|---|---|---|---|
| Support for capitalizing on RDI facilities' potential in close connection with the innovation needs of SMEs | ROP BI | PRIs, HEIs, SMEs | €36 million |
| RDI centers - including collaborative research | ROP NW | PRIs, HEIs, SMEs | €11.5 million |
| Creativity & Innovation Centres / OPEN-LABS | ROP W | PRIs, HEIs, Firms (all sizes) | €19 million |
| Supporting the activities of RDI organizations and infrastructures | ROP W | PRIs, HEIs, Firms (all sizes) | €12.5 million |

Source: World Bank. | Note: NE = Northeast Region; SE = Southeast Region; W = West Region; C = Central Region; SM = South Muntenia Region; BI = Bucharest-Ilfov Region.

**Three ROPs provide support for shared R&D infrastructure: Bucharest Ilfov, West, and Northwest** (Figure 11). The Bucharest Ilfov instrument is described above, providing support for the construction of new shared public R&D facilities and access to those facilities by regional SMEs. Two instruments supported by ROP West and ROP Northwest will support the development of new public-private R&D facilities, and one instrument supported by ROP West will develop one or more open innovation labs for use by public and private actors.

**Figure 11 Support for shared research infrastructure in regional operational programs. by region, 2021–2027 programming period**




Source: World Bank.

# 3.2.4 Technology transfer offices (TTOs)

- Operational fundings for TTOs was a key gap in the previous programming period.
- In the current programming period, support for TTOs will still not be available from national programs and in several regions, including the capital region.

**Operational funding for TTOs was a key gap in the previous programming period, and while several ROPs will support technology transfer investments and operations, support for TTOs will not be available in several regions or from national programs.** Importantly, much of the nation's research capacity is based in the Bucharest-Ilfov region, but TTOs in the capital region will not have access to support for their operations.

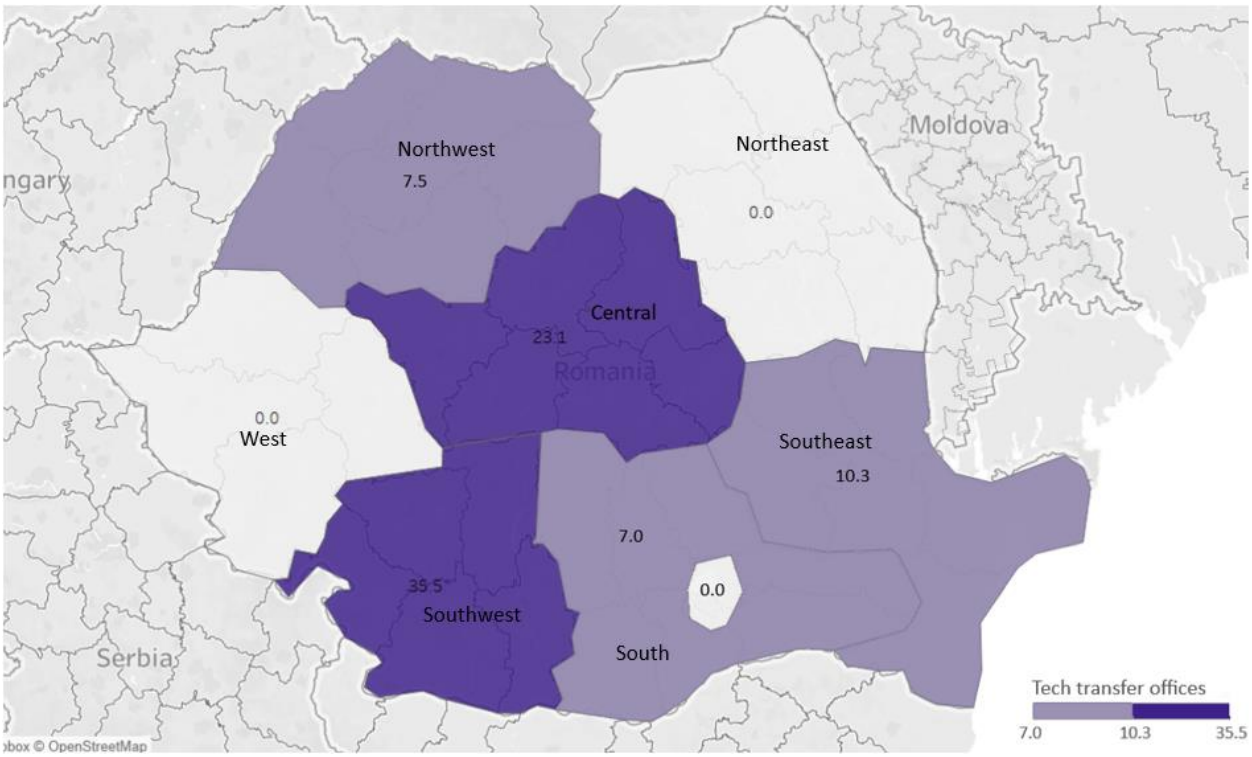
**Support for TTOs (infrastructure and operations) comes entirely from the ROPs, with six instruments providing 83.4 million in allocated funding**. For the purpose of this report, support for technology transfer infrastructure is defined as support for the construction and operation of new or existing TTOs and facilities. As discussed earlier in this report, most public sector TTOs lack dedicated budgets, staff, and resources and have limited capacity to carry out technology transfer activities. A key reason for this is that the previous programming period provided limited support for the operation and activities of new or existing TTOs, so PRIs and HEIs have very limited funding for TTO operations. In the 2021–2027 period, five of the ROPs will provide some form of support to TTOs, while no support for TTOs will be provided in the Northeast, West, or Bucharest-Ilfov regions or at the national level (Table 20 and Figure 12). Critically, much of the nation's research capacity is based in the capital region, but TTOs in the region will not have access to support for their operations.

**Table 20 Planned support for technology transfer infrastructure, 2021–2027 programming period**

| Instrument | Funding Program | Target beneficiaries | Budget |
|---|---|---|---|
| Supporting technological transfer | ROP SE | TTOs | €10.3 million |
| Supporting technology transfer to SMEs | ROP NW | PRIs, TTOs | €7,5 million |
| R&I and TT Infrastructure in cooperation with the SMEs | ROP SW | TTOs, SMEs | €20.1 million |
| Technology transfer and innovation | ROP SW | TTOs | €15.4 million |
| Development of public R&D and TT capacities | ROP C | TTOs | €23.1 million |
| Supporting technology transfer for the benefit of SMEs | ROP SM | TTOs | €7 million |

Source: World Bank. | Note: NE = Northeast Region; SE = Southeast Region; W = West Region; C = Central Region; SM = South Muntenia Region; BI = Bucharest-Ilfov Region.

**Figure 12 Support for TTOs in regional operational programs, by region, 2021–2027 programming period**




Source: World Bank.

# 3.2.5 Support to intermediaries

- Support to intermediaries will increase dramatically in the new programming period.
- There are apparent overlaps in PN4 instruments and regional support to incubators, accelerators, and clusters.

**Support to intermediaries increases dramatically in the new programming period, although there appears to be overlaps in intermediary support between the ROPs and PN4.** For this report, support to intermediaries is defined as direct financial support for the operation and activities of intermediary organizations (other than TTOs, which are covered in the previous subsection), such as incubators and accelerators; cluster organizations; and science, technology, and industrial parks. The 2021–2027 period includes 27 instruments with more than €400 million in allocated funding for intermediaries, while the previous period only included three instruments and €14 million in disbursed funding. However, there is apparent overlap in PN4 and ROP support for incubators, accelerators, and cluster organizations.

**The ROPs are the primary source of funding for intermediary organizations in the 2021–2027 programming period, with limited funding planned at the national level** (Table 21). See the subsections below for instruments and analysis of support for intermediaries by type.

**Table 21 Support for intermediaries by funding source, 2021–2027 programming period**

| | PN4 | POCIDIF | ROPs | NRRP | OP Health |
|---|---|---|---|---|---|
| # of instruments | 3 | 1 | 21 | 0 | 0 |
| Allocated funding | Unknown (no funding announced) | €12.0 M | €430.9 M | €0 | €0 M |

Source: World Bank.

## *Support for incubators and accelerators*

**The ROPs are the primary source of allocated funding to incubators, accelerators, and other early-stage business intermediary organizations** (Table 22). All eight regions will provide some form of support to regional incubators and accelerators, with allocated funding ranging from €2.9 million up to €19.4 million (Figure 13).

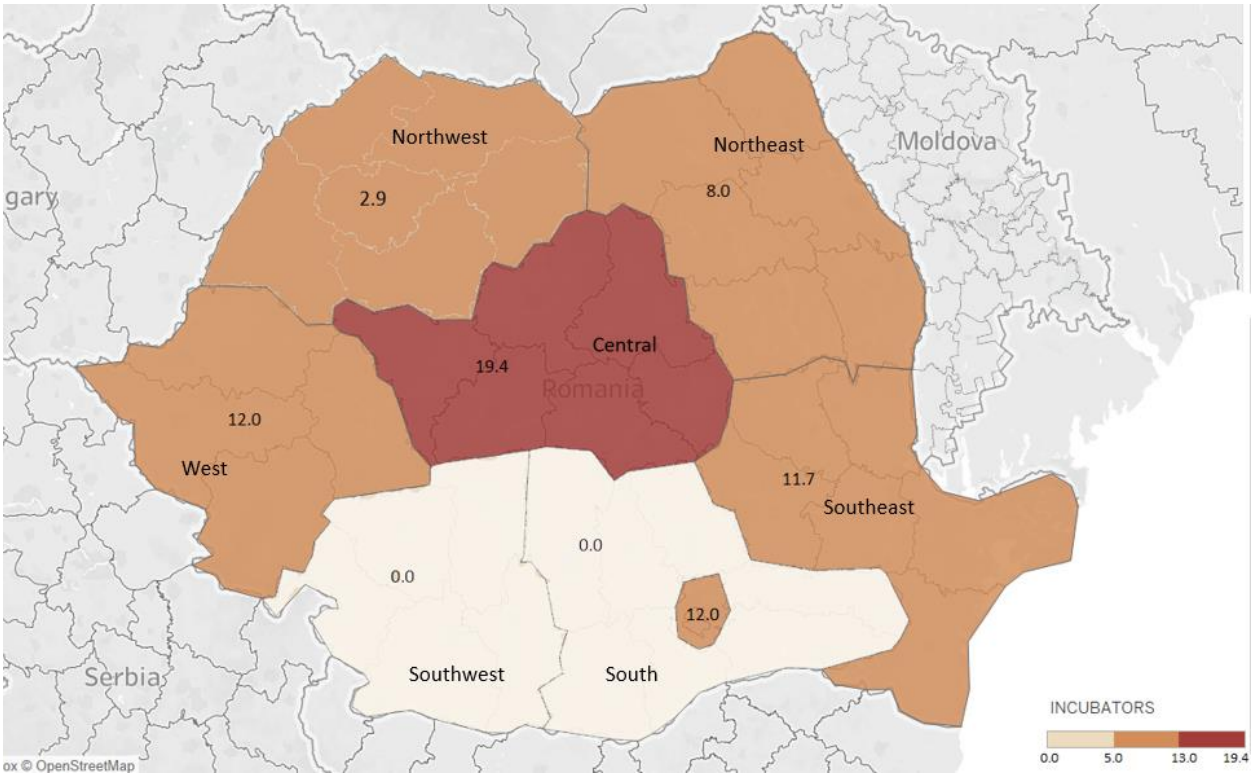
**PN4 includes two national-level instruments supporting incubators and accelerators, which need to be sufficiently differentiated from support provided at the regional level or consolidated**. Given that all the ROPs include instruments targeting such intermediaries, these PN4 instruments should be reexamined for relevance and potentially eliminated so their budgets can be transferred to higher priority instruments.

**Table 22 Planned support for incubators and accelerators, 2021–2027 programming period**

| Instrument | Funding Program | Target beneficiaries | Budget |
|---|---|---|---|
| "Incubator" Grant | PN4 | Incubators and accelerators | Unknown |
| "Accelerator" Grant | PN4 | Incubators and accelerators | Unknown |
| Creation / operationalization of a national entrepreneurial HUB | POCIDIF | RDA Northeast, Incubators and accelerators | €12 million |
| Supporting entrepreneurship through development business incubators | ROP BI | Incubators and accelerators | €12 million |
| Supporting companies through business support infrastructures - incubation | ROP SE | Incubators and accelerators | €11,7 million |
| Supporting the development of business incubators and of newly created enterprises | ROP NW | Incubators and accelerators | €2.9 million |
| Business support structures - incubators | ROP SW | Incubators and accelerators | €9.4 million |
| Business support structures | ROP W | Incubators and accelerators | €12 million |
| Business incubators and accelerators | ROP C | Incubators and accelerators | €19.4 million |
| Supporting business incubators and industrial parks | ROP SM | Science and tech parks | €47 million |
| MVP—Start-ups and spin-offs | ROP NE | Incubators and accelerators | €8 million |

Source: World Bank. | Note: NE = Northeast Region; SE = Southeast Region; W = West Region; C = Central Region; SM = South Muntenia Region; BI = Bucharest-Ilfov Region.

**Figure 13 Support for incubators and accelerators in regional operational programs, by region, 2021–2027 programming period**




Source: World Bank.

## *Support for clusters*

**Six of the eight ROPs provide support to cluster organizations** (Table 23). Allocated funding for clusters ranged from €1.1 million (in ROP Southeast) to €12 million (in ROP Northeast), while the Northwest and Southwest ROPs have no instruments supporting clusters (Figure 14).

**PN4 also includes one national level instrument supporting clusters, which needs to be sufficiently differentiated from ROP support to cluster organizations**. Given that most of the ROPs include instruments targeting clusters, the PN4 instrument may provide the most value by focusing on cluster organizations in the Northwest and Southwest regions, where no such support is planned, or on clusters focused on specific sectors where more support and expertise may be needed.

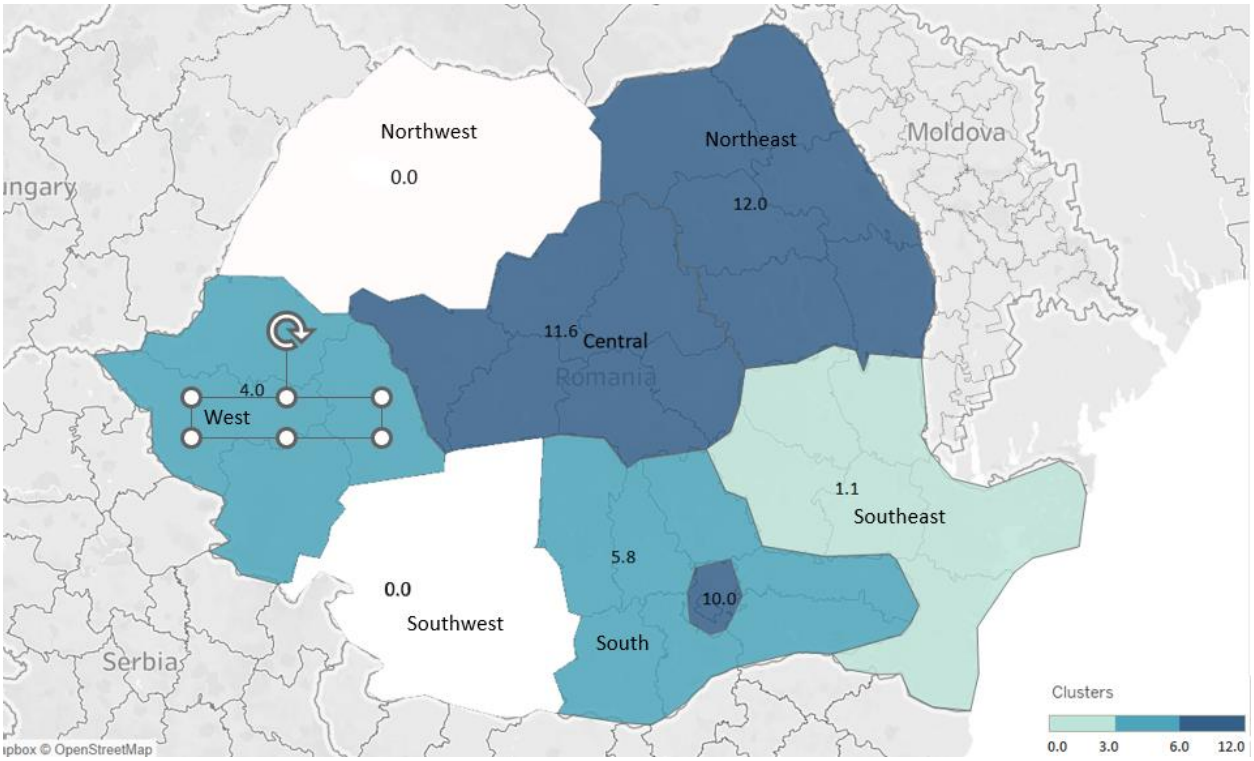
**Table 23 Planned support for cluster organizations, 2021–2027 programming period**

| Instrument | Funding Program | Target beneficiaries | Budget |
|---|---|---|---|
| Innovative Clusters | PN4 | Clusters | Unknown |
| Support for innovation clusters | ROP BI | Clusters | €10 million |
| Development of innovative clusters | ROP NE | Clusters | €12 million |
| Increasing the competitiveness of SMEs through support for clusters | ROP SE | Clusters | €1,1 million |
| Innovation clusters | ROP W | Clusters | €4 million |

| | | | |
|---|---|---|---|
| Innovation clusters | ROP C | Clusters | €11,6 million |
| Supporting clusters | ROP SM | Clusters | €5,8 million |

Source: World Bank. | Note: NE = Northeast Region; SE = Southeast Region; W = West Region; C = Central Region; SM = South Muntenia Region; BI = Bucharest-Ilfov Region.

**Figure 14 Support for cluster organizations in regional operational programs, by region, 2021–2027 programming period**




Source: World Bank.

## *Support for science, technology, and industrial parks*

**Support for science, technology, and industrial parks comes entirely from the ROPs, with six of the eight regions providing support to such organizations** (Table 24). Allocated funding for science, technology, and industrial parks ranges from €12.9 million (in ROP Central) to €49.5 million (in ROP Northwest), while the West and Northeast ROPs have no instruments supporting parks (Figure 15).

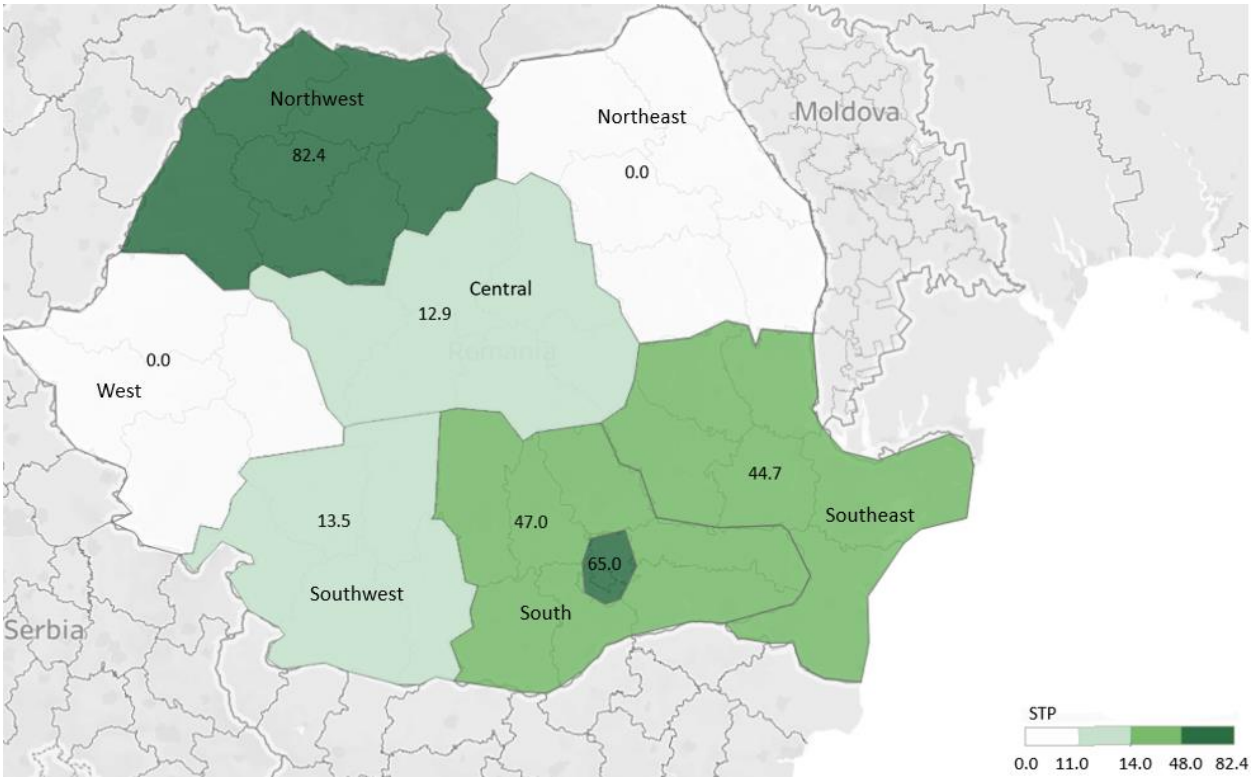
**Table 24 Planned support for science and technology parks, 2021–2027 programming period**

| Instrument | Funding Program | Target beneficiaries | Budget |
|---|---|---|---|
| Supporting companies through business support infrastructures - industrial parks | ROP SE | Science and tech parks | €44,7 million |
| Support for smart specialization parks | ROP NW | Science and tech parks | €32,9 million |
| Supporting the development of initial investments of SMEs within the smart specialization parks - COMPONENT 2 | ROP NW | Science and tech parks | €49,5 million |

| | | | |
|---|---|---|---|
| Business support structures - Industrial parks | ROP SW | Science and tech parks | €13,5 million |
| Industrial parks in Regional Smart Specialization Strategies (RIS3) areas | ROP C | Science and tech parks | €12,9 million |
| Supporting business incubators and industrial parks | ROP SM | Science and tech parks | €47 million |

Source: World Bank. | Note: NE = Northeast Region; SE = Southeast Region; W = West Region; C = Central Region; SM = South Muntenia Region; BI = Bucharest-Ilfov Region.

**Figure 15 Support for science and technology parks in regional operational programs, by region, 2021–2027 programming period**




Source: World Bank.

# 3.2.6 Support for technology transfer and innovation skills

- The new policy mix includes increased funding for innovation-related skills, but funding for developing technology transfer skills in the public sector appears extremely limited.

**There is a strong need to build technology transfer skills in the public sector, but the design and targeting of new instruments supporting skills development is largely unknown**. While the 2021–2027 programming period includes €79 million allocated towards developing innovation-related skills, at present only €1.4 million is explicitly directed toward developing technology transfer skills in public sector PRIs, HEIs, and TTOs—a key gap in Romania's innovation system.

**POCIDIF and ROPs are the primary sources of allocated funding for technology transfer and innovation skills** (Table 25). For the purpose of this report, support for technology transfer and innovation skills is defined as support to PRIs, HEIs, researchers, firms, intermediaries, and/or training providers for the development of technology transfer and innovation-related skills and capacity.

**Table 25 Support for technology transfer and innovation by funding source, 2021–2027 programming period**

| | PN4 | POCIDIF | ROPs | NRRP | OP Health |
|---|---|---|---|---|---|
| # of instruments | 4 | 1 | 10 | 0 | 0 |
| Allocated funding | Unknown (no funding announced) | €40.0 M | €39.1 M | €0 | €0 M |

Source: World Bank.

**Technology transfer skills and capacity building is a major need in Romania, but currently only three ROP instruments have allocated funding targeting TTOs**. Several recent analyses (European Commission, 2022; World Bank, 2023a; JRC, forthcoming) have found that most public sector TTOs lack the knowledge needed to interpret national IP legislation, develop licensing agreements, or support commercialization activities, and there is a strong need to build TTO capacity. In the previous programming period, no instruments provided such support at the regional or national levels. At present, only three ROP instruments have allocated budgets that address TTO skills and capacity: ROP Southeast (with an allocated budget of €4.7 million), ROP Southwest (€1.4 million), and ROP Northeast (€0.9 million) (Table 26).

**There is a strong need for national-level support to address the technology transfer skills gap**. At present, PN4 includes two instruments that could address technology transfer skills (*Training of tech transfer experts* and *Twinning program*), but they have no budget allocations as of the writing of this report and their objectives and design is currently unknown. The POCIDIF *Skills development and capacity building of actors in the R&D sector*, with €40 million in allocated funding, could potentially target the technology transfer skills gap, but its design and objectives are currently unknown. Addressing the gap in technology transfer training and capacity building should be a priority for Romanian policy makers, either through these planned instruments or new instruments targeting this objective.

**Table 26 Planned support for technology transfer skills, 2021–2027 programming period**

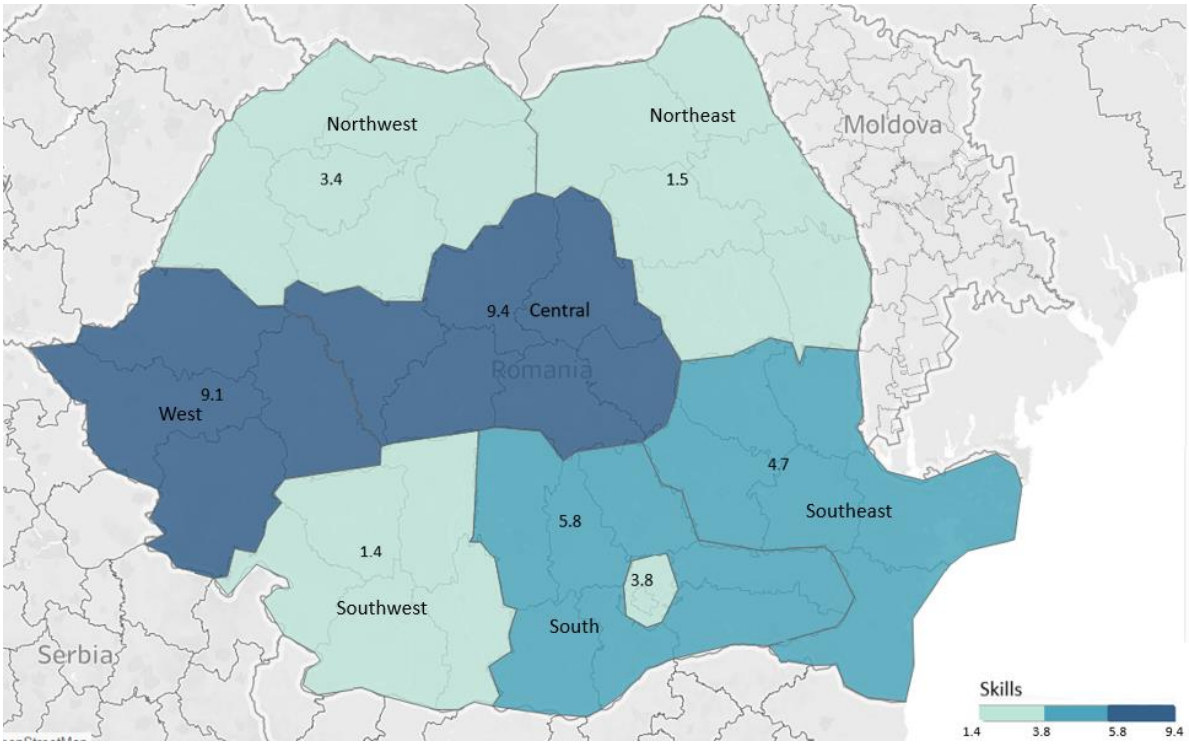
| Instrument | Funding Program | Target beneficiaries | Budget |
|---|---|---|---|
| 300+ Innovators and Entrepreneurs | PN4 | Entrepreneurs | Unknown |
| High tech competitions (for students) | PN4 | HEIs, Firms | Unknown |
| Training of tech transfer experts | PN4 | PRIs, HEIs, TTOs | Unknown |
| Twinning program | PN4 | PRIs, HEIs, TTOs | Unknown |
| Skills development and capacity building of actors in the R&D sector | POCIDIF | Unknown | €40 million |
| Skills development and capacity building of actors in the R&D sector | POCIDIF | Unknown | €40 million |
| Development of skills for smart specialization and entrepreneurship | ROP SE | SMEs; PRIs; TTOs | €4.7 million |
| Developing skills for smart specialization, | ROP SW | PRIs, TTOs, firms | €1.4 million |

| | | | |
|---|---|---|---|
| industrial transition and entrepreneurship | | | |
| Research Valorization Program—RVP 3.0 | ROP NE | HEIs, TTOs | €0.9 million |
| Skills for smart specialization | ROP NE | SMEs | €0.6 million |
| Skills development | ROP W | SMEs | €9,1 million |
| Developing skills | ROP C | Firms, PRIs, HEIs | €9,4 million |
| Developing skills in the areas of smart specialization, industrial transition and entrepreneurship | ROP SM | SMEs, PRIs, HEIs, public authorities | €5,8 million |
| Training courses for research entities | ROP NW | HEIs, PRIs | €0.5 million |
| Developing skills within SMEs for innovation, technological modernization, industrial transition, circular economy, etc. | ROP BI | Training providers | €3,8 million |
| Vocational training courses for SMEs | ROP NW | Training providers, SMEs | €2,9 million |

Source: World Bank. | Note: NE = Northeast Region; SE = Southeast Region; W = West Region; C = Central Region; SM = South Muntenia Region; BI = Bucharest-Ilfov Region.

**All ROPs have at least one instrument targeting innovation skills**. Regional instruments range in size (from €500,000 to €9.4 million) and target a range of beneficiaries, including firms, PRIs, HEIs, and training providers (Figure 16).

**Figure 16 Support for technology transfer and innovation skills in regional operational programs, by region, 2021–2027 programming period**




Source: World Bank.

# 3.2.7 Early-stage company support

- Support to early-stage companies has increased, but allocations are still below the support provided by Croatia and Poland in the previous period on a per GDP basis.
- POCIDIF and ROPs include six instruments targeting early-stage companies, which will likely provide overlapping support

**Support to early-stage companies has increased dramatically over the 2014–2020 programming period, but allocations are still below the support provided by Croatia and Poland in the previous period on a per GDP basis**. While allocated funding to support early-stage companies is more than double the disbursed funding from the 2014–2020 programming period, on an annual basis planned support for startups will still be 22 percent of that provided by Poland and 83 percent that provided by Croatia in the previous period on a per GDP basis (as shown in Table 11). There is an apparent overlap in support in the POCIDIF portfolio of startup support instruments and between national and regional instruments supporting startups.

**Many new instruments supporting startups and entrepreneurial intermediaries have been introduced in the new period in PN4, POCIDIF, ROPs, and OP Health**. For the purpose of this report, support for early-stage companies is defined as direct financial support to early-stage companies (startups and spinoffs) or support to funds that will make investments in early-stage companies. POCIDIF includes two early-stage support instruments with a total allocation of over almost €70 million, the ROPs include three instruments with €40 million in allocations, OP Health includes one instruments with €12 million in allocation, and PN4 include three instruments that do not yet have budget allocations as of the writing of this report (Table 27).

**Table 27 Support for technology transfer and innovation by funding source, 2021–2027 programming period**

| | PN4 | POCIDIF | ROPs | NRRP | OP Health |
|---|---|---|---|---|---|
| # of instruments | 3 | 2 | 3 | 0 | 1 |
| Allocated funding | Unknown (no funding announced) | €68.6 M | €41.7 M | €0 | €12 M |

Source: World Bank.

**POCIDIF and ROPs include six instruments targeting early-stage companies, which will likely provide overlapping support** (Table 28). Such overlaps in support will require attention to either consolidate instruments that are too similar in design or to alter the designs and objectives to differentiate the instruments. Potential overlaps include:

- **POCIDIF support for startups**: POCIDIF includes almost €70 million in allocated funding for two instruments - Support *for newly created innovative enterprises*, which targets firms less than five years old, and *Support for innovative start-ups and spin-offs*, targeting firms less than three years old. The two instruments both provide support for R&D from TRL5 to TRL8/9 It is not clear why separate instruments are needed to support these similar sets of beneficiaries and activities - consolidating these instruments into one national-level support instrument for early stage companies with a larger budgets and regular (e.g., annual calls for proposals) would improve the consistency of early-stage company support in Romania and reduce potential confusion among beneficiaries.

- **National and regional level support to startups**: The POCIDIF *Support for newly created innovative enterprises* and *Support for innovative start-ups and spin-offs* appear to provide similar support to the ROP Northwest *Support for newly created innovative enterprises* instrument. The POCIDIF implementing body should coordinate with the NW RDA to understand how best to differentiate these instruments and reduce potential confusion among target beneficiaries.

**PN4 includes support for three separate funds that will make investments in early-stage companies, but it is unclear how these funds will be different from each other.** PN4 includes support for three separate early-stage funds (*Innovative Business Matching Fund, Seed Capital Matching Fund,* and *Tech Transfer Fund*) but it is not clear how these funds will be different or who will manage the funds. If the investments are focused on post-revenue stage only (with ticket sizes above around €200,000), introducing multiple public funds into Romania's small innovation finance system may also create market distortions, artificially raising valuations in the relatively small number of investment-ready startups in the country. Financing for the pre-revenue stage of startups is needed to create a pipeline.

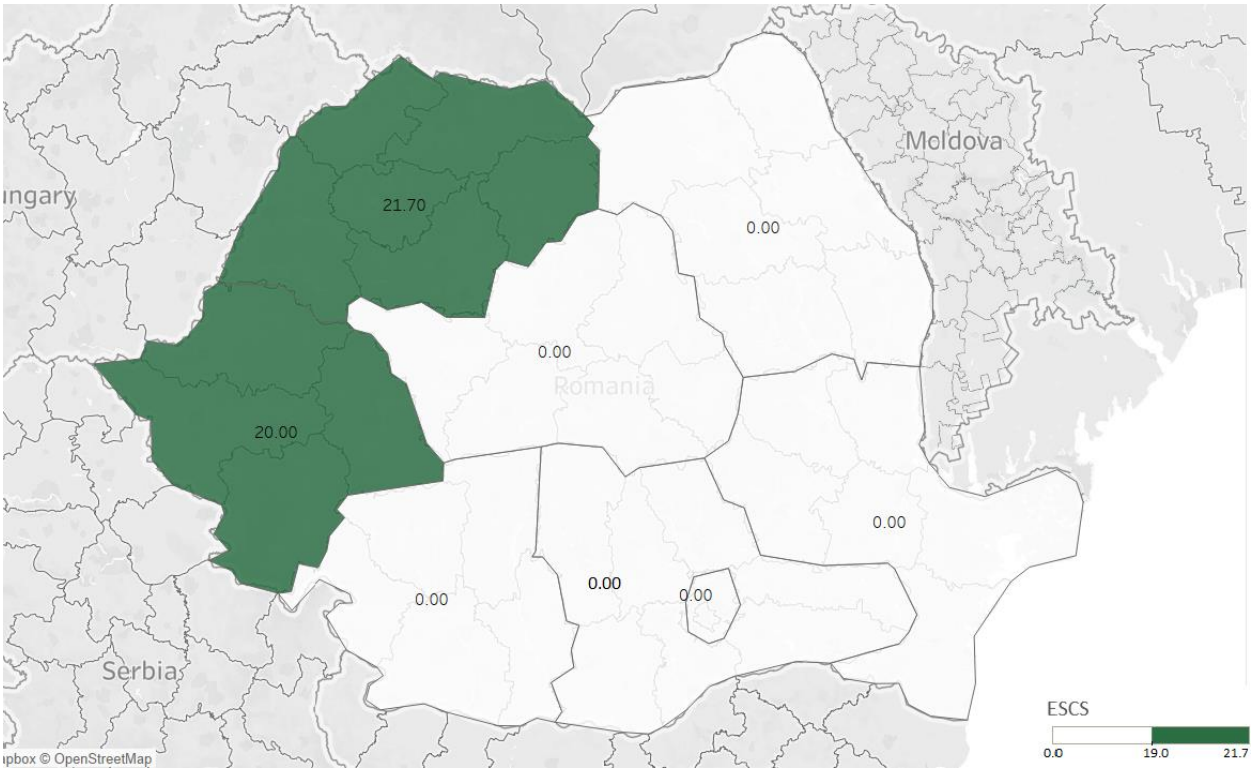
**Table 28 Planned support for early-stage companies and spinouts, 2021–2027 programming period**

| Instrument | Funding Program | Target beneficiaries | Budget |
|---|---|---|---|
| Innovative Business Matching Fund | PN4 | Startups | Unknown |
| Seed Capital Matching Fund | PN4 | Startups | Unknown |
| Tech Transfer Fund | PN4 | Startups | Unknown |
| Support for newly created innovative enterprises | POCIDIF | Startups | €46 million |
| Support for innovative start-ups and spin-offs | POCIDIF | Startups | €22.6 million |
| Support for newly created innovative enterprises, start-ups and spin-offs | AM PO Health (MIPE) & OI Health | Startups | €12.8 million |
| Support for newly created innovative enterprises | ROP NW | Startups | €21.7 million |
| Newly created enterprises | ROP W | Startups | €20 million |

Note: NW = Northwest Region; NE = Northeast Region; C = Central Region; W = West Region; BI = Bucharest-Ilfov Region | See Appendix 2 for a full list of ROP instruments.

**Only two ROPs provide support for early-stage companies**. The ROPs for the West and Northwest regions allocate €20 million and €21.7 million respectively in support of early-stage companies, while none of the other regions provide this type of support (Figure 17). Given that a number of instruments are planned to support startups at the national level, the lack of regional-level support may not be an issue.

**Figure 17 Support for early-stage companies in regional operational programs, by region, 2021–2027 programming period**




Source: World Bank.

SECTION 4

# RECOMMENDATIONS FOR IMPROVING SUPPORT FOR PRIVATE SECTOR INNOVATION AND PUBLIC-PRIVATE COLLABORATION

# 4. Recommendations for improving support for private sector innovation and public-private collaboration

**The following set of recommendations aim to improve the quality and consistency of public support for private sector innovation and public-private collaboration in Romania**. Recommendations include:

- Address gaps and overlaps in the planned portfolio of private sector innovation and public-private collaboration instruments by consolidating overlapping government-funded instruments, coordinating SME support and support to intermediaries, and addressing gaps in support for TTOs early-stage startups, and technology transfer skills;
- Ensure predictability and stability of funding for key R&I instruments through multi-annual budgeting and regular calls for proposals for key R&I instruments;
- Revise the incentive system for public R&D institutions and researchers to include KPIs related to private sector collaboration, technology transfer, and commercialization;
- Revise Romania's corporate tax deduction to spur private sector R&D investment;
- Provide capacity building support to improve the innovative performance of PRIs and HEIs;
- Reduce the administrative burden of R&I instruments to improve private sector uptake;
- Provide support for lowering information barriers between public and private sector R&I actors.

Table 29 summarizes the recommendations, bodies responsible for implementation, prioritization, and timeline. The remainder of this section provides a detailed description of each recommendation.

**Table 29 Summary of recommendations**

| Recommendation | Stakeholders | Priority | Timeline |
|---|---|---|---|
| Address gaps and overlaps in the R&I planned portfolio consolidating overlapping government-funded instruments, coordinating SME support and support to intermediaries, and addressing gaps in support to TTO and R&D infrastructure, early-stage startups and skills. | MCID, POCIDIF Implementation Body, UEFISCDI, RDAs, Ministry of European Investments and Projects (MIPE) | High | Short term |
| Ensure predictability and stability of funding for key R&I instruments through the use of program-based budgeting and regular calls for proposals for key R&I instruments | MCID, POCIDIF Implementation Body, UEFISCDI, RDAs, Ministry of Finance | High | Short term |
| Revise the incentive system for public R&D institutions and researchers | MCID, Ministry of Education, Romanian Academy | High | Short term |
| Revise Romania's corporate tax deduction to spur private sector R&D investment | MCID, Ministry of Finance | High | Short term |
| Provide capacity building support to improve the innovative performance of PRIs and HEIs | MCID, Ministry of Education, Romanian Academy | High | Medium term |

| | | | |
|---|---|---|---|
| Reduce the administrative burden of R&I instruments | Policy Support Facility (PSF) Unit, POCIDIF Implementation Body, UEFISCDI, RDAs, MIPE | High | Medium term |
| Provide support for lowering information barriers between public and private sector R&I actors | MCID, PRIs | Medium | Medium term |

**The report also includes recommendations for the inputs to the design and implementation of three pilot instruments aimed at improving innovation and public-private collaboration in Romania**. After consultations with MCID and other key stakeholders, the WB team will develop detailed grant manuals for each of these instruments providing detailed information on the program design, eligibility criteria and calls for proposals, selection panel, selection criteria and processes, technical and financial reporting requirements, aid intensities, eligible expenditures, and other key features of the schemes.

**This section provides descriptions of three pilot instruments**:

- **Collaborative Innovation Grant Program (CIGP)**: This is a collaborative research and innovation grant program that provides matching funding for joint projects between at least one Romanian firm and at least one Romanian public research institute (PRI or HEI) for the development of new or improved products, services, and processes. All projects are designed and led by the private sector. This instrument aims to build firm competitiveness and capacity to engage in innovation through access to innovation financing, access to public sector expertise and infrastructure, and other innovation and advisory services.
- **Innovative Value Chain Grant Program (IVCGP)**: This is a collaborative research and innovation grant program that provides matching funding to consortia composed of one large company connected to global supply chains, at least one SME, and at least one PRI/HEI to engage in one or more collaborative R&D projects, with the aim of creating new or improved commercially viable products, services, and processes that add value to the European and/or global value chains. The instrument aims to enable Romanian innovation seeking firms and PRIs to collaboratively engage in European and global value chains.
- **Matchmaking Program (MP)**: This is a pilot grant program that provides funding for a qualified matchmaking organization to design and implement a matchmaking initiative that will bring together Romanian firms and public sector R&D organizations, with the goal of increasing joint private/public sector engagement in applied R&D. The MP is designed to synergize with CIGP (or other grant programs as needed), with the initiative to be held in advance of the call for proposals of CIGP to allow for the formation of new collaborations and partnerships that could apply for those programs.

## *Address gaps and overlaps in the planned portfolio of private sector innovation and public-private collaboration instruments.*

**Background:**

- The analysis of Romania's support for innovation and collaboration identified several areas of overlap, as well as potential gaps, in the policy mix.
- **Incentives for collaboration**:

    - The NRRP includes several reforms relevant to institutional and researcher incentives for public-private collaboration, but they are limited in scope with few resources for implementation.
- **Private sector innovation**:
    - POCIDIF *Innovative technological projects* provides support for later-stage development of new or improved products in SMEs, including initial investments in production lines, which appears to overlap will several regional instruments (e.g., Northeast *RDI projects and investments in SMEs,* Bucharest Ilfov *Support for RDI activities in SMEs,* and Northwest *Projects in smart specialization areas -production component*) that provide similar support for later-stage commercialization and initial production lines.
    - POCIDIF *Support for transfer of knowledge and technology between private actors* supports private-private R&D collaborations between SMEs and large firms, which overlaps with support from two regional instruments (Central ROP *Development of private RDI capacities at the enterprise level* and South Muntenia ROP *R&I activities in SMEs to increase the level of technological maturity in areas of smart specialization*).
- **Public-private R&D collaboration projects**:
    - There is limited support for industry-led collaboration.
    - There are no instruments explicitly aimed at forming connections between PRIs, HEIs, and large firms.
    - Two instruments (*Bridge grant* and *Demonstrative experimental projects*) are very similar in their design, target beneficiaries, and eligible activities.
    - The *"Idea-to-market"* instrument, which provides staged support for technology development from TRL 1-8, duplicates support available elsewhere in the PN4 portfolio.
- **Shared R&D infrastructure**:
    - The 2021–2027 policy mix includes two instruments supporting private sector access to public R&D facilities, a clear area of need, but funding has not yet been allocated at the national level.
- **Support to intermediaries**:
    - Support for TTO operations and activities is extremely limited.
    - PN4 includes two instruments supporting incubators and accelerators, which likely will provide overlapping support with support for these intermediaries provided by the ROPs.
    - PN4 includes one instrument supporting cluster organizations, which likely will provide overlapping support with support for clusters provided by the ROPs.
- **Innovation skills**:
    - Support for developing technology transfer skills is extremely limited.
- **Early-stage company support**:
    - POCIDIF includes almost €70 million in allocated funding for two instruments - Support *for newly created innovative enterprises*, which targets firms less than five years old, and *Support for innovative start-ups and spin-offs*, targeting firms less than three years old. The two instruments both provide support for R&D from TRL5 to TRL8/9 It is not clear why separate instruments are needed to support these similar sets of beneficiaries and activities.
    - The POCIDIF *Support for newly created innovative enterprises* and *Support for innovative start-ups and spin-offs* appear to provide similar support to the ROP Northwest *Support for newly created innovative enterprises* instrument.

**Recommendation:**

- A working group (or groups) should be created and meet on a regular basis and provide inputs into the design of instruments that have not yet issued calls for proposals.
- Key issues to be addressed by the working group(s) would include:
    - **Consolidation.** Consolidating PN4 instruments supporting public-private collaboration into a smaller number of instruments with larger budgets and regular (e.g., annual calls for proposals) to improve the consistency of innovation support in Romania and reduce potential confusion among beneficiaries.
    - **Coordination:**
        - **of SME support.** Coordination between the national programs and the ROPs on how best to differentiate national and regional instruments targeting initial production of innovations in SMEs and collaborations between SMEs and large firms.
        - **of support to intermediaries.** Coordination between MCID, UEFISCDI, and RDAs to understand how best to differentiate PN4 support for intermediaries (e.g., cluster organizations, incubators, accelerators, business services providers, technology brokers, etc.) with the support being provided by the ROPs.
    - **Addressing gaps:**
        - **in support for TTOs.** Ensuring that PN4 includes support for TTO operations and activities and ensuring complementarity between PN4 and ROPs instruments targeting TTOs and similar institutions, such as industry liaison offices.
        - **In access to public R&D infrastructure.** Ensuring that PN4 will include at least one instrument that supports private sector actors to access public R&D infrastructure and/or builds public sector capacity to attract private actors to use public facilities.
        - **Skills targeting.** Ensuring that PN4 and POCIDIF instruments targeting skills are focused on building technology transfer skills and capacity in the public sector—a key area of need.
        - **Early-stage startup support,** ensuring that funding is available for high-potential startups in the pre-revenue pre-MVP (minimum viable product) stage in order to create a pipeline for Venture Capital market.

| **Prioritization**: | **Timeline** | **Stakeholders** |
|---|---|---|
| **High** | Short term | MCID, POCIDIF Implementation Body, UEFISCDI, RDAs, MIPE |

## *Ensure predictability and stability of funding for key R&I instruments*

**Background**:

- **Lack of predictability.** Romania's public funding for R&I is characterized by a lack of continuity and predictability in financial support. The lack of multiannual funding for R&I

support instruments inhibits Romania's R&I support, as R&I implementers rarely know the budgets for their programs for the coming fiscal year, making it difficult to issue calls for proposals on a regular (or predictable) basis.
- **Delays in implementation.** Many OP instruments have suffered from numerous delays due to high levels of bureaucracy, technical delays for in the preparation of guidelines, delays in project selection due to difficulties in finding expert evaluators, long contracting and procurement procedures, and other implementation issues.
- **Uncertainty.** This unpredictability has created a large degree of uncertainty among R&I performers and has hindered long-term planning and projects.

**Recommendations**

- Building MCID's capacity to plan R&I instruments on a multi-annual basis. Efforts could include:
  - **Program-based budgeting for (at least) key instruments**: Identifying and prioritizing ten to fifteen key instruments in the PN4 portfolio that do not yet have allocations and negotiating with the Ministry of Finance to set minimum annual allocations for these instruments for the next three to four years. Once the allocations have been made, MCID and UEFISCDI can then establish a calendar of calls for proposals for these instruments, allowing target beneficiaries to know when they will be launched.
  - **Annual calls for proposals for key instruments.** Supporting the POCIDIF Implementation Body, UEFISCDI, and the RDAs to create systems and processes that allow for annual calls for proposals for key instruments for the 2021–2027 period.

| **Prioritization**: | **Timeline** | **Stakeholders** |
|---|---|---|
| **High** | Short term | MCID, Ministry of Finance, POCIDIF Implementation Body, UEFISCDI, RDAs, MIPE |

## *Revise the incentive system for public R&D institutions and researchers*

**Background**

- **PRIs and HEIs have few incentives to engage in market-oriented research or collaborate with the private sector**. PRI and HEI institutional funding programs emphasize publications as KPIs and do not consider the exploitation of research results, such as patents, in the market. Institutional KPIs also do not consider "economic activities", such as training and consulting services provided to SMEs, even though these represent a form of knowledge transfer to the private sector.
- **INCDs face a particular challenge related to the interpretation of State Aid rules regarding income from private sector sources, which acts as a disincentive to attracting additional funds from economic activities.** Should an institute receive 20 percent or more of its income from economic activities (e.g., non-research activities,

such as training, consulting, and testing services), its institutional funding becomes subject to State Aid regulations which likely require the implementation of a "claw-back" mechanism to return funding that was originally not considered State Aid in proportion to the economic activity undertaken. Institutes lack clear national methodologies and internal procedures on how to register, monitor, and report on their economic and non-economic activity to comply with these State Aid regulations.

- **Public sector researchers also lack incentives to engage in market-oriented research or collaborate with the private sector**. Patents are considered in researcher career incentive frameworks, but the exploitation and use of those patents within the market is not. Some INCDs provide their researchers with monetary incentives for attracting private sector research funding, but this is not a standard practice across INCDs.

**Recommendation:**

- Reform institutional and researcher incentive frameworks to include KPIs that incentivize public sector actors to engage in market-oriented research, private sector collaboration, and commercialization.
    - Institutional funding schemes should include KPIs related to commercialization and tech transfer activities (e.g., licenses, spin-offs, contract research, industry research collaboration, etc.). The schemes should also recognize institutions' economic activities related to knowledge transfer, such as training, testing, and consulting services to the private sector, as well as non-monetary knowledge transfer activities, such as staff exchanges in industry and researchers' involvement in firm creation through startups and spinoffs.
    - Researcher career frameworks should include KPIs related to technology transfer and collaborative research activities (e.g., licenses, contract research, industry research collaboration, startup and spinoff creation, etc.) for career development and salary progression. Career frameworks should also encourage mobility between PRIs and the private sector through secondments, sabbaticals, joint positions and especially through PhDs in industry.

| **Prioritization**: | **Timeline** | **Stakeholders** |
|---|---|---|
| **High** | Short term | MCID, Ministry of Education, Romanian Academy |

## *Revise Romania's corporate tax regime to spur private sector R&D investment*

**Background**:

- **The use of R&D tax incentives is low** in Romania relative to EU and OECD peers.
- Romania has a tax deduction scheme aimed at incentivizing private sector investments in R&D, but uptake has been limited by the administrative burden required to attain the deduction and challenges with contracting of experts from the National Register.

**Recommendation**:

- Replace and simplify the current R&D tax regime (e.g., the corporate tax deduction and accelerated depreciation of R&D equipment schemes) with a single refundable tax credit. A tax credit would be preferable to the enhanced deduction for several reasons. First, an enhanced deduction provides only a limited incentive to invest in additional R&D capital expenditure – because the benefit of the enhanced allowance for capital expenditure can only be realized slowly over time, and businesses may significantly discount the value of the incentive compared to the upfront cost of the R&D investment. This may both reduce the overall impact of the incentive, and create a bias in favor of labor-intensive R&D. In contrast, provision of a tax credit for all R&D expenditures would provide the same upfront benefit for both labor and capital expenditures. Second, for firms that are in scope of the recently agreed "Pillar Two" Global Minimum Tax, they may lose the benefit of the enhanced allowance because there is no accommodation under Pillar Two for such incentives (OECD, 2023). In contrast, a tax credit would be compatible with Pillar Two as long as it is refundable. (Pillar Two treats a non-refundable tax credit as a reduction in tax, but a refundable tax credit as an increase in income). A third benefit of a refundable tax credit is that it would also incentive R&D expenditure by loss-making businesses (e.g., R&D start-ups that are often unprofitable in early years), whereas they cannot immediately benefit from the enhanced deduction. There are integrity risks associated with refundable tax credits – in particular, difficulties in recovering refunded credits that are ultimately determined not to be eligible for the incentive. However, these risks could be mitigated by making the R&D tax credit fully refundable only within four years (four years is the maximum period under the Pillar Two rules for a refundable tax credit to be treated as income).
- Capacity building support to MCID on the implementation of the new tax credit to ensure adoption of global best practices and reduce administrative burden in the pre-accreditation process.

| **Prioritization**: | **Timeline** | **Stakeholders** |
|---|---|---|
| **High** | Short term | MCID, Ministry of Finance, National Agency for Fiscal Administration (ANAF) |

## *Provide capacity building support to improve the innovative performance of PRIs and HEIs*

**Background:**

- **HEIs play a very limited role in performing research in Romania**. The higher education sector only performed 10 percent of GERD in 2022, which is less than half of the EU 27 average. Romanian HEIs have historically been viewed as teaching institutions and did not play a role in the performance of research in the communist era. While this has changed somewhat in recent decades, HEIs still play a much smaller role in Romania's R&I system than most peers.
- **There are few formal pathways for the private sector to provide inputs into PRI and HEI research agendas**. The private sector generally does not provide inputs or

guidance to PRI institutional research agendas—firms cannot sit on PRI governing committees per current legislation, although a few PRIs have steering committees which invite firms to discuss their research needs. Several key universities do have steering committees where MNCs and other firms provide inputs to curricula based on their skills needs, but their inputs into university research agendas appear limited.

- **Institutes and their researchers lack skills and resources for knowledge and technology transfer activities**. All PRIs and HEIs have TTOs (many of which were created with support from structural funds in previous programming period), but few have TTOs with dedicated budgets or staff—instead many are staffed by researchers who work in the TTO part time and have limited expertise in IP regulations or processes. As a result, most TTO staff have limited knowledge of national IP legislation or on commercialization and technology transfer practices. TTOs generally lack the capacity to conduct market research, properly value their research outputs, and engage in broader research valorization activities. For this reason, most TTOs serve as project implementation offices, while only a few are active in finding potential research partners, marketing existing IP, etc.
- **INCDs face a particular challenge related to the interpretation of State Aid rules regarding income from private sector sources, which acts as a disincentive to attracting additional funds from economic activities.** Should an institute receive 20 percent or more of its income from economic activities (e.g., non-research activities, such as training, consulting, and testing services), its institutional funding becomes subject to State Aid regulations which likely require the implementation of a "claw-back" mechanism to return funding that was originally not considered State Aid in proportion to the economic activity undertaken. Institutes lack clear national methodologies and internal procedures on how to register, monitor, and report on their economic and non-economic activity to comply with these State Aid regulations.
- **The WB is implementing a pilot program to build PRI capacity, but it is small in scale**. The WB is currently implementing a pilot program aiming to support six research institutes in reforming and rescoping their institutional missions and governance mechanisms to improve research excellence and relevance.

**Recommendations:**

- Develop a program to provide technical assistance and capacity building support to PRIs and HEIs and their TTOs to build their innovation capabilities. This support could include:
  - **Industry representation.** Support (through reforms and changes to governance) to ensure industry representation in PRO/HEI governing bodies (steering/trust boards) and consultation in the definition of research and knowledge strategies.
  - **Strategies aligned with national goals.** Support to clarify institutional missions and strategies to ensure they are aligned with national goals and strategies (related to research excellence and private sector collaboration), as well as local industry specialization and regional Smart Specialization Strategies.
  - **Development of sustainable business models.** Support institutions to develop sustainable business models for their TTOs and for increasing revenues from competitive grants, contract research, and economic activities, such as training, testing, and consulting services.
  - **Capacity to apply state aid rules.** Support to PRIs on the interpretation of State Aid rules related to income from private sector sources.

- **Capacity for technology transfer and IP.** Provision of capacity building and training on technology transfer and commercialization to TTO staff and researchers on IP laws, invention disclosure, patenting, licensing, market assessment, startup/spin-off formation, and other key processes related to research valorization.

| **Prioritization**: | **Timeline** | **Stakeholders** |
|---|---|---|
| **High** | Medium term | MCID, Ministry of Education, Romanian Academy |

## *Reduce the administrative burden of R&I instruments to improve private sector uptake*

**Background**:

- **High administrative burden limits private sector uptake of R&I instruments….** Analysis of the functionality of Romania's public support for innovation shows that uptake of R&I instruments is likely deterred by administrative burden – particularly among large enterprises.
- **….particularly among MNCs.** Multiple MNCs interviewed by the WB team said they do not plan to participate in future national grant programs because of the administrative burden experienced in past programs.
- **National instruments are more burdensome compared to EU implemented programs.** Private sector stakeholders interviewed by the WB team reported finding national grant instruments overly burdensome in their application and reporting processes when compared to European programs, such as Horizon. Examples of this burden include the requirement to create a detailed (often more than 50 pages) business plan as part of their application for some programs funded under PN3/4 and financial reporting requirements that require reporting on the hourly salaries of each worker that worked on a given R&D project.
- **Financing reporting requirements are particularly burdensome.** A recent WB survey of beneficiaries of several Romanian R&D programs, both public and private sector respondents also reporting being unsatisfied with reporting requirements of their programs – particularly the financial reporting requirements (World Bank, 2023a).
- **Potential simplifications.** Previous WB work on reducing the administrative burden of public support for innovation indicate several potential areas for reducing burden in Romania's innovation portfolio. These include potential reforms to both the application process and reporting requirements – however, additional analysis will be required to determine the feasibility of these reforms before they can be implemented.

**Recommendations:**

- One or more working groups should be created and meet on a regular basis to provide and ongoing support for reducing the administrative burden of R&I instrument application and reporting processes.
- These working groups should be informed by stakeholder consultations with implementers and public and private sector beneficiaries of R&I programs to understand the key areas of administrative burden.

- Potential reforms to application processes of innovation support instruments:
    - **Reduce or eliminate the requirement for detailed business plans in applications**. Several instruments funded under PN3/4 require firm application to submit a detailed business plan as part of the application. Firms interviewed by the WB team said these business plans were often 50 pages or more in length and require a large investment in time and resources to produce. This requirement is not in line with best practices in private sector innovation support – these instruments require matching funds from the private sector, and if firms are investing their own money in the project, they clearly see a business case for their investment. Further evidence in the form of a detailed business plan if not needed.
    - **Acquire application documentation ex officio where possible.** Certain documentation required in the application stage, such as tax documents and certification of clean criminal records, can be acquired by implementing bodies or managing authorities ex officio, thus reducing the amount of paperwork applicants are required to file. Generally, managing authorities have the required power to request ex officio clean criminal certificates or certificate of absence of tax liabilities. It may also be possible to acquire financial statements ex officio from the National Agency for Fiscal Administration. Wherever possible, implementers should make use of existing digital platforms and services to streamline application processes and reduce transaction costs for applicants.
    - **Defer any documents not essential to the application process from application phase to the contracting phase.** The submission requirements of any documents that are not essential to the application process (e.g., not required to determine eligibility or to evaluate the merit of the project) should be deferred until the contracting phase of the project.
- Potential reforms to reporting requirements:
    - **In financial reporting, verify R&D expenditures ex post rather than ex ante.** For programs supporting R&D activities, R&D activities can be presumed to be eligible ex ante and then verified ex post. In such a system, applicants self-report whether specific R&D activities are eligible without presenting documented evidence, and implementors conduct ex post audits to verify eligible costs.
    - **Align reporting on personnel costs with global best practices.** Reporting on the personnel working on eligible R&D activities for some programs requires payroll information (i.e., the specific salaries of R&D workers), which is not in line with global best practices in financial reporting. In many other countries, firms establish an hourly/daily rate for categories of workers (e.g., all R&D managers have a rate of €80 per hour, R&D technicians have a rate of €50 per hour, etc.) in their grant contracts—this allows firms to simply report the hours worked per worker category, without the need to provide documentation from their payroll.

| **Prioritization**: | **Timeline** | **Stakeholders** |
|---|---|---|
| **High** | Medium term | MCID, MIPE, POCIDIF Implementation Body, UEFISCDI, RDAs |

### *Provide support for lowering information barriers between public and private sector R&I actors*

**Background**

- **Limited information about research collaboration partners.** Romanian R&I actors, in both the public and private sectors, lack information about the capabilities and interests of potential collaboration partners. Romanian PRIs and universities lack resources to identify new partners outside of their traditional partners. Similarly, smaller private sector actors, such as SMEs and startup, do not have the resources to scout potential collaboration partners and have very limited information about other public and private research organizations. Even MNCs, which have resources and actively scout universities for research talent, have limited information about the activities and capabilities of Romanian PRIs.
- **Limited support to bridge information gaps.** There is limited support for lowering information barriers and forming new research connections. The planned policy mix includes limited support for lowering information barriers between R&I actors and creating new R&I partnerships. PN4 includes a new Tech Transfer Festival instrument, but the objectives, beneficiaries, format, and budget of the proposed festival(s) is currently unknown. UEFISCDI also has an online platform called Brainmap, which provides information on more than 55,000 public sector research performers to help interested parties identify research partners for PN4 grants. However, few stakeholders interviewed by the WB team – including none from the private sector – had ever used the platform for matchmaking purposes.

**Recommendation:**

- **Creation of an online portal with information and inquiries.** New collaborations could be fostered through the creation of an online portal that provides information on the capabilities of PRIs and allows firms to submit inquiries for new projects. This portal could provide information on the infrastructure, capabilities, and projects of PRIs and allow firms to submit inquiries describing their innovation needs through a standard form. PRIs would then respond within a set period of time (10 business days, for example) with a proposal that responds to the firm's need (similar to the portal used by the Łukasiewicz Network, described in Box 5).

| **Prioritization**: | **Timeline** | **Stakeholders** |
|---|---|---|
| **Medium** | Medium term | MCID, PRIs |

# 4.1 Collaborative Innovation Grant Program (CIGP)

## *Objective*

The objective of the proposed CIGP is to foster collaborative industry-driven research by incentivizing private sector companies and public sector R&D organizations to engage in joint applied R&D and innovation projects with the goal of creating new or improved commercially

viable products and services, as well as innovative technologies with significant future impact and market potential.

## *Target Beneficiaries*

Romania-based private sector firms in partnership with at least one PRI and/or at least one university

## *Rationale*

CIGP aims to address two key failures identified by the WB's analysis:

- **Weak capacity for innovation in the private sector.** BERD as a share of GDP is low relative to peers and was less than 20 percent of the EU 27 average in 2020. Innovation activities are highly concentrated among large firms (particularly multinationals), while Romanian SMEs have weak capacities to engage in innovation—from 2018 to 2020, SMEs performed just 10 percent of BERD in Romania, compared to 26 percent performed by SMEs in Czechia, 30 percent in Poland, 36 percent in Croatia, and 40 percent in Bulgaria.
- **Lack of funding for innovation activities among SMEs.** There are few SMEs that engage in innovation activities, and for those that do, these activities appear highly contingent on the availability of public financing. As in the rest of the world, traditional financing sources, such as bank loans, generally will not finance innovation activities due to the high-risk nature of the activities. Public funding is therefore needed to address these financing gaps. However, Romania's planning policy mix for the 2021-2027 programming period provides increased support for R&I, but funding for private sector innovation will still likely be significantly lower than Poland's private sector support in the 2014-2020 programming period.
- **Lack of support for industry-led R&D collaborations.** In the previous programming period, there were only two instruments (POC *Innovative Technological Projects* and PN3 *Transfer to economic actors*) that supported industry-led collaborations where a private company was able to define a research project around their specific needs. While a number of new instruments supporting collaborative R&D have been introduced in the 2021-2027 programming period, it is unknown if any of them will support industry-led R&D. Global experience has shown that firms have little incentive to engage in R&D collaborations if they are unable to set the research agenda or own the project results (Becker, 2015).

## *Relationship to planned 2021-2027 policy mix*

CIGP was designed to address an identified need for support for industry-led collaborations in R&D. The 2021–2027 programming period will see a large increase in instruments and allocated funding supporting public-private collaboration, but there is limited support for industry-led collaborations. At present, there appear to be two planned instruments that can support industry-led, public-private collaborations for R&D, but their design and budgets likely will not be sufficient to fully address the need for industry-led research.

- PN4 ***Transfer to the business entity*** program shares a similar design to CIGP, but has several challenges in its design and implementation that limit its effectiveness:

  - **Limited budget:** In the 2014–2020 programming period, PTE issued three calls for proposals with a total of just €45.5 million in disbursed funding—very small relative to the size of the Romania economy and just the 23rd largest instrument in the Romanian R&I policy mix.
  - **Irregular calls for proposals:** PTE launched calls in 2016, 2019, and 2021 when funding was made available by MCID and the Ministry of Finance, rather than on a regular schedule that target beneficiaries could plan for.
  - **Challenges in design and implementation:** The current design provides limited support for the later stages of commercialization. The program supports 12- to 24-month-long projects through TRL 4-6 with grants up to €300,000, and beneficiaries can apply for an extension of 6 months and 30 percent of the project budget (up to €90,000) to support development through TRL 7-8. The time and budget allowed for development through TRLs 7-8 may be insufficient, and it is unclear if there is another PN4 or POCIDIF instrument that beneficiaries could apply to for further support in commercializing their projects through these later stages. A previous WB analysis (2023) also found issues in the PTE design related to a lack of ToC; poorly defined and disconnected indicators for inputs, activities, outputs, and outcomes; and burdensome application and reporting requirements (including a requirement for a detailed business plan as part of project applications).
- POC/POCIDIF ***Innovative technological projects*** program can support industry-led research collaborations, although the program targets larger in size than CIGP and collaboration is not required to participate in the program.
  - **Collaboration not required:** SMEs can apply to *Innovative technological projects* individually, or in collaboration with a public-sector partner, but collaborations are not required for a project to be eligible.
  - **Larger project budgets:** *Innovative technological projects* historically targeted projects that are much larger in size (average project size of €2.3 million) than those supported by CIGP.
  - **Support for initial production:** *Innovative technological projects* program provides support for capital expenses (i.e., the purchase equipment and construction of facilities) for the initial production of new products, which is not supported by CIGP – this is a key reason for the difference in project budget size between the two programs.
  - **Irregular calls for proposals:** *Innovative technological projects* had calls for proposals in 2017 and 2022, rather than on a regular (e.g., annual) basis.

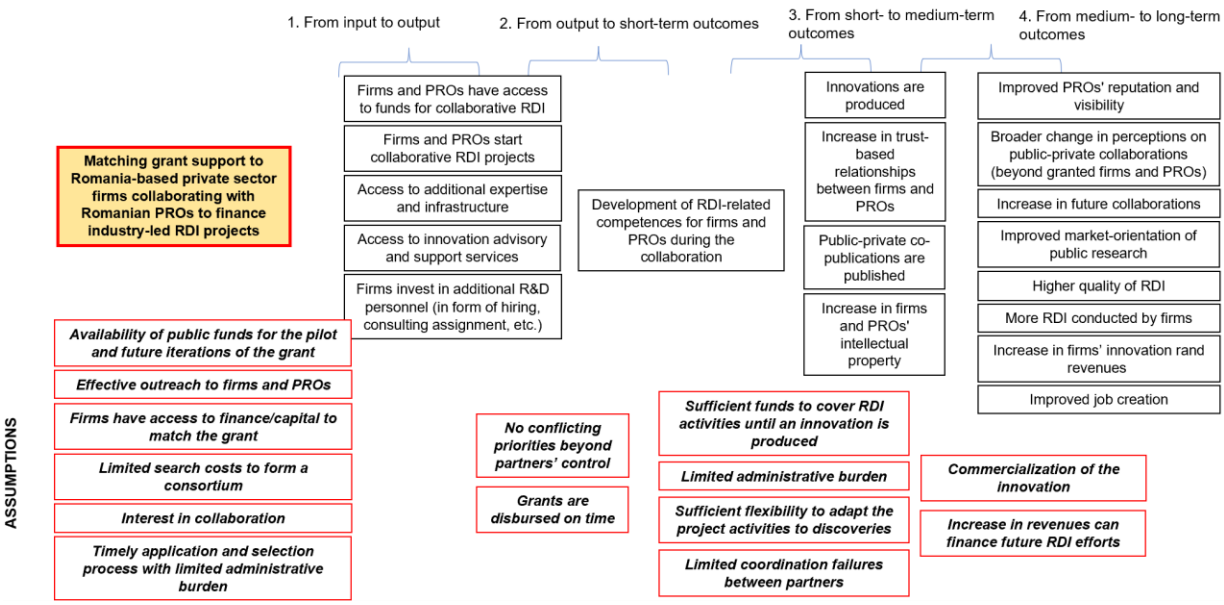
## *Approach*

CIGP supports partnerships of one or more private sector firm in collaboration with at least one PRI or university. The CIGP will offer private sector firm(s) a grant of up to €400,000 to engage in collaborative R&D projects with the aim of creating new or improved commercially viable products and services. Depending on applicable State Aid intensities (see Table 31 below), projects could range from €600,000 to €1 million in total budget (including private sector co-investment). The supported projects will be designed and led by private sector firm(s) with support from public research institute(s) or university(s). If more than one private sector firm is included in the proposal, a lead firm needs to be identified by the applicants. The research organizations must receive at least 30 percent of the grant funding. Proposals involving multiple firms and/or multiple research organizations in a value-added arrangement will be given special consideration, such

as additional points in the evaluation process (highest number for proposals including firms, PRIs and HEIs). The project duration would be up to 30 months.

As detailed in the CIGP ToC (Figure 18), CIPG provides public funds for financing industry-led collaborative R&D projects. Through these collaborations, beneficiary firms gain access to additional expertise and infrastructure via their public-sector partners. Using project funds, beneficiaries have access to innovation advisory and support services and can build R&I capabilities through the hiring of personnel and purchase of equipment (as required for the project). In the short-term, these outputs should lead to the development of R&I-related competences among beneficiary firms and PRIs/HEIs during the collaboration. The enhanced expertise in R&I for firms and PRIs/HEIs should then result in new IP and innovations. Finally, quality and quantity of RDI conducted by firms and PRIs/HEIs should increase, resulting in increases to firm competitiveness, revenues, and job creation.

**Figure 18 CIGP Theory of Change (ToC)**




CIGP supports industry-led partnerships consisting of at least one firm and one public-sector organization.

### Eligibility criteria

CIGP supports industry-led partnerships consisting of at least one firm and one public-sector organization.

Firms that meet the following criteria are eligible to participate for the program as lead beneficiaries or project partners:

- Any Romania-based private sector firms with at least 75 percent ownership by the private sector;
- Firms deemed to be financially viable;
- Firms can apply for only one project per call (to allow for broader participation).

Romanian PRIs and universities that have signed the *Declaration of compliance with the definition of research organizations*, as defined in the Research Law and the State Aid Regulation, are eligible to participate for the program as project partners.

Firms and public institutions from outside of Romania may participate as project subcontractors, but are limited to receive no more than 15 percent of grant funding.

### Calls for proposals

Calls for Proposals should be issued annually by the implementing body. Relevant proposal instructions and related procedures manual should be made available well in advance (at least 3 months) of each call for proposals. Project proposals processing requirements will be streamlined and aligned with EU guidelines to the extent possible including for the application documents, evaluation process, as well as disbursements and reporting.

### Eligibility and assessment of proposals

Once submitted, all proposals will be tested for eligibility by the implementing body. Eligible proposals will then be reviewed by three independent peer reviewers (2 technical and 1 business reviewer) to be assigned by the implementing entity. Peer reviewers' comments will be then submitted to an independent selection panel (ISP) with five members made up of reputed researchers (two), private sector business (two) and financing experts (one) (two national members and three international members) to be established by the implementing body. The ISP will make the final decision on project selection and funding.

### Selection criteria

Selection criteria by the ISP will use the following five main criteria identified in Table 30.

**Table 30 CIGP Selection Criteria**

| Selection Criteria Category | Weight |
|---|---|
| Commercial potential | 30% |
| Quality and collaborative potential of the team members<br>• Quality of project team<br>• Organizational design and management systems of the collaborative team<br>• Roles, responsibilities, accountabilities, and authorities for all participants | 20% |
| Quality of management plan, appropriate budget size, allocation, and justification of resources | 20% |
| Proposed approach including clarity/depth of outcome milestones, project management risks and mitigation, etc. | 15% |
| Quality and value-added arrangement of collaborating organizations involved in the proposed project | 15% |

Additional details regarding the CIGP selection and evaluation process will be provided in the CIGP Operations Manual.

### State aid

Private sector co-financing will be determined by State Aid limits, as shown in Table 31.

**Table 31 CIGP State Aid Intensities**

| | Small Enterprises | Medium Enterprises | Large Enterprises |
|---|---|---|---|
| Fundamental research (TRL 1) | 100% | 100% | 100% |
| Industrial research (TRL 2-4) | 70% | 60% | 50% |
| • subject to effective collaboration between undertakings (for large enterprises cross-border or with at least one SME) or between an undertaking and a research organization, or<br>• subject to wide dissemination of results, or | 90% | 80% | 70% |
| • subject to the R&D project being carried out in assisted regions fulfilling the conditions of Article 107(3)(a) of the Treaty, or<br>• subject to the R&D project being carried out in assisted regions fulfilling the conditions of Article 107(3)(c) of the Treaty | 90% or 85% | 80% or 75% | 70 or 65% |
| Experimental development (TRL 5-8) | 45% | 35% | 25% |
| • subject to effective collaboration between undertakings (for large enterprises cross-border or with at least one SME) or between an undertaking and a research organization, or<br>• subject to wide dissemination of results, or | 60% | 50% | 40% |
| • subject to the R&D project being carried out in assisted regions fulfilling the conditions of Article 107(3)(a) of the Treaty, or<br>• subject to the R&D project being carried out in assisted regions fulfilling the conditions of Article 107(3)(c) of the Treaty | 50% or 60% | 40% or 50% | 30 or 40% |
| Aid for feasibility studies | 70% | 60% | 50% |
| • in assisted regions fulfilling the conditions of Article 107(3)(c) of the Treaty, or<br>• in assisted regions fulfilling the conditions of Article 107(3)(a) of the Treaty | 75% or 80% | 65% or 70% | 55% or 65% |
| Innovation aid to SMEs | 50% | 50% | |

Acceptable co-financing includes applicant's own resources in cash contribution, existing or potential private investors/venture capital/private equity or debt financing, and other private sector cash contributions. At least 50 percent of the total program funding for the CIGP each call should be allocated to proposals led by MSMEs.

### Eligible project costs

Eligible project costs of CIGP funds include (subject to EU State-Aid rules):

- Project team and project management
- IP protection and licensing in domestic and/or EU and international markets
- External services required for project.
- Training and travel required for project.

- Purchases of equipment and consumables required for project implementation (not to exceed 30 percent of the total project cost)
- Overhead costs (not to exceed 10 percent of the total project costs).

## *Implementing Body*

MCID will determine the implementation entity.

## *Risks*

There are several key risks to the scheme, which are detailed in Table 32.

**Table 32 CIGP Risks**

| Risk | Mitigation |
|---|---|
| **Lack of interest/demand for instrument among target beneficiaries** | The launch of CIGP should include a strong outreach campaign targeting innovative firms, as well as PRIs and HEIs. The MP will also include an outreach campaign and was designed to support the formation of new partnerships that could apply to CIGP. |
| **Lack of availability of financing** | The WB team will work with MCID and the implementing body to advocate for and justify the need for annual funding for CIGP with key funding and policymaking bodies within the Romanian government. |
| **Challenges in design and implementation could damage public-private relationships** | The WB team hopes to work closely with the implementing body to assist the design of the grant materials and implementation processes to assure the adoption of global good practices in grant design and administration. |
| **High administrative burden** | The WB team will support the implementing body in streamlining application guidelines and technical and financial reporting requirements, in compliance with State Aid and auditing rules. |

## *Funding*

€40 million per year annual from 2024-2028.

## *Monitoring and evaluation (M&E)*

CIGP will be assessed based on its success in generating a set of KPIs among supported beneficiaries, as shown in Table 33.

**Table 33 CIGP Key Performance Indicators**

| Indicator | Definition |
|---|---|
| Increase in R&D investments by awarded firms | Average percentage increase in total R&D expenditures of awarded firms between baseline and measurement year. |
| Increase in R&D staff by awarded firms | Average percentage increase in R&D staff (full-time equivalent (FTE)) of awarded firms between baseline and measurement year. FTE is obtained by comparing the firms' employees' average number of hours worked to the average number of hours |

| | |
|---|---|
| | of a full-time worker. A full-time person is therefore counted as one FTE, while a part-time worker gets a score in proportion to the hours he or she works. |
| Number of IP applications filed | Number of IP (patents, protected trademarks, industrial design) applications filed by awarded consortia within 3 years before the event and the measurement year. |
| Number of technology transfers realized between awarded firms and any PRIs/HEIs | Number of technology transfers realized within consortia members in the measurement year. The technology transfer can be in the form of R&D agreements or IP licensing agreements, or spin-offs. |
| Increase in turnover by awarded firms | Average percentage increase in the turnover generated by awarded firms: the sum of percentage increase in turnover for each awarded firm divided by the number of awarded firms. |
| Increase in exports of awarded firms | Average percentage increase in the total exports generated by awarded firms: the sum of percentage increase in exports for each awarded firm divided by the number of awarded firms. |
| Increase in FTE of awarded firms | Average percentage increase in the number of FTEs of awarded firms: the sum of percentage increase in FTE for each awarded firm divided by the number of awarded firms. |
| Increase in productivity of awarded firms | Average percentage increase in value added (following Eurostat's definition) per FTE of awarded firms: the sum of percentage increase in value added per FTE for each awarded firm divided by the number of awarded firms. |
| Number of public-private collaborations on innovation activities including awarded firms | Number of public-private collaborations on innovation activities including awarded firms before the event and at measurement year. |

A complete results framework, including indicators related to the instrument inputs, activities, outputs, and outcomes (in line with the ToC) is available in Appendix 2, along with definitions and data collection protocols.

**Impact evaluation**

CIGP should undergo an impact evaluation to assess if the public support leads firms to create new or improved commercially viable products and services. More specifically, the following evaluation questions shall be answered:

1. Impact of Collaborative Innovation Grants: What is the impact of the CIGP on firm performance? Does benefitting of the Collaborative Innovation Grants increase firm innovative activities, inputs, and growth?
2. Impact of Collaborative Innovation Grants on collaborations**:** What is the impact of the CIGP on the number of collaborations between firms for PRIs?
3. Heterogeneous Effects: What type of firms benefit most from the grants? In what type of sectors are they operating, what is their age and size? Who within the firm should ideally be targeted for larger outcomes?

Two evaluation designs are possible to measure the impacts of the CIGP and answer the evaluation questions. In the first evaluation design, randomization into the program and comparison group is carried out among all eligible firms. In the second evaluation design, randomization into the program and comparison group is carried out among firms in a pre-defined middle range of ranks.

**Under the first evaluation design**, the specific impact evaluation method to be employed would be a **randomized control trial design** with all firms applied to the CIGP. Outcomes are measured at the firm level. All firms that applied for the Collaborative Innovation Grant that are eligible for the program (required total sample size is at least 200 firms that are eligible) will be randomly divided into two groups: the comparison group (at least 100 firms) and the program group (at least 100 firms). The program group will receive financial assistance to engage in joint applied R&D and innovation projects. The comparison group will not receive any financial support.

**Under the second evaluation design**, the specific impact evaluation method to be employed would be a **randomized control trial design with randomization of firms that fall within a pre-defined middle range of ranks.** Among all eligible firms, this setup provides financing to projects with the highest potential, with no financing to eligible projects of the lowest potential. To implement the randomization, the following procedure shall be followed:

- Eligible projects will undergo an assessment by the selection panel of the selection criteria (detailed in Table 30) and each application will receive a score ranging from 0 to 3 for each of the five selection criteria. The definitions of these criteria and their respective scores were developed jointly by the WB team and MCID.
- Eligible projects scoring 0 or 1 in three or more selection criteria will be considered as low potential and will not receive financing.
- Eligible projects scoring 3 in three or more selection criteria will be considered the projects with the highest potential and will directly receive the grant.
- All other eligible projects will be assessed as projects with promising potential and will be placed in the randomization pool. From that pool, firms are randomly divided into two groups: the comparison group (at least 100 firms) and the program group (at least 100 firms).
- The program-selected group will receive the CIGP grant. The comparison group will not receive any financial support.

A complete description of the CIGP Impact Evaluation Plan can be found in Appendix 3.

# 4.2 Innovative Value Chain Grant Program (IVCGP)

## *Objective*

The objective of this instrument is to enable Romanian innovation seeking firms and PRIs to collaboratively engage in European and global value chains through a strategic, long-term collaborations with anchor large companies integrated in global markets and with offices in Romania. The program will fund the piloting, demonstration, commercialization and scale-up of one or more innovative products and services from TRL3 to TRL 8 in key value chains, while also equipping domestic actors with necessary skills and capabilities to succeed at the European and global level.

## *Target Beneficiaries*

Consortia composed of one large company connected to global supply chains and with official presence in Romania (representing the demand side of the supply chain), and at least one SME and at least one PRI/HEI (representing the supply side of the supply chain).

## *Rationale*

IVCGP aims to address three key challenges identified by the WB's analysis:

- **Innovation activities are highly concentrated among large firms (particularly multinationals), while Romanian SMEs have weak capacities to engage in innovation** – from 2018 to 2020, SMEs performed just 10 percent of BERD in Romania, compared to 26 percent performed by SMEs in Czechia, 30 percent in Poland, 36 percent in Croatia, and 40 percent in Bulgaria.
- **Limited research capabilities in the public sector due to limited and unpredictable budgets.** Competitive funding, in the form of national grant programs, is highly unpredictable and there is limited support for long-term (e.g., three years or more) collaborations. The limited and unpredictable funding environment makes it extremely difficult for public sector organizations to build research capacity and makes them less attractive as research partners for the private sector.
- **The public sector's R&D collaborations with large companies are limited in size and scope.** Large firms' collaborations with HEIs are generally one-off engagements with individual professors and small in size, while large firms have little to no engagement with PRIs due to a lack of information and mismatched incentives.

In additional, IVCGP seeks to support Romania to take advantage of recent restructuring of global supply chains. Global supply chains are undergoing a reconfiguration process in response to the pandemic and geopolitical crises that the global economy has faced in the past three years. Firms are diversifying their supply chains and considering reshoring or nearshoring some of their investments from remote regions. Numerous large international firms are currently repositioning their production capabilities in Central and Eastern European (CEE) countries leveraging the region's competitive advantages: highly qualified and cost-competitive workforce, stable political environment, well-developed infrastructure, a long industrial tradition, and the borderless flow of goods within the EU's Single Market. Romania, as a CEE country, is well-positioned to take advantage of this reconfiguration of value chains and the focus on nearshoring.

## *Relationship to planned 2021-2027 policy mix*

The planned policy mix provides limited support for industry-led collaborations, forming linkages between the public sector and large firms, or for long-term collaborations between innovation actors. At present, there appear to be two planned two instruments that can support industry-led, public-private collaborations for R&D: PN4 *Transfer to the business entity program* and POC/POCIDIF *Innovative technological projects*. However, these programs are focused on smaller consortia and shorter projects (12-24 months in duration) than the IVCGP program.

IVCGP has a somewhat similar model to the new POCIDIF *Support for RDI projects for thematic consortia* program (announced in February 2024), which will support consortia of at least three

SMEs and one public entity on R&I projects of up to €10 million. However, IVCGP has important differences in its design from the POCIDIF instrument:

- IVCGP projects must be industry led (*Support for RDI projects for thematic consortia* projects can be led by HEIs or PRIs, as well as firms).
- IVCGP projects must respond to the needs of large firms active in EU or global value chains (acting as the demand side of the instrument), which ensures that projects supported by the program are driven by industry needs. This model also provides the private sector consortia partners with incentives to collaborate in R&D, which the *Support for RDI projects for thematic consortia* program lacks.
- IVCGP projects are smaller in total budget (€2.5 million vs. €10 million for *Support for RDI projects for thematic consortia*) and do not provide funding for TRL 9 (initial production of innovations). Maximum grant funding for IVCGP could be increased in subsequent years based on demand.

The policy mix also does not include any instruments specifically focused on connecting large firms with the public sector and has limited support for collaborative projects of three or more years in duration.

## *Approach*

Through a value-chain approach the IVCGP enables collaboration across the entire innovation ecosystem, eases connectivity to regional and global markets, and facilitates the spill-over effects from top innovators to the rest of the ecosystem. The beneficiary is a consortia consisting of one large company connected to global supply chains and with official presence in Romania (representing the demand side of the supply chain), and at least one SME and at least one PRI/HEI (representing the supply side of the supply chain) a matching grant between €2.5 million to engage in one or more collaborative R&D projects in critical value chains for the Romanian economy, with the aim of creating new or improved commercially viable products, services, and processes and add value to the European and/or global value chains.

Depending on feedback from stakeholders and beneficiaries, and based on the data from monitoring, the maximum grant size could be increased after 2024. If the maximum grant size is increased above €4 million, the WB team and implementer will assess whether it is necessary to introduce a multi-phased approach to the grant.[10]

The targeted value chains for the pilot edition will be selected from those listed as National Smart Specializations:

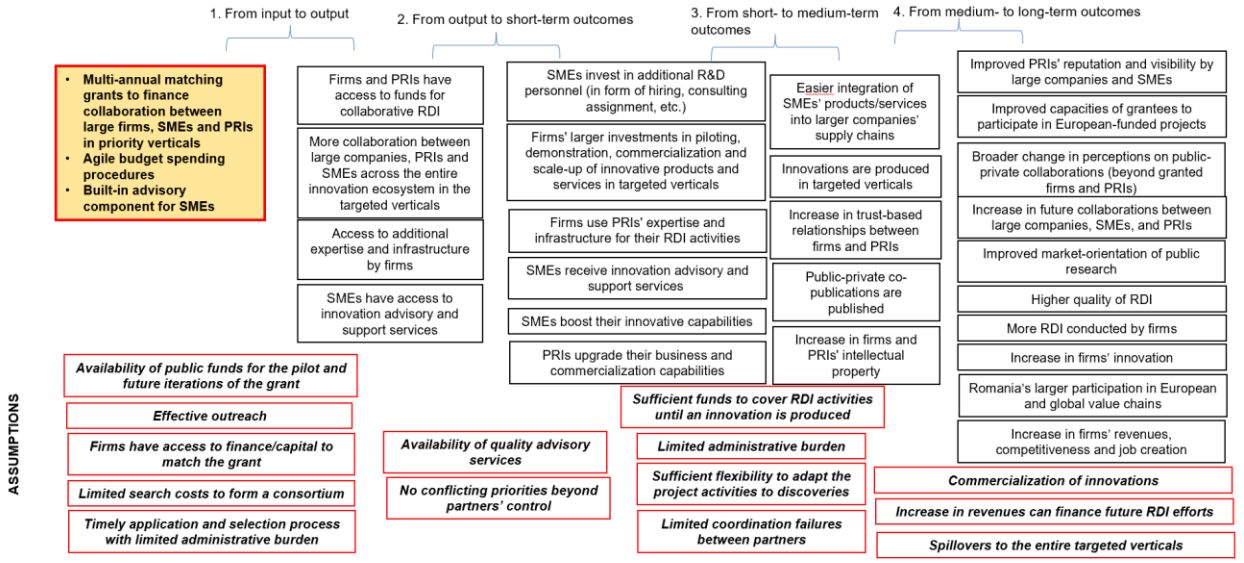
- Biotechnologies (e.g., Agritech, Food security)
- Advanced digital technologies (e.g., Robotics, Cybersecurity)
- Energy & Mobility (e.g., electrical vehicles, storage units)
- Manufacturing (e.g., Additive manufacturing)
- Advanced materials (e.g., biomaterials, new composites)
- Climate tech (e.g., Recycling, Carbon-capture tech)
- eHealth (e.g., wearables, wellbeing)

[10] In a two phased approach, the grant would split into two phases. Beneficiaries who reach specific milestones (defined in their application) in Phase 1 of the grant would then receive funding for Phase 2, while those beneficiaries that do not achieve Phase 1 milestones would not receive Phase 2 funding.

Priority will be given to three Smart Specializations domains with the most added value to the national economy and highest potential to release competitive products and services at regional and global level. The program will utilize a programmatic approach, allowing beneficiaries the flexibility to develop multiple R&D and commercialization projects under a single grant. Depending on applicable State Aid intensities (see Table 35 below), projects could range from approximately €3 million to €6.3 million in total budget (including private sector co-investment). The supported projects will be designed and led by large anchor firms active in European and global value chains, with research and coordination support provided by public research institute(s) or university(s). Selection criteria will put high value on the matching investments by private firms and on the capacity building activities for SMEs and PRIs. The project duration would be up to 36 months.

As detailed in the IVCGP ToC (Figure 19), IVCGP provides public funds for financing collaboration between large firms, SMEs, and PRIs in priority verticals. Through these collaborations, beneficiary SMEs gain access to additional expertise and infrastructure via their partnerships with large firms and public-sector collaborators. Using project funds, beneficiaries have access to innovation advisory and support services and can build R&I capabilities through the hiring and training of personnel and purchase of materials and components (as required for the project). In the short-term, these outputs should lead to the development of R&I-related competences among beneficiary firms and PRIs/HEIs during the collaboration. The enhanced expertise in R&I for firms and PRIs/HEIs should then result in new IP and innovations. In the medium-term, participating SMEs should become more integrated into larger companies' supply chains, while public sector beneficiaries should become more market-oriented in their research due to their interactions with private sector collaborators. In the long term, Romania should see larger participation in European and global value chains, resulting in increases to firm competitiveness, revenues, and job creation.

**Figure 19 IVCGP Theory of Change (ToC)**



### Eligibility criteria

IVCGP supports industry-led consortiums consisting of at least one large firm integrated in global chains, and with official presence in Romania, one public-sector organization and at least one SME. Both demand and supply side should be represented in the consortium composition.

Romanian PRIs and universities that have signed the *Declaration of compliance with the definition of research organizations*, as defined in the Research Law and the State Aid Regulation, are eligible to participate for the program as project partners.

The lead firm in the consortium must be active in one of the target industries and the proposed innovative products and/or services are at least at TRL 3. Project duration is up to 36 months.

### Calls for proposals

Calls for Proposals should be issued annually by the implementing body. Relevant proposal instructions and related procedures manual should be made available well in advance (at least 3 months) of each call for proposals.

Project proposals processing requirements will be streamlined and aligned with EU guidelines, including for the application documents, evaluation process, and disbursements and reporting.

### Eligibility and assessment of proposals

Once submitted, all proposals will be tested for eligibility by the implementing body. Eligible proposals will then be reviewed by three independent peer reviewers with knowledge and experience of the relevant industry sector. Peer reviewers' comments will be then submitted to an ISP with five members made up of reputed researchers (two), private sector business (two with knowledge and experience of the relevant industry sector) and financing experts (one) (two national members and three international members) to be established by the implementing body. The ISP will make the final decision on project selection and funding.

### Selection criteria

Selection criteria by the IVCGP will use the following four main criteria identified in Table 34. Additional points will be awarded to projects that aim to develop technology or product platforms that could support multiple applications of high commercial potential and for applications in the Smart Specialization domains with the most added value to the national economy and highest potential to release competitive products and services at regional and global level.

**Table 34 CIGP Selection Criteria**

| Selection Criteria Category | Weight |
|---|---|
| EU and/or global commercial potential of products and services | 40% |
| Quality and collaborative potential of the team members<br>• Specific expertise of consortium members<br>• Organizational design and management systems of the team<br>• Roles, responsibilities, accountabilities, and authorities for all participants | 30% |
| Quality of management plan, appropriate budget size, allocation, and justification of resources | 20% |
| Impact and sustainability of the collaboration | 10% |

Additional details regarding the IVCGP selection and evaluation process will be provided in the IVCGP Operations Manual.

### State aid

Private sector co-financing will be determined by State Aid limits, as shown in Table 35.

**Table 35 CIGP State Aid Intensities**

| | Small Enterprises | Medium Enterprises | Large Enterprises |
|---|---|---|---|
| Fundamental research (TRL 1) | 100% | 100% | 100% |
| Industrial research (TRL 2-4) | 70% | 60% | 50% |
| • subject to effective collaboration between undertakings (for large enterprises cross-border or with at least one SME) or between an undertaking and a research organization, or<br>• subject to wide dissemination of results, or | 80% | 75% | 65% |
| • subject to the R&D project being carried out in assisted regions fulfilling the conditions of Article 107(3)(a) of the Treaty, or<br>• subject to the R&D project being carried out in assisted regions fulfilling the conditions of Article 107(3)(c) of the Treaty | 80% or 75% | 75% or 70% | 65 or 60% |
| Experimental development (TRL 5-8) | 45% | 35% | 25% |
| • subject to effective collaboration between undertakings (for large enterprises cross-border or with at least one SME) or between an undertaking and a research organization, or<br>• subject to wide dissemination of results, or | 60% | 50% | 40% |
| • subject to the R&D project being carried out in assisted regions fulfilling the conditions of Article 107(3)(a) of the Treaty, or<br>• subject to the R&D project being carried out in assisted regions fulfilling the conditions of Article 107(3)(c) of the Treaty | 50% | 40% | 30 % |
| Aid for feasibility studies | 70% | 60% | 50% |
| • in assisted regions fulfilling the conditions of Article 107(3)(c) of the Treaty, or<br>• in assisted regions fulfilling the conditions of Article 107(3)(a) of the Treaty | 75% or 80% | 65% or 70% | 55% or 65% |
| Innovation aid to SMEs | 50% | 50% | |

Acceptable co-financing includes applicant's own resources in cash contribution, existing or potential private investors/venture capital/private equity or debt financing, and other private sector cash contributions.

### Eligible project costs

Eligible project costs of IVCGP funds include (subject to EU State-Aid rules):

- Project team and project management

- IP protection and licensing in domestic and/or EU and international markets
- External services required for project up to 30% of the total grant
- Training and travel required for project
- Purchases of consumables required for project implementation (not to exceed 20 percent of the total project cost)
- Overhead costs (not to exceed 10 percent of the total project costs)

## *Implementing Body*

MCID will determine the implementation entity.

## *Risks*

There are several key risks to the scheme, which are detailed in Table 36.

**Table 36 IVCGP Risks**

| Risk | Mitigation |
|---|---|
| **Lack of interest/demand for instrument among target beneficiaries** | The launch of IVCGP should include a strong outreach campaign targeting both MNCs active in Romania, as well as innovative firms, existing supplier SMEs, PRIs, and HEIs. The MP will also include an outreach campaign and was designed to support the formation of new partnerships that could apply to IVCGP. |
| **Lack of availability of financing** | The WB team will work with MCID and the implementing body to advocate for and justify the need for annual funding for IVCGP with key funding and policymaking bodies within the Romanian government. |
| **Challenges in design and implementation could damage public-private relationships** | The WB team hopes to work closely with the implementing body to assist in the design of the grant materials and implementation processes to assure the adoption of global good practices in grant design and administration. |
| **High administrative burden** | The WB team will support the implementing body in streamlining application guidelines and technical and financial reporting requirements, in compliance with State Aid and auditing rules. |

## *Funding*

€50 million per year annually from 2024-2028. Depending on private sector interest in the program, the budget may increase in subsequent years.

## *Monitoring and Evaluation (M&E)*

IVCGP will be assessed based on its success in generating a set of KPIs among supported beneficiaries, as shown in Table 37.

**Table 37 IVCGP Key Performance Indicators**

| Indicator | Definition |
|---|---|
| Increase in R&D investments by awarded firms | Average percentage increase in total R&D expenditures of awarded firms between baseline and measurement year. |

| | |
|---|---|
| Increase in R&D staff by awarded firms | Average percentage increase in R&D staff (FTE) of awarded firms between baseline and measurement year. FTE is obtained by comparing the firms' employees' average number of hours worked to the average number of hours of a full-time worker. A full-time person is therefore counted as one FTE, while a part-time worker gets a score in proportion to the hours he or she works. |
| Number of products/services stemming from SMEs integrated into larger companies supply chains | Number of products/services stemming from SMEs integrated into larger companies supply chains. |
| Increase in turnover by awarded firms | Average percentage increase in the turnover generated by awarded firms: the sum of percentage increase in turnover for each awarded firm divided by the number of awarded firms. |
| Increase in exports of awarded firms | Average percentage increase in the total exports generated by awarded firms: the sum of percentage increase in exports for each awarded firm divided by the number of awarded firms. |
| Increase in FTE of awarded firms | Average percentage increase in the number of FTEs of awarded firms: the sum of percentage increase in FTE for each awarded firm divided by the number of awarded firms. |
| Increase in productivity of awarded firms | Average percentage increase in value added (following Eurostat's definition) per FTE of awarded firms: the sum of percentage increase in value added per FTE for each awarded firm divided by the number of awarded firms. |
| Increase in firms' R&D investments in the targeted verticals | Average percentage increase in total R&D expenditures of firms in the targeted verticals between baseline and measurement year: the sum of percentage increase in total R&D expenditures for each firm in the targeted verticals divided by the number of firms in the targeted verticals. |
| Increase in exports of firms in the targeted verticals | Average percentage increase in the total exports generated by firms in the targeted verticals: the sum of percentage increase in exports for each firm in the targeted verticals divided by the number of firms in the targeted verticals. |

A complete results framework, including indicators related to the instrument inputs, activities, outputs, and outcomes (in line with the ToC) is available in Appendix 2, along with definitions and data collection protocols. Due to the relatively low number of beneficiaries who will participate in the program per year, MP should be evaluated through qualitative methods (e.g., interviews and focus groups with beneficiaries) in the short term. The program could then be evaluated quantitatively after several iterations of the program have been implemented and the number of total beneficiaries is higher.

## 4.3 Matchmaking Program (MP)

### *Objective*

The objective of the Matchmaking Program (MP) is to build relationships between Romanian private sector companies and public sector R&D organizations with the goal of increasing joint private/public sector engagement in applied R&D and innovation projects to create new or improved commercially viable products and services.

## *Target Beneficiaries*

Qualified matchmaking and innovation support organizations are the direct beneficiaries of MP funding.

Private sector firms, PRIs, and HEIs are the target participants of the matchmaking activities funded by the program and are thus indirect beneficiaries of the program.

## *Rationale*

MP aims to address one key failure identified by the WB's analysis:

- **Information barriers between R&I actors**. Key R&I actors lack information about the capabilities and interested of potential collaboration partners. Even MNCs, which have resources to actively scout universities for research talent, have limited information about the activities and capabilities of Romanian PRIs. Other actors, such as SMEs, universities, and PRIs, do not have the resources to scout potential collaboration partners and have very limited information about other public and private research organizations.

## *Relationship to planned 2021-2027 policy mix*

The planned policy mix includes limited support for lowering information barriers between R&I actors and creating new R&I partnerships. PN4 includes a new *Tech Transfer Festival* instrument, but the objectives, beneficiaries, format, and budget of the proposed festival(s) is currently unknown. UEFISCDI also has an online platform called Brainmap, which provides information on more than 55,000 public sector research performers to help interested parties identify research partners for PN4 grants. However, few stakeholders interviewed by the WB team – including none from the private sector – had ever heard of or used the platform.

## *Approach*

MP will support a qualified matchmaking and/or innovation support organization with a grant of up to €200,000 to design and implement a matchmaking initiative that will bring together private sector firms and relevant PRIs and universities with the purpose of fostering long term, trust-based relationships that may lead to joint private/public sector engagement in applied R&D and innovation projects to create new or improved commercially viable products and services.

Applicants to MP will propose their own approach to the matchmaking initiative that they believe will achieve the desired outcomes, although proposals must include the following elements, which will allow for an impact assessment of the MP:

- **Outreach and registration of participants:** The initiative will begin with an outreach campaign to invite interested firms and researchers to register for the matchmaking initiative. Interested firms and researchers will register and answer questionnaires that profile them according to their interests and needs. The matchmaking organization must achieve a target of 200 firms and 100 public researchers to register for the initiative. The WB team will randomly select at least 100 firms to participate in the subsequent stages of the matchmaking initiative.

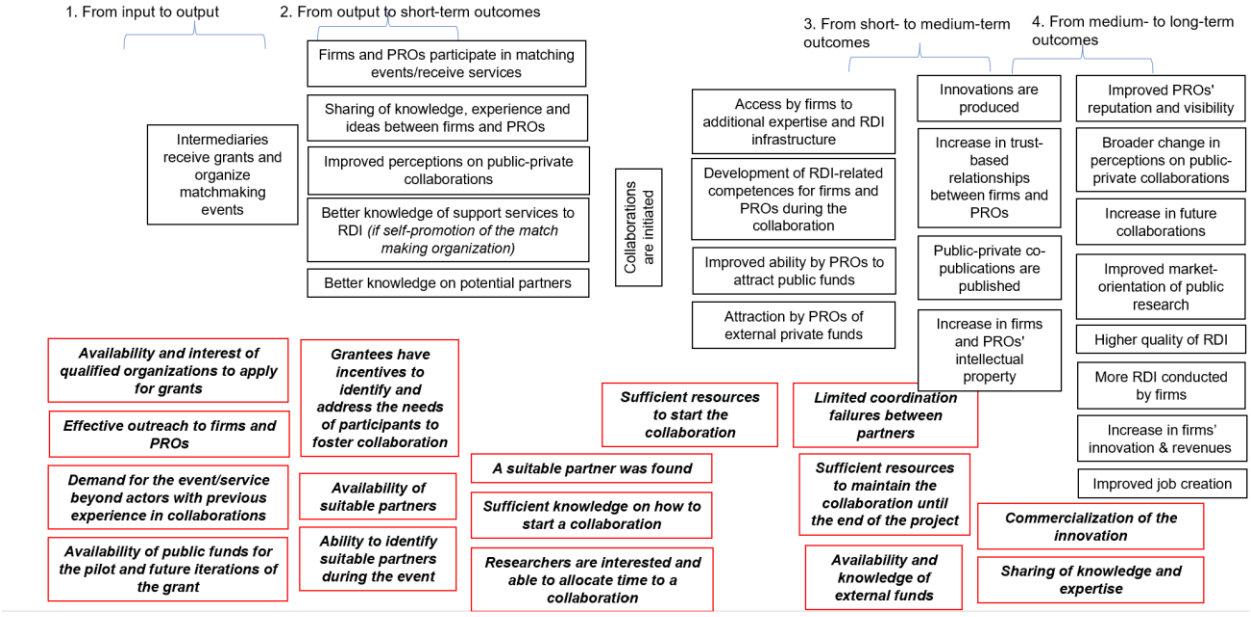
- **Matchmaking event(s):** The matchmaking organization will organize one or more matchmaking events that will allow firms and public researchers to meet other innovation actors with similar interests and needs.
- **Follow up support:** The matchmaking organization will provide follow up coordination and technical support to paired firms and public researchers the firms to discuss concrete problems and possible solutions and develop new collaborations.

For more information on the impact evaluation plan for MP, see Appendix 3.

### Theory of change (ToC)

As detailed in the MP ToC (Figure 20), MP provides public funds to qualified organizers for the design and implementation of matchmaking events where firms and PRIs can come together to meet and learn about each other's capabilities, interested, and needs related to R&I. Firms and PRIs participate in the matchmaking events and share knowledge, experience, and ideas with each other. This exchange should lead to improved perceptions on public-private collaborations among participants, better knowledge of R&I support services available, and better knowledge of potential partners in R&I collaborations. In the short-term, this should lead to new collaborations between participants. Once collaborations between firms and PRIs have been initiated, participants should have access to additional expertise and R&I infrastructure, leading to development of R&I-related competences among collaborating firms and PRIs/HEIs. The enhanced expertise in R&I for firms and PRIs/HEIs should then result in new IP and innovations. Finally, quality and quantity of R&I conducted by firms and PRIs/HEIs should increase, resulting in increases to firm competitiveness, revenues, and job creation.

**Figure 20 MP Theory of Change (ToC)**




### Eligibility criteria

Applicant eligibility criteria:

- Organizations that design and implement events that bring different groups together for joint learning and development, or
- Organizations that support SMEs/startups and/or public sector research organizations.

**Related programs**

The MP will be directly linked to CIGP and IVCGP by supporting the formation of new partnerships and collaborative projects that can be funded by these programs. The grantee organization, in coordination with the implementing body, will implement the matchmaking activities in advance of the launch of the calls for proposals for CIGP and IVCGP in 2024 (and in future years as well).

**Calls of proposals**

Relevant proposal instructions and related procedures manual should be made available well in advance (at least 3 months) of the call for proposals. These proposals will be reviewed and evaluated by a three-member panel (appointed by the implementing body) who will have the final decision regarding selection and funding of the proposals. The proposal processing procedures will be simple and follow a streamlined evaluation process (details regarding the evaluation process will be provided in the MP Operations Manual.)

Selection criteria for MP will use the following four main criteria identified in Table 38.

**Table 38 CIGP Selection Criteria**

| Selection Criteria Category | Weight |
|---|---|
| Applicant track record in supporting innovation, SMEs, or startups and/or in designing and hosting events that bring different organizations together for joint learning and development | 40% |
| Quality of the matchmaking team | 25% |
| Outreach plan for generating interest in matchmaking events | 25% |
| Quality of management plan, budget size and justification for requested resources | 10% |

Additional details regarding the MP selection and evaluation process will be provided in the MP Operations Manual.

**State aid**

Private sector co-financing will be covered by *de minimis* State Aid rules.

**Eligible costs**

Cost of designing and implementing events are eligible costs.

## *Implementing Body*

MCID will determine the implementation entity.

## *Risks*

There are several key risks to the scheme, which are detailed in Table 39.

**Table 39 MP Risks**

| Risk | Mitigation |
|---|---|
| **Lack of suitable matchmaking organizations to design and implement program** | The WB has conducted a survey of innovation support organizations in Romania and can provide support in identifying the most promising organizations that could develop this sort of matchmaking initiative. |
| **Lack of interest/demand for instrument among target beneficiaries** | Applicants to MP must include an outreach campaign as part of the matchmaking initiative, and the quality of their proposed outreach campaign is one of the selection criteria for choosing the grantee of the program. |
| **Lack of availability of financing** | The WB team will work with MCID and the implementing body to advocate for and justify the need for funding for MP with key funding and policymaking bodies within the Romanian government. |

## *Funding*

€200,000 per annual call of proposals annually from 2024-2028.

## *Monitoring and Evaluation (M&E)*

MP will be assessed based on its success in generating a set of KPIs among supported beneficiaries, as shown in Table 40.

**Table 40 CIGP Key Performance Indicators**

| Indicator | Definition |
|---|---|
| Number of firms participating in supported events organized by the grantees | Head count of firms represented by one or several individuals taking part in events organized by grantees as part of their grant. |
| Number of PRIs/HEIs participating in supported events organized by the grantees | Head count of PRIs and of HEIs represented by one or several individuals taking part in events organized by grantees as part of their grant. |
| Number of participating firms that initiated a collaboration with a PRI/HEI for innovation activities | Number of participating firms collaborating with a PRI/HEI for conducting innovation activities within 3 years before participating in the event and 6 months after the event organized by grantees as part of their grant. Collaborative innovation activities include all developmental, financial and commercial activities undertaken by a firm together with a PRI/HEI and that are intended to result in an innovation for the firm. An innovation is a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process). (OECD, Oslo manual) Collaborations include a joint publication, joint submission of a project proposal or a new contracted collaborative project, other formal agreements and contracts, memoranda of understanding and other forms of collaboration involving the participating firm and a PRI/HEI for innovation activities. |

| | |
|---|---|
| Number of public collaborations initiated by participating firms applying for public (national or European) funds | Number of participating firms applying jointly with a PRI/HEI for funds provided by national or European programs. |
| Share of sustained collaborations between participating firms and a PRI/HEI for innovation activities | Ratio between the number of participating firms that completed (but not interrupted) or are still in collaboration with a PRI/HEI for innovation activities 3 years after the event and the number of participating firms that had initiated a collaboration 1 year after the event. |

A complete results framework, including indicators related to the instrument inputs, activities, outputs, and outcomes (in line with the ToC) is available in Appendix 2, along with definitions and data collection protocols.

**Impact evaluation**

MP will undergo an impact evaluation to assess if the matchmaking initiative is an effective and cost-efficient investment to increase the number of successful business-science collaborations. The evaluation will help policymakers to identify what type of support works, for whom, and under which conditions. More specifically, the following evaluation questions shall be answered:

1. Creating Matches: Does suggesting potential pre-selected partners result in a business-science match for the duration of program implementation? In other words, what is the likelihood that firms will be interested in the profiles of the scientists shortlisted for them? How does the final selection of matched partners differ from initial expectations about the "ideal" business/science partner?
2. Impact of Matchmaking: What is the impact of matchmaking on business-science collaborations, perceptions about scientists, and firm-performance?
3. Heterogeneous Effects of Matchmaking: What type of firms benefit most from matchmaking? In what type of sectors are they operating, what is their age, and size? Who, within the firm, should ideally be targeted for larger impacts?

The evaluation design follows four steps: outreach, eligibility, random assignment to the matchmaking initiative, and follow-up measures of outcomes with selected and non-selected group of firms:

- First, a large outreach campaign shall reach many firms and scientists to register for matchmaking support.
- Second, an eligible pool of scientists and firms is shortlisted following specific eligibility criteria.
- Third, due to limited available spots in each phase of the matchmaking initiative, a lottery shall decide among the eligible pool who will participate in subsequent phases of the matchmaking.
- Fourth, the firms randomly selected for the matchmaking initiative and non-selected firms will be re-contacted after the end of the matchmaking initiative and information will be independently collected on their firm performance and in particular investments and engagement in R&D with new partners. Differences in outcomes will help identify the impacts of the matchmaking initiative.

A complete description of the MP Impact Evaluation Plan can be found in Appendix 3.

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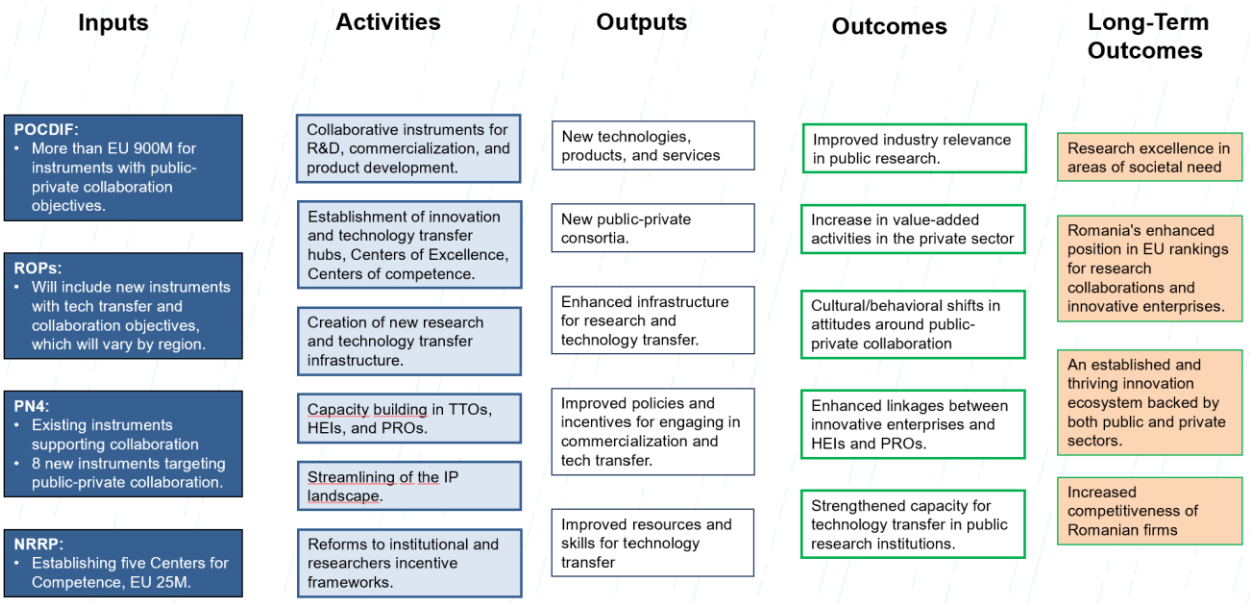
# Appendix 1. Romania's Policy Objectives for Public-Private R&D Collaboration

**Romania's overall objectives in areas of research and innovation, as laid out in the National Strategy for Research, Innovation and Smart Specialization 2022-2027 (SNCISI), National Plan for RDI (PN4), and Operational Program Smart Growth, Digitization and Financial Instruments (POCIDIF), are as follows**:

- Research excellence in areas of societal need;
- An enhanced national position in EU innovation rankings;
- An established and thriving innovation ecosystem backed by both public and private sectors; and
- Increased competitiveness of Romanian firms.

**Romania's support for public-private collaboration has not been clearly linked to these higher-level objectives, but collaboration support could target intermediate objectives that work toward Romania's overall R&I ambitions**. The recent analysis of Romania's policy mix (World Bank, 2023a) found that most R&I instruments lack objectives that are measurable or that are well-linked to higher-level strategic objectives, including instruments supporting collaboration. In 2023, the World Bank held several workshops with MCID and UEFISCDI on developing theories of change (ToCs) for Romania's R&I support, including two focused on public-private collaboration. These workshops established that Romanian collaboration support should target could target intermediate objectives that work toward Romania's strategic objectives. For example, by supporting collaborative research grants and other types of collaboration support, Romania can enhance linkages between innovative enterprises and HEIs and PRIs and, through interaction with industry, increase the market relevance in public research. Through capacity-building support, Romania can strengthen the technology transfer capabilities of PRIs, which in turn, can increase the competitiveness and value added of the private sector through the transfer of ideas and technologies from the public sector.

**Figure 21 Draft Theory of Change for Public-Private Collaboration in Romania**




Source: World Bank.

**Romania has set several targets for its support for collaboration for the 2021-2027 period**. SNCISI aims to increase the number of innovative enterprises collaborating with PRIs in Romania, public-private co-publications, and companies introducing new products to the market. Reform 4 of the NRRP aims for 40 percent of the project funded by MCID and its agencies have at least one business entity involved as a partner by 2026.

# Appendix 2. Results Frameworks for Pilot Instruments

## *Collaborative Innovation Grant Program Results Framework*

| ToC level | Indicator | Definition | Baseline | Data source | Frequency | Disaggregation | Responsible |
|---|---|---|---|---|---|---|---|
| Input | Number of eligible consortia applying for the grant | Number of eligible consortia applying for the grant. Eligibility is described in the program documents. A consortium consists of at least one MSME and one PRO/HEI. | N/A | Application form | By call for proposals | By call, industry, S3 thematic priority area, region | Program implementer |
| Input | Number of consortia receiving grants | Number of eligible consortia receiving grants. Eligibility is described in the program documents. A consortium consists of at least one MSME and one PRO/HEI. | N/A | Application form | By call for proposals | By call, industry, S3 thematic priority area, region | Program implementer |
| Input | Average budget of the awarded projects | Total budget of all awarded projects divided by the number of awarded project. | N/A | Internal project documents | By call for proposals | By call, industry, S3 thematic priority area, region | Program implementer |
| Input | Total budget disbursed to the grantees | Total budget of all awarded projects from the instrument. | 0 | Internal project documents | By call for proposals | By call for proposals | |
| Assumption | Timeliness of the selection process | Number of months between the call publication and the publication of results. | N/A | Internal project documents | By call for proposals | By call for proposals | Program implementer |
| Assumption | Timeliness of grants payments | Number of months between the publication of results and the reception of funds by grantees. | N/A | Internal project documents | By call for proposals | By call for proposals | Program implementer |

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|---|---|---|---|---|---|---|---|
| Output | Investment in innovation advisory and support services | Average share (in percentage) of expenditures made by the awarded consortia for innovation advisory and support services in the total project's budget. Innovation advisory and support services include market analyses, feasibility studies, concepts and/or strategies for product development and/or commercialization (e.g., studies or commercialization plan). | N/A | Application form<br>Beneficiary report/Follow-up survey with firm | Beneficiaries report every 6 months after project start | By type of support | Program implementer |
| Short-term outcome | Increase in R&D investments by awarded firms | Average percentage increase in total R&D expenditures of awarded firms between baseline and measurement year. | Defined by the application form | Application form<br>Beneficiary report/Follow-up survey with firm | Beneficiaries report every 6 months after project start | By industry, S3 thematic priority area, region | Program implementer |
| Short-term outcome | Increase in R&D staff by awarded firms | Average percentage increase in R&D staff (FTE) of awarded firms between baseline and measurement year. FTE is obtained by comparing the firms' employees' average number of hours worked to the average number of hours of a full-time worker. A full-time person is therefore counted as one FTE, while a part-time worker gets a score in proportion to the hours he or she works. | Defined by the application form | Application form<br>Beneficiary report/Follow-up survey with firm | Beneficiaries report every 6 months after project start | By industry, S3 thematic priority area, region | Program implementer |
| Short-term outcome | Quality of the consortia's collaboration | Awarded firms and PRIs/HEIs' perceived quality of collaboration at measurement year. Likert scale 1 (extremely bad) to 5 (extremely good). | N/A | Follow-up survey with firms and PRIs/HEIs | One year after the start of the project | | Program implementer |
| Assumption | Number of regular meetings between awarded SMEs and PRIs/HEIs | Average number of regular meetings between awarded SMEs and PRIs/HEIs. Regular is defined as weekly, bi-weekly or monthly meetings. | N/A | Follow-up survey with firms and PRIs/HEIs | One year after the start of the project | | Program implementer |
| Assumption | Perceived administrative burden | Beneficiary firms' self-reported level of satisfaction with administrative procedures to obtain the grant and with monitoring obligations. | N/A | Follow-up survey with firms and PRIs/HEIs | One year after the start of the project | | Program implementer |

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|---|---|---|---|---|---|---|---|
| Assumption | Total amount invested in the awarded projects | Grantees' total expenditures to implement the awarded project. | 0 | Beneficiary report | Final beneficiary report | By funding sources | Program implementer |
| Medium-term outcome | Number of public-private co-publications including a participating firm | Number of public-private coauthored publications realized by awarded consortia within 3 years before the event and at measurement year. The public-private co-publications are defined as all research-related papers (research articles, research reviews, notes, letters) published in the Web of Science database. | Defined from secondary data (Web of Science) | Secondary data (Web of Science) | 3 years after the start of the project | By industry, S3 thematic priority area, region | Managing authority |
| Medium-term outcome | Number of IP applications filed | Number of IP (patents, protected trademarks, industrial design) applications filed by awarded consortia within 3 years before the event and the measurement year. | Defined by the application form (Baseline assessment) Secondary data | Application form (Baseline assessment) Secondary data Beneficiary report/Follow-up survey with firm | Beneficiaries report every 6 months after project start | By type, status (filed, registered/approved), type of procedure (national/international), industry, S3 thematic priority area, region | Program implementer |
| Medium-term outcome | Number of technology transfers realized between awarded firms and any PRIs/HEIs | Number of technology transfers realized within consortia members in the measurement year. The technology transfer can be in the form of R&D agreements or IP licensing agreements, or spin-offs. | Defined by the application form (Baseline assessment) Secondary data | Application form (Baseline assessment) Secondary data Beneficiary report/Follow-up survey with firm | Beneficiaries report every 6 months after project start | By type, industry, S3 thematic priority area, region | Program implementer |
| Medium-term outcome | Share of awarded projects that resulted in innovation introduction | Ratio between the number of awarded project that resulted in an innovation introduction and the number of awarded projects. Innovation is defined as new/significantly improved product/service on the market or new/significantly improved process implemented. | N/A | Beneficiary report/Follow-up survey with firm | Beneficiaries report every 6 months after project start | By industry, S3 thematic priority area, region | Program implementer |
| Long-term outcome | Increase in turnover by awarded firms | Average percentage increase in the turnover generated by awarded firms: the sum of percentage increase in turnover for each awarded firm divided by the number of awarded firms. | Defined by the application form (Baseline assessment) | Application form (Baseline assessment) Secondary data | 2 years after project completion | By industry, S3 thematic priority area, region | Grantee, managing authority |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | Secondary data | | | | |
| Long-term outcome | Increase in exports of awarded firms | Average percentage increase in the total exports generated by awarded firms: the sum of percentage increase in exports for each awarded firm divided by the number of awarded firms. | Defined by the application form (Baseline assessment) Secondary data | Application form (Baseline assessment) Secondary data | 2 years after project completion | By industry, S3 thematic priority area, region | Grantee, managing authority |
| Long-term outcome | Increase in FTE of awarded firms | Average percentage increase in the number of FTEs of awarded firms: the sum of percentage increase in FTE for each awarded firm divided by the number of awarded firms. | Defined by the application form (Baseline assessment) Secondary data | Application form (Baseline assessment) Secondary data | 2 years after project completion | By industry, S3 thematic priority area, region | Grantee, managing authority |
| Long-term outcome | Increase in productivity of awarded firms | Average percentage increase in value added (following Eurostat's definition) per FTE of awarded firms: the sum of percentage increase in value added per FTE for each awarded firm divided by the number of awarded firms. | Defined by the application form (Baseline assessment) Secondary data | Application form (Baseline assessment) Secondary data | 2 years after project completion | By industry, S3 thematic priority area, region | Grantee, managing authority |
| Long-term outcome | Improved ranking of PRIs/HEIs | Improved institutional ranking of PRIs/HEIs in the SCIMAGO Institutions Ranking | Secondary data | SCIMAGO Institutions Ranking (includes 42 institutions) | 2 years after project completion | | Managing authority |
| Long-term outcome | Number of public-private collaborations on innovation activities including awarded firms | Number of public-private collaborations on innovation activities including awarded firms before the event and at measurement year. | Defined by the application form (Baseline assessment) Secondary data | Application form (Baseline assessment) Secondary data | 2 years after project completion | By industry, S3 thematic priority area, region | Grantee, managing authority |
| Long-term outcome | Number public-private collaborations on innovation activities | Number of public-private collaborations on innovation activities including any Romanian-based firm and Romanian based PRO/HEI at baseline and at measurement year. | Secondary data | Secondary data | 2 years after project completion | By industry, S3 thematic priority area, region | Managing authority |

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| Long-term outcome | Increase in awarded firms' R&D investments | Average percentage increase in total R&D expenditures of awarded firms between baseline and measurement year: the sum of percentage increase in total R&D expenditures for each awarded firm divided by the number of awarded firms. | Defined by the application form (Baseline assessment) Secondary data | Application form (Baseline assessment) Secondary data | 2 years after project completion | By industry, S3 thematic priority area, region | Grantee, managing authority |
| Long-term outcome | Increase in awarded PRIs/HEIs' licensing and commercialization revenue | Amount of revenue generated by awarded PRIs/HEIs from technology licensing, patents, and commercialization activities. | Secondary data ? | Secondary data ? | 2 years after project completion | | Managing authority |

**APPENDIX 2**

# *Innovative Value Chain Program Results Framework*

| ToC level | Indicator | Definition | Baseline | Data source | Frequency | Disaggregation | Responsible |
|---|---|---|---|---|---|---|---|
| Input | Number of eligible consortia applying for the grant | Number of eligible consortia applying for the grant. Eligibility is described in the program documents. | N/A | Application form | By call for proposals | By call, industry, S3 thematic priority area, region, whether public-private collaboration | Program implementer |
| Input | Number of eligible consortia receiving grants | Number of eligible consortia receiving grants. Eligibility is described in the program documents. | N/A | Application form | By call for proposals | By call, industry, S3 thematic priority area, region, whether public-private collaboration | Program implementer |
| Input | Number of entities receiving grants | Number of entities that receiving grants across the selected consortia. | N/A | Application form | By call for proposals | By call, type (large firm, SMEs, PRIs), industry, S3 thematic priority area, region | Program implementer |
| Assumption | Timeliness of the selection process | Number of months between the call publication and the publication of results. | N/A | Internal project documents | By call for proposals | By call for proposals | Program implementer |
| Assumption | Timeliness of grants payments | Number of months between the publication of results and the reception of funds by grantees. | N/A | Internal project documents | By call for proposals | By call for proposals | Program implementer |
| Output | Average budget of the awarded projects | Total budget of all awarded projects divided by the number of awarded projects. | N/A | Internal project documents | By call for proposals | By call for proposals | Program implementer |
| Output | Total budget disbursed to the grantees | Total budget of all awarded projects from the instrument. | 0 | Internal project documents | By call for proposals | By call for proposals | Program implementer |
| Output | Share of awarded projects involving a collaboration between firms and PRIs | Number of awarded projects involving a public-private collaboration divided by the of number of awarded projects | N/A | Internal project documents | By call for proposals | By call for proposals | Program implementer |
| Short-term outcomes | Share of firms that have received grants using (technology or research) infrastructure and expertise of PRIs | Number of firms that have received grants using (technology or research) infrastructure and expertise of PRIs by the number of awarded firms | Defined by the application form | Application form (Baseline assessment) Beneficiary report | Beneficiaries report every 6 months after project start | By firm size, industry, S3 thematic priority area, region | Program implementer |
| Short-term outcomes | Share of firms that have received grants | Number of firms that have received grants acquiring advisory services eligible for | Defined by the | Application form (Baseline | Beneficiaries report every 6 | By firm size, industry, S3 thematic priority area, region | Program implementer |

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|---|---|---|---|---|---|---|---|
| | acquiring advisory services eligible for the grant | the grant by the number of awarded firms | application form | assessment) Beneficiary report | months after project start | | |
| Short-term outcomes | Increase in R&D personnel of participating firms | Average percentage increase in R&D staff (FTE) of awarded firms between baseline and measurement year. FTE is obtained by comparing the firms' employees' average number of hours worked to the average number of hours of a full-time worker. A full-time person is therefore counted as one FTE, while a part-time worker gets a score in proportion to the hours he or she works. | Defined by the application form | Application form (Baseline assessment) Beneficiary report | Beneficiaries report every 6 months after project start | By firm size, industry, S3 thematic priority area, region | Program implementer |
| Short-term outcomes | Private investments made by participating firms' (SMEs, larger firms) for piloting, demonstration, commercialization and scale-up of innovative products and services for the financed projects | Total R&D expenditures non covered by the grant (matching funds) of participating firms for the financed projects. | Defined by the application form | Application form (Baseline assessment) Beneficiary report | Beneficiaries report every 6 months after project start | By firm size, industry, S3 thematic priority area, region, TRL level | Program implementer |
| Assumption | Grantees' reporting burden | Participating consortia' self-reported time (in hours) spent to prepare the beneficiary report. | N/A | Beneficiary report | Beneficiaries report every 6 months after project start | | Program implementer |
| Medium-term outcomes | Number of products/services stemming from SMEs integrated into larger companies supply chains | Number of products/services stemming from SMEs integrated into larger companies supply chains. | Defined by the application form | Application form (Baseline assessment) Beneficiary report | Beneficiaries report every 6 months after project start Final beneficiary report 2 years after end of project implementation | By firm size, industry, S3 thematic priority area, region, TRL level | Program implementer |
| Medium-term outcome | Number of innovations introduced by the financed projects | Number of innovations introduced by the financed projects. Innovation is defined as new/significantly improved product/service on the market | N/A | Beneficiary report (Follow-up survey with firm) | By call Beneficiary report every 6 months after project start Final beneficiary report 2 years | By industry, S3 thematic priority area | Grantee, managing authority |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | or new/significantly improved process implemented. | | | after end of project implementation | | |
| Medium-term outcome | Share of participating large companies that have introduced one innovation | Ratio between the number of participating large companies that introduced an innovation and the number of participating large companies. Innovation is defined as new/significantly improved product/service on the market or new/significantly improved process implemented. | Defined by the application form (Baseline assessment) Secondary data | Application form (Baseline assessment) Secondary data (Eurostat) Beneficiary report (Follow-up survey with firm) | By call Beneficiary report every 6 months after project start Final beneficiary report 2 years after end of project implementation | By industry, S3 thematic priority area | Grantee, managing authority |
| Medium-term outcome | Share of participating SMEs that have produced one innovation | Ratio between the number of participating SMEs that produced an innovation and the number of participating SMEs. Innovation is defined as new/significantly improved product/service on the market or new/significantly improved process implemented. | Defined by the application form (Baseline assessment) Secondary data | Application form (Baseline assessment) Secondary data (Eurostat) Beneficiary report (Follow-up survey with firm) | By call Beneficiary report every 6 months after project start Final beneficiary report 2 years after end of project implementation | By industry, S3 thematic priority area | Grantee, managing authority |
| Medium-term outcome | Number of public-private co-publications including a participating firm | Number of public-private coauthored publications within 3 years before the event and at measurement year. The public-private co-publications are defined as all research-related papers (research articles, research reviews, notes, letters) published in the Web of Science database. | Defined from secondary data (Web of Science) | Secondary data (Web of Science) | By call 3 years after the call | By firm size, research field, industry, S3 thematic priority area | Managing authority |
| Medium-term outcome | Number of technology transfers realized between participating firms and PRIs | Number of technology transfers (R&D agreements or IP licensing agreements, or spin-offs) realized between participating firms and a PRI within 3 years before the event and the measurement year. | Defined by the registration form (Baseline assessment) | Application form (Baseline assessment) Beneficiary report (Follow-up survey with firm) | By call Beneficiary report every 6 months after project start Follow up survey 3 years after the project start | By firm size, industry, S3 thematic priority area. | Grantee, managing authority |

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|---|---|---|---|---|---|---|---|
| Medium-term outcome | Number of IP applications filed by participating consortia | Number of IP (patents, protected trademarks, industrial design) applications filed by targeted verticals within 3 years before the event and the measurement year. | Defined by the application form (Baseline assessment) Secondary data | Application form (Baseline assessment) Secondary data (Eurostat) Beneficiary report (Follow-up survey with firm) | Beneficiaries report every 6 months after project start | By type, status (filed, registered/approved), type of procedure (national/international), industry, S3 thematic priority area, region | Program implementer, managing authority |
| Medium-term outcomes | Participating firms' perceived barriers to public-private collaborations | Participating firms' self-reported barriers to conduct any or more collaborations with PRIs for their innovation activities before and after the event. Score obtained from a Likert scale from (1) Strongly disagree to (5) Strongly agree on the following items:<br>-We are uncertain about the capabilities of research organizations and/or universities<br>-Research organizations and/or universities do not understand our needs<br>-The services of research organizations and/or universities are very expensive<br>-We believe the services of research organizations and/or universities prioritize different outputs than us<br>-We believe the services of research organizations and/or universities have very different timelines than ours<br>-We have confidentiality concerns<br>-We do not know how to start a collaboration<br>(Adapted from Croatia's M&E framework report and Croatia's matchmaking project) | Defined by the application form (Baseline assessment) | Application form (baseline assessment) Follow-up survey with firm | 3 years after the project start | By firm size, industry, S3 thematic priority area, prior experience collaborating with a PRI | Grantee, Implementer |

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|---|---|---|---|---|---|---|---|
| Long-term outcome | Number public-private collaborations on innovation activities | Number of public-private collaborations on innovation activities including any Romanian-based firm and Romanian based PRO/HEI at baseline and at measurement year. | Defined by the application form (Baseline assessment) Secondary data | Application form (Baseline assessment) Secondary data (Eurostat) | 6 years after the start of the project | | Managing authority |
| Long-term outcome | PRIs' licensing and commercialization revenue | Amount of revenue generated by PRIs from technology licensing, patents, and commercialization activities. | Secondary data (if primary data not available) | Secondary data (if primary data not available) | 6 years after the start of the project | | Managing authority |
| Long-term outcome | Increase in participating PRIs and firms' participation in European-funded projects | Average percentage increase in the number of European-funded projects to which the participating entity takes part between baseline and measurement year: the sum of percentage increase in total number of European-funded to which a participating entity takes part projects divided by the number of participating entities | Secondary data | Secondary data (CORDIS) | 6 years after the start of the project | By type (PRIs, SMES, large firms), industry, S3 thematic priority area | Managing authority |
| Long-term outcome | Increase in participating firms' R&D investments | Average percentage increase in total R&D expenditures of participating firms between baseline and measurement year: the sum of percentage increase in total R&D expenditures for each participating firm divided by the number of participating firms. | Defined by the application form (Baseline assessment) Secondary data | Application form (Baseline assessment) Secondary data (Eurostat) | 6 years after the start of the project | By firm size, industry, S3 thematic priority area | Grantee, managing authority |
| Long-term outcome | Increase in turnover of participating firms . | Average percentage increase in the turnover generated by participating firms: the sum of percentage increase in turnover for each participating firm divided by the number of participating firms. | Defined by the registration form (Baseline assessment) Secondary data | Application form (Baseline assessment) Secondary data (Eurostat) | 6 years after the start of the project | By firm size, industry, S3 thematic priority area | Grantee, managing authority |

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| Long-term outcome | Increase in exports of participating firms | Average percentage increase in the total exports generated by participating firms: the sum of percentage increase in exports for each participating firm divided by the number of participating firms. | Defined by the registration form (Baseline assessment) Secondary data | Application form (Baseline assessment) Secondary data (INS) | 6 years after the start of the project | By firm size, industry, S3 thematic priority area | Grantee, managing authority |
| Long-term outcome | Increase in FTE of participating firms | Average percentage increase in the number of FTEs of participating firms: the sum of percentage increase in FTE for each participating firm divided by the number of participating firms. | Defined by the registration form (Baseline assessment) Secondary data | Application form (Baseline assessment) Secondary data (Eurostat) | 6 years after the start of the project | By firm size, industry, S3 thematic priority area | Grantee, managing authority |
| Long-term outcome | Increase in productivity of participating firms | Average percentage increase in value added (following Eurostat's definition) per FTE of participating firms: the sum of percentage increase in value added per FTE for each participating firm divided by the number of participating firms. | Defined by the registration form (Baseline assessment) Secondary data | Application form (Baseline assessment) Secondary data (Eurostat) | 6 years after the start of the project | By firm size, industry, S3 thematic priority area | Grantee, managing authority |
| Long-term outcome | Increase in firms' R&D investments in the targeted verticals | Average percentage increase in total R&D expenditures of firms in the targeted verticals between baseline and measurement year: the sum of percentage increase in total R&D expenditures for each firm in the targeted verticals divided by the number of firms in the targeted verticals. | Defined by the application form (Baseline assessment) Secondary data | Application form (Baseline assessment) Secondary data (Eurostat) | 6 years after the start of the project | By firm size, industry, S3 thematic priority area | Grantee, managing authority |
| Long-term outcome | Increase in turnover of firms in the targeted verticals | Average percentage increase in the turnover generated by firms in the targeted verticals: the sum of percentage increase in turnover for each firm in the targeted verticals divided by the number of firms in the targeted verticals. | Defined by the registration form (Baseline assessment) Secondary data | Application form (Baseline assessment) Secondary data (Eurostat) | 6 years after the start of the project | By firm size, industry, S3 thematic priority area | Grantee, managing authority |
| Long-term outcome | Increase in exports of firms in the targeted verticals | Average percentage increase in the total exports generated by firms in the targeted verticals: the sum of percentage increase in exports for each firm in the targeted verticals divided by | Defined by the registration form (Baseline assessment) Secondary data | Application form (Baseline assessment) Secondary data (INS) | 6 years after the start of the project | By firm size, industry, S3 thematic priority area | Grantee, managing authority |

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| | | the number of firms in the targeted verticals. | | | | | |
| Long-term outcome | Increase in FTE of firms in targeted verticals | Average percentage increase in the number of FTEs of firms in the targeted verticals: the sum of percentage increase in FTE for each firm in the targeted verticals divided by the number of firms in the targeted verticals. | Defined by the registration form (Baseline assessment) Secondary data | Application form (Baseline assessment) Secondary data (Eurostat) | 6 years after the start of the project | By firm size, industry, S3 thematic priority area | Grantee, managing authority |
| Long-term outcome | Increase in productivity of firms in targeted verticals | Average percentage increase in value added (following Eurostat's definition) per FTE of firms in the targeted verticals: the sum of percentage increase in value added per FTE for each firm in the targeted verticals divided by the number of firms in the targeted verticals. | Defined by the registration form (Baseline assessment) Secondary data | Application form (Baseline assessment) Secondary data (Eurostat) | 6 years after the start of the project | By firm size, industry, S3 thematic priority area | Grantee, managing authority |

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# *Matchmaking Program Results Framework*

| ToC level | Indicator | Definition | Baseline | Data source | Frequency | Disaggregation | Responsible |
|---|---|---|---|---|---|---|---|
| Input | Total budget disbursed to the grantees | Sum of the monetary value of all grants allocated under this instrument. | 0 | Internal project documents | By call for proposals | | Implementer |
| Input | Average budget disbursed to grantees | Average monetary amount distributed to grantees under this instrument. | N/A | Internal project documents | By calls for proposals | | Implementer |
| Input | Number of events organized | Number of matchmaking events organized by grantees. | N/A | Registration form | By call for proposals | | Grantee |
| Output | Number of eligible organizations applying for the grant | Number of eligible organizations applying for the grant. Eligibility is described in the program documents and verified by the implementer. | N/A | Application form | By call for proposals | | Implementer |
| Assumption | Number of firms applying for the event organized by the grantees | Number of firms applying to register to the events organized by the grantees. | N/A | Registration form | By event organized | By grantee, firm size, industry, RIS3 thematic priority area, prior experience with public-private collaboration | Grantee |
| Assumption | Number of PRIs/HEIs applying for the event organized by the grantees | Number of PRIs/HEIs applying to register to the events organized by the grantees. | N/A | Registration form | By event organized | By grantee, PRI vs HEI, research field. If of interest, we could consider type (for HEIs: university, academy, polytechnical university, institute, university college, postgraduate schools; for PRIs: by research orientation - basic research, applied research, both equally present). | Grantee |

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| Short-term outcome | Number of firms participating in supported events organized by the grantees | Head count of firms represented by one or several individuals taking part in events organized by grantees as part of their grant. | 0 | Attendance list | By event organized | By grantee, firm size, industry, S3 thematic priority area, prior experience with public-private collaboration | Grantee |
| Short-term outcome | Number of PRIs/HEIs participating in supported events organized by the grantees | Head count of PRIs and of HEIs represented by one or several individuals taking part in events organized by grantees as part of their grant. | 0 | Attendance list | By event organized | By grantee, PRI vs HEI, research field If of interest, we could consider type (for HEIs: university, academy, polytechnical university, institute, university college, postgraduate schools; for PRIs: by research orientation - basic research, applied research, both equally present). | Grantee |
| Short-term outcome | Number of participants in supported events organized by the grantees | Head count of individuals participating in events organized by grantees as part of their grant. | 0 | Attendance list | By event organized | By grantee, participants' prior personal experience with public-private collaboration, sector (public or private), technical VS managerial role, gender | Grantee |
| Short-term outcome | Participating firms' knowledge of event participants about potential partners for collaborations | Knowledge of firms participating in events organized by grantees as part of their grant about potential scientists for collaborations before and after the event. Please rate the following statement on a scale from 1 (Not true at all) to 5 (Very true). We do not have enough information about which firms to collaborate with. | Defined by the registration form | Registration form Post-event survey with firms | By event organized | By grantee, firm size, industry, S3 thematic priority area, prior experience with public-private collaboration | Grantee, Implementer |

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| Short-term outcome | Participating firms' interest in starting a collaboration with events' participants | Participating firms' self-reported intention to contact scientists that took part in the event within six months for a potential collaboration. Please rate the following statement on a scale from 1 (Not likely at all) to 5 (Very likely). We will contact one or several scientists met during the event in the next six months to discuss potential collaborations. | Defined by the registration form | Registration form<br>Post-event survey with firms | By event organized | By grantee, firm size, industry, S3 thematic priority area, prior experience with public-private collaboration | Grantee, Implementer |
| Short-term outcome | Participating firms' perceived barriers to public-private collaborations | Participating firms' self-reported barriers to conduct any or more collaborations with PRIs/HEIs for their innovation activities before and after the event. Score obtained from a Likert scale from (1) Strongly disagree to (5) Strongly agree on the following items:<br>-We are uncertain about the capabilities of research organizations and/or universities<br>-Research organizations and/or universities do not understand our needs<br>-The services of research organizations and/or universities are very expensive<br>-We believe the services of research organizations and/or universities prioritize different outputs than us<br>-We believe the services of research organizations and/or universities have very different timelines than ours<br>-We have confidentiality concerns<br>-We do not know how to start a collaboration<br>(Adapted from Croatia's M&E framework report and Croatia's matchmaking project) | Defined by the registration form | Registration form<br>Post-event survey with firms | By event organized | By grantee, firm size, industry, S3 thematic priority area, prior experience with public-private collaboration | Grantee, Implementer |

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| Short-term outcome | Number of participating firms that initiated a collaboration with a PRO/HEI for innovation activities | Number of participating firms collaborating with a PRO/HEI for conducting innovation activities within 3 years before participating in the event and 6 months after the event organized by grantees as part of their grant. Collaborative innovation activities include all developmental, financial and commercial activities undertaken by a firm together with a PRO/HEI and that are intended to result in an innovation for the firm. An innovation is a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process). (OECD, Oslo manual) Collaborations include a joint publication, joint submission of a project proposal or a new contracted collaborative project, other formal agreements and contracts, memoranda of understanding and other forms of collaboration involving the participating firm and a PRO/HEI for innovation activities. | Defined by the registration form Secondary data | Registration form Follow-up survey with firms | By event organized Follow-up survey one year after the event | By firm size, research field, industry, S3 thematic priority area | Grantee, Implementer |
| Short-term outcome | Number of public-collaborations initiated by participating firms applying for public (national or European) funds | Number of participating firms applying jointly with a PRO/HEI for funds provided by national or European programs. | Defined by the registration form Secondary data | Registration form Follow-up survey with firms | By event organized Follow-up survey one year after the event | By firm size, research field, industry, S3 thematic priority area | Grantee, Implementer |
| Assumption | Share of sustained collaborations between participating firms | Ratio between the number of participating firms that completed (but not interrupted) or are still in collaboration with a PRO/HEI | 0 | Follow-up survey with firms | Follow-up survey 3 years after the event | By firm size, research field, industry, S3 thematic priority area | Implementer |

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| | and a PRO/HEI for innovation activities | for innovation activities 3 years after the event and the number of participating firms that had initiated a collaboration 1 year after the event. | | | | | |
| Assumption | Quality of participating firms' collaborations with PRIs/HEIs | Participating firms' perceived quality of collaboration with PRO/HEI within 3 years before the event and measurement year. Likert scale 1 (extremely bad) to 5 (extremely good). | Defined by the registration form | Registration form<br>Follow-up survey with firms | By event organized<br>Follow-up survey 3 years after the event | By firm size, research field, industry, S3 thematic priority area | Grantee, Implementer |
| Medium-term outcome | Increase in participating firms' R&D investments | Average percentage increase in total R&D expenditures of participating firms between baseline and measurement year. | Defined by the registration form (Baseline assessment)<br>Secondary data | Registration form (Baseline assessment)<br>Secondary data<br>Beneficiary report (if coupled with a matching or collaborative grant)/Follow-up survey with firm | By event<br>Beneficiary report every 6 months after project start<br>Follow up survey 3 years after the event | By firm size, industry, S3 thematic priority area, source of funds, whether there is collaboration | Grantee, Implementer |
| Medium-term outcome | Increase in participating firms' R&D staff | Average percentage increase in R&D staff (FTE) of participating firms between baseline and measurement year. FTE is obtained by comparing the firms' employees' average number of hours worked to the average number of hours of a full-time worker. A full-time person is therefore counted as one FTE, while a part-time worker gets a score in proportion to the hours he or she works. | Defined by the registration form (Baseline assessment)<br>Secondary data | Registration form (Baseline assessment)<br>Secondary data<br>Beneficiary report/Follow-up survey with firm | By event<br>Beneficiary report every 6 months after project start<br>Follow up survey 3 years after the event | By researchers VS auxiliary staff, firm size, industry, S3 thematic priority area, whether there is collaboration | Grantee, Implementer |
| Medium-term outcome | Number of public-private co-publications including a participating firm | Number of public-private coauthored publications within 3 years before the event and at measurement year. The public-private co-publications are defined as all research-related papers (research articles, research reviews, notes, letters) | Defined from secondary data (Web of Science) | Secondary data (Web of Science) | By event<br>3 years after the event | By firm size, research field, industry, S3 thematic priority area | Managing authority |

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| | | published in the Web of Science database. | | | | | |
| Medium-term outcome | Number of IP applications filed by participating firms | Number of IP (patents, protected trademarks, industrial design) applications filed by participating firms within 3 years before the event and the measurement year. | Defined by the registration form (Baseline assessment) Secondary data | Registration form (Baseline assessment) Secondary data Beneficiary report/Follow-up survey with firms | By event Beneficiary report every 6 months after project start Follow up survey 3 years after the event | By type, status (filed, registered/approved), type of procedure (national/international), industry, S3 thematic priority area. | Grantee, managing authority |
| Medium-term outcome | Number of technology transfers realized between participating firms and PRIs/HEIs | Number of technology transfers (R&D agreements or IP licensing agreements, or spin-offs) realized between participating firms and a PRO/HEI within 3 years before the event and the measurement year. | Defined by the registration form (Baseline assessment) Secondary data | Registration form (Baseline assessment) Secondary data Beneficiary report/Follow-up survey with firm | By event Beneficiary report every 6 months after project start Follow up survey 3 years after the event | By type, industry, S3 thematic priority area. | Grantee, managing authority |
| Medium-term outcome | Share of participating firms that have introduced one innovation | Ratio between the number of participating firms that introduced an innovation and the number of participating firms. Innovation is defined as new/significantly improved product/service on the market or new/significantly improved process implemented. | Defined by the registration form | Registration form (Baseline assessment) Secondary data Beneficiary report/Follow-up survey with firm | By event Beneficiary report every 6 months after project start Follow up survey 3 years after the event | By firm size, industry, S3 thematic priority area | Grantee, managing authority |
| Long-term outcome | Increase in turnover of participating firms. | Average percentage increase in the turnover generated by participating firms: the sum of percentage increase in turnover for each participating firm divided by the number of participating firms. | Defined by the registration form (Baseline assessment) Secondary data | Registration form (Baseline assessment) Secondary data | 6 years after the event | By firm size, industry, S3 thematic priority area | Grantee, managing authority |

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| Long-term outcome | Increase in exports of participating firms | Average percentage increase in the total exports generated by participating firms: the sum of percentage increase in exports for each participating firm divided by the number of participating firms. | Defined by the registration form (Baseline assessment) Secondary data | Registration form (Baseline assessment) Secondary data | 6 years after the event | By firm size, industry, S3 thematic priority area | Grantee, managing authority |
| Long-term outcome | Increase in FTE of participating firms | Average percentage increase in the number of FTEs of participating firms: the sum of percentage increase in FTE for each participating firm divided by the number of participating firms. | Defined by the registration form (Baseline assessment) Secondary data | Registration form (Baseline assessment) Secondary data | 6 years after the event | By firm size, industry, S3 thematic priority area | Grantee, managing authority |
| Long-term outcome | Increase in productivity of participating firms | Average percentage increase in value added (following Eurostat's definition) per FTE of participating firms: the sum of percentage increase in value added per FTE for each participating firm divided by the number of participating firms. | Defined by the registration form (Baseline assessment) Secondary data | Registration form (Baseline assessment) Secondary data | 6 years after the event | By firm size, industry, S3 thematic priority area | Grantee, managing authority |
| Long-term outcome | Improved ranking of PRIs/HEIs that collaborated with participating firms | Change in institutional ranking of PRIs/HEIs that collaborated with a participating firm since the event in the SCIMAGO Institutions Ranking between baseline and measurement year. | Secondary data | SCIMAGO Institutions Ranking (includes 42 institutions) | 6 years after the event | | Managing authority |
| Long-term outcome | Number of public-private collaborations on innovation activities including participating firms | Number of public-private collaborations on innovation activities including participating firms before the event and at measurement year. | Defined by the registration form (Baseline assessment) Secondary data | Registration form (Baseline assessment) Secondary data | 6 years after the event | By firm size, industry, S3 thematic priority area | Grantee, managing authority |
| Long-term outcome | Number public-private collaborations on innovation activities | Number of public-private collaborations on innovation activities including any Romanian-based firm and Romanian based PRO/HEI at baseline and at measurement year. | Secondary data | Secondary data | 6 years after the event | | Managing authority |

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| Long-term outcome | Increase in participating firms' R&D investments | Average percentage increase in total R&D expenditures of participating firms between baseline and measurement year: the sum of percentage increase in total R&D expenditures for each participating firm divided by the number of participating firms. | Defined by the registration form (Baseline assessment) Secondary data | Registration form (Baseline assessment) Secondary data | 6 years after the event | By firm size, industry, S3 thematic priority area | Grantee, managing authority |
| Long-term outcome | PRIs/HEIs' licensing and commercialization revenue | Amount of revenue generated by PRIs/HEIs from technology licensing, patents, and commercialization activities. | Secondary data ? | Secondary data ? | 6 years after the event | | Managing authority |

# Appendix 3. Impact Evaluation Plans for Pilot Instruments

**Conducting impact evaluations is crucial to identifying which instruments or programs work, for whom, under what conditions, and at what costs**. Evaluations can generate valuable lessons for policy learning and evidence-based decision making. What sets impact evaluations apart from other evaluation approaches is their emphasis on causality, i.e., the clear linkage between the actions and their intended or unintended impacts. Impact evaluations rely on the rigorous comparison between instruments and policies' intended beneficiaries and non-beneficiaries serving as a comparison group. They strive to answer questions like "What would have happened in the absence of the intervention?" or "What is the attributable impact of the intervention?"

**The so-called gold standard to identify the causal effects of instruments and policies is based on the application of the randomized controlled trial (RCT)**. RCTs involve randomly assigning potential beneficiaries into a group of instrument or program participants and a comparison group. The random assignment of potential beneficiaries into two groups, a program and a comparison group, is widely used in medicine and increasingly applied in social sciences worldwide. RCTs are considered the gold standard for evaluating the causal impact of specific interventions or policies. By randomly assigning participants, RCTs help ensure that any observed differences between the groups can be attributed to the intervention rather than to other factors. This random assignment allows for drawing reliable conclusions about the effectiveness of the intervention and establishing causal relationships between the intervention and the outcomes of interest. Randomization should not always be used to select beneficiaries, but only at one point in time, after which the usual way of selecting beneficiaries can be followed. Randomization, however, might not always be feasible. For instance, establishing a suitable comparison group is challenging when a policy is only targeted at 50 beneficiaries. A minimal sample size is required to ensure that randomization leads to similar characteristics among randomly assigned beneficiaries and non-beneficiaries.

**Because randomization might not always be feasible, quasi-experimental methods are the second-best evaluation designs.** Quasi-experimental methods share similarities with experimental designs, such as RCTs, but lack full control over the assignment of participants to an instrument or program and comparison groups. They also involve comparing groups that are exposed to the intervention with similar groups that are not, allowing for causal inference. Each quasi-experimental method requires method-specific identifying conditions that allow accounting for some but not all potential confounding factors. The common ground of the identifying conditions is the need to collect data to verify them (which needs to be planned carefully). The four most common quasi-experimental methods are difference-in-differences (DiD), regression discontinuity, propensity score matching, and instrumental variables.

- **Difference-in-differences** is a statistical method that compares the changes in outcomes between a group of intended beneficiaries and a group of non-beneficiaries before and after an intervention, with the identifying condition being the assumption that the average pre-intervention trends of the two groups would have remained parallel in the absence of the intervention.

- **Regression discontinuity** is a research design that takes advantage of a predefined cutoff point determining the assignment of policy beneficiaries to compare the outcomes of individuals just above (intended beneficiaries) and just below (non-beneficiaries) the cutoff. The identifying condition is the assumption that beneficiaries just above and non-beneficiaries just below the cutoff point have, on average, similar observable characteristics before the start of instrument or policy implementation.
- **Propensity score matching** is a statistical technique that matches intended beneficiaries and non-beneficiaries based on their propensity scores, corresponding to the estimated probabilities of receiving the instrument or policy interventions. The identifying condition is the assumption that the groups are similar, on average, in all observed characteristics that should not be affected by the instrument or policy interventions after matching.
- **Instrumental variables approach** is a statistical technique relying on an external source of variation in instrument or policy participation to estimate the policy impacts. This source should be outside individuals' control and independent of their characteristics while increasing the likelihood of their receiving instrument or policy interventions. The identifying condition is that the instrumental variable affects outcomes only through its impact on the program.

Independent of experimental or quasi-experimental method, two essential conditions need to be fulfilled for an impact evaluation: an eagerness to learn and a commitment to a credible comparison group. To find out what works best for whom at which costs, establishing a group of non-beneficiaries that can serve as comparison group and ensuring that this group does not receive the instrument or policy interventions during their implementation is an absolute requirement. An interest in working together with a team of independent evaluators that are conducting the evaluation and acquiring knowledge on how to improve investments is also essential.

## *I. Matchmaking Program Impact Evaluation Plan*

### Background

**Matchmaking can be a key instrument to support the establishment of linkages between firms and scientists.** Currently**,** the Romanian innovation ecosystem is characterized by relatively poor linkages/interactions between the private sector and PRIs. Firms and scientists do not collaborate for a variety of reasons, including information frictions, behavioral biases, high/uncertain transaction costs, and financial constraints. In Romania, collaboration often occurs within the same university network and through personal contacts.

**To increase the number of successful business-science collaborations, matchmaking events and matchmaking support shall be provided by an implementing partner**. While the events help to bring together potential partners, the support focuses on establishing business-science collaborations based on background characteristics, such as fields of expertise, location, and needs. Once the linkages between scientist and firms are created, the partnerships shall be supported through intensive handholding and knowledge transfer on key questions related to IP regulations, partnership agreements, and certification processes, amongst others. The matched pairs of scientists and business shall then be encouraged and supported to work on concrete projects, to establish cooperation agreements and eventually generate joint innovations.

## Evaluation Questions

**The impact evaluation will be conducted to assess if the matchmaking initiative is an effective and cost-efficient investment to increase the number of successful business-science collaborations**. The goal is to evaluate the impacts of business-science matchmaking support in promoting linkage-building and R&D collaboration. The rigorous impact evaluation shall provide insights into the ways and importance of supporting business-science collaboration in driving collaborations and eventually innovation.

**The evaluation shall help policymakers to identify what type of support works, for whom, and under which conditions**. More specifically, the following evaluation questions shall be answered:

1. **Creating Matches**: Does suggesting potential pre-selected partners result in a business-science match for the duration of program implementation? In other words, what is the likelihood that firms will be interested in the profiles of the scientists shortlisted for them? How does the final selection of matched partners differ from initial expectations about the "ideal" business/science partner?
2. **Impact of Matchmaking**: What is the impact of matchmaking on business-science collaborations, perceptions about scientists, and firm-performance?
3. **Heterogeneous Effects of Matchmaking**: What type of firms benefit most from matchmaking? In what type of sectors are they operating, what is their age, and size? Who, within the firm, should ideally be targeted for larger impacts?

## Evaluation Design

**The evaluation design follows four steps: outreach, eligibility, random assignment to the matchmaking initiative, and follow-up measures of outcomes with selected and non-selected group of firms**. First, a large outreach campaign shall reach many firms and scientists to register for matchmaking support. Second, an eligible pool of scientists and firms is shortlisted following specific eligibility criteria. Third, due to limited available spots in each phase of the matchmaking initiative, a lottery shall decide among the eligible pool who will participate in the first (pilot) phase. Fourth, the firms randomly selected for the matchmaking initiative and non-selected firms will be re-contacted after the end of the matchmaking initiative and information will be independently collected on their firm performance and in particular investments and engagement in R&D with new partners. Differences in outcomes will help identify the impacts of the matchmaking initiative. The next paragraphs describe the four steps in greater detail.

**In the first step of the evaluation, a large outreach campaign shall reach many firms and scientists that would be invited to register through a simplified registration form on a dedicated website**. In more detail, applications would be open to all scientists who, through the matchmaking events, would want to connect with companies for the purpose of commercializing their scientific work, potentially starting new projects and collaborations. At the same time, all business entities registered in Romania, regardless of their size and sector of activity, who need cooperation with the scientific community in order to start and strengthen their business activities could apply. Ideally, they would already invest in some form of R&D. The outreach campaign shall make clear that this is a pilot project and that not everyone will be selected for the first phase.

**In the second step, the eligibility criteria would be applied, and the matchmaker team would shortlist the eligible pool of scientists and firms – those that are likely to benefit from the**

**matchmaking**. It is essential for the impact evaluation design that all firms are serious about their involvement, i.e., commit to send relevant representatives to the matchmaking events who are knowledgeable of their R&D investments or investment plans. All eligible firms will need to commit to be recontacted even if they are not selected for the first phase of the matchmaking support.

**In the third step, a random assignment (i.e., a lottery) shall decide who will eventually be selected for the first (pilot) phase of the matchmaking support**. If the outreach campaign works well and the interest in the matchmaking is high, the matchmaking initiative will have limited available spots (e.g., for 100 firms) to ensure high-quality matchmaking support. Thus, all eligible firms registering for the matchmaking event (required total sample size is of at least 200 firms) will be randomly divided into two groups: the comparison group (at least 100 firms) and the program-selected group (at least 100 firms). The program-selected group will start with the matchmaking activities, while the comparison group will be used to observe what would have happened to the program group in the absence of having been selected to the matchmaking initiative (i.e., represent the so-called counterfactual state). This pilot phase of the matchmaking initiative shall generate evidence of its effectiveness. If proven effective, the initiative can be repeated in later years and also be implemented with the comparison group.

**Program-selected firms will be invited to participate in a number of activities, while firms in the comparison group will not be invited to any of these components**. The activities of the matchmaking initiative include, first, invitations to a set of in-person events including workshops to catalyze collaborations and include facilitated brainstorming sessions to identify joint areas for collaboration and the provision of informational materials that would facilitate a collaboration such as model templates for allocation of IP resulting from the partnership (if any). Second, firms and scientists shall be actively matched. Thereby, firms will suggest up to three scientist matches for each program-selected firm. The third will be post-workshop support in facilitating the resolution of any issues in the collaboration.

**It is also envisioned to test the matchmaking initiative against an alternative, more cost-efficient approach that would involve a digital outreach of the firms to scientists**. Firms share their technological problem by filling out a simple form on a platform. Once the challenge was analyzed, the firm is connected with scientists to provide comprehensive assistance in the firm's R&D activities. The solution to the firm's challenge is accurately tailored to the needs.

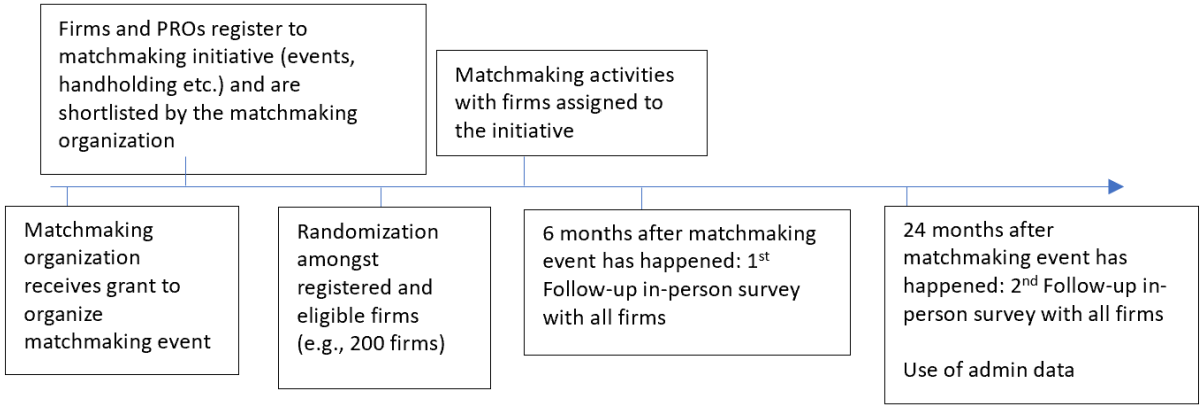
**Timing of Outcome Measurements, Data Sources, and Indicators**

**The impact evaluation shall make use of three sources of information to measure impacts.** First, program-implementation data, incl. registration forms of firms and scientists and information on attendance and participation in matchmaking events. Second, in-person surveys conducted with all eligible firms and scientists. Third, administrative data and publicly available information capturing relevant firm-level performance indicators.

**Each of the three data sources is used at different points in time during the impact evaluation to measure changes induced by the matchmaking support**. Outcomes will be measured at least at three points of time: before, during, and after the matchmaking support. Measuring or assessing characteristics or outcomes before the launch of the matchmaking support is also referred to as the baseline or needs assessment. The baseline assessment of firms can be realized within the registration form of firms to participate in the matchmaking event. Outcomes measured during implementation are obtained from in-person surveys with all firms

(also referred to as follow-up survey). Program-implementation data should be used to monitor the successful implementation of the matchmaking support and uptake by firms. Finally, an in-person survey with all firms will capture the outcomes after the support has ended. The final assessment or measurement of outcomes after the intervention has been implemented is referred to as endline. Endline outcomes can also be taken from administrative data under the assumption that the data is accessible and can be uniquely matched to each firm. The outcomes collected after the end of the matchmaking support are those used for the comparison between the program-selected and the comparison group. Please see Figure 22 for a tentative timeline.

**Figure 22 Matchmaking evaluation timeline**




**Key outcome indicators are classified into short-term outcomes, mid-term and long-term outcomes.** The short-term outcomes shall help capturing the effects or changes that are measured and observed during the implementation of the initiative and over a relatively brief period of time following the implementation end of the initiative (e.g., weeks or few months after the end of implementation). The mid-/long-term outcomes refer to effects or changes that may take longer (e.g., years after the end of implementation) to manifest. Table 38 lists short-term outcomes which should be measured 6 months after the matchmaking support started. Table 39 lists mid-/long-term outcomes which should be measured in months or years after the end of the matchmaking support. The second column in both tables specifies the data sources from where the indicator should be obtained.

**Table 41 Short-term Key Outcome Indicators**

| Short-term Key Outcome Indicators | Data Sources |
|---|---|
| Firms and scientists are successfully matched in line with the suggestions by the matchmaking | In-person survey |
| Firms provide positive feedback on scientists; more positive perceptions about counterpart | In-person survey |
| More business-science exchange of ideas on processes, products, etc. | In-person survey |
| Collaboration agreement developed/ signed (yes/no) | Administrative data |
| Number of IP clauses established | Administrative data |
| Joint business plan initiated/ developed | Administrative data |
| Firm's increased utilization of research infrastructures | In-person survey |

| | |
|---|---|
| Increased size of network with the scientists | In-person survey |
| More transfer of relevant knowledge and technology from research to businesses, and vice versa | In-person survey |
| Joint grant application prepared/ submitted for funding (e.g., for matching grants) | Administrative data |
| Increased number of scientists engaged in R&D per firm | Administrative data |

**Table 42 Mid-/Long-term Key Outcome Indicators**

| Mid-/Long-term Key Outcome Indicators | Data Sources |
|---|---|
| Number of publications produced based on the collaboration | In-person survey |
| Number of patents filed (jointly with scientist and by firm alone) | Administrative data |
| Number of commercialized products (new/improved) | Administrative data |
| Quality of newly initiated R&D projects | In-person survey |
| Number of partners engaging in new R&D projects | Administrative data |

### Power Calculations

**Power calculations refer to the determination of the minimum sample size needed for a study to detect a meaningful effect**. The calculations require the assumption of a specified level of statistical significance and a desired level of statistical power. Statistical power is the probability that a study will correctly reject a false null hypothesis, indicating the ability of the study to detect a true effect if it exists.

**The power calculations are conducted for selected key short-term outcomes which are considered likely to change**. Table 43 reports the required sample sizes (last column) for different short-term outcomes based on the baseline average, expected change in outcome, and power.

**Table 43 Power Calculations**

| Outcome | Baseline average | Expected change in outcome | Expected power | Required sample size |
|---|---|---|---|---|
| Innovative enterprises that co-operated on R&D and other innovation activities with PRIs | 4.1% | 15 percentage points | 80% | 142 |
| Percent of firms that introduced a new product/service | 25.4% | 15 percentage points | 80% | 306 |
| Percent of firms that spend on R&D | 9.2% | 15 percentage points | 80% | 192 |

### Risks and Mitigation Strategies

**There is a risk that eligible firms may not participate in the interventions, which could limit the effectiveness of the impact evaluation**. This, however, would be in itself an important outcome of the project. To mitigate this risk, the outreach efforts should be designed to be as engaging and informative as possible, highlighting the potential benefits of collaboration and the specific advantages of the interventions.

**Even if firms participate in the matchmaking initiative, there is a risk that the impact may be limited if the collaborations are not successful or do not lead to tangible outcomes or if the matches do not "fit well"**. Again, this would be an important learning, captured in the firms' and researchers' feedback. To mitigate this risk, the matchmaking initiative will be designed to provide as much support and guidance as possible to the firms and researchers involved, including careful needs assessment, tailored advice, and relevant consultancy services.

**Firms might drop out of the matchmaking initiative during its implementation or might not be available for follow-up in-person surveys**. This case, when study group members drop out of the study or data on them cannot be recovered, is called attrition. The ability to detect statistically significant effects relies on low attrition rates. To mitigate the risk of attrition, firms are required to agree during registration to the matchmaking to be contacted again.

## *II. Collaborative Innovation Grant Program Impact Evaluation Plan*

### Background

**Romanian innovation ecosystem is characterized by relatively poor linkages and interactions between the private sector and PRIs**. Romania experiences a weak demand for innovation from the private sector. Innovation activities are highly concentrated among large firms, while Romanian SMEs have weak capacities to engage in innovation. There are few SMEs that engage in innovation activities, and for those that do, these activities appear highly contingent on the availability of public financing.

**Collaborative Innovation Grants tackle the under-investment of firms in innovation by providing public funding while increasing firm-scientist linkages**. Matching grants, such as the Collaborative Innovation Grant, could potentially overcome reluctance of firms to invest in innovation and stimulate new innovation activities and services. Since the projects in which the grants should be invested are collaborative projects between firms and PRIs, new collaborations are established.

### Evaluation Questions

**The impact evaluation shall be conducted to assess if the Collaborative Innovation Grants lead firms to create new or improved commercially viable products and services.** More specifically, the following evaluation questions shall be answered:

4. **Impact of Collaborative Innovation Grants**: What is the impact of the Collaborative Innovation Grants on firm performance? Does benefitting of the Collaborative Innovation Grants increase firm innovative activities, inputs, and growth?
5. **Impact of Collaborative Innovation Grants on Collaborations:** What is the impact of the Collaborative Innovation Grants on the number of assignments by firms for PRIs?
6. **Heterogeneous Effects**: What type of firms benefit most from the grants? In what type of sectors are they operating, what is their age and size? Who within the firm should ideally be targeted for larger outcomes?

## Evaluation Design

**Two evaluation designs are possible to measure the impacts of the Collaborative Innovation Grants**. In the first evaluation design, randomization into the program and comparison group is carried out among all eligible firms. In the second evaluation design, randomization into the program and comparison group is carried out among firms in a pre-defined middle range of ranks.

**Since the Collaborative Innovation Grant is a newly developed instrument, the first phase is a pilot phase used to generate evidence on the instrument's effectiveness**. Due to the piloting nature of the first phase, the number of grants is limited. Therefore, in both evaluation designs a lottery is applied to select awarded firms. If the Collaborative Innovation Grant is proven to be effective, it can be repeated in later years.

**Under the first evaluation design, the specific impact evaluation method to be employed would be a randomized control trial design with all firms applied to the Collaborative Innovation Grant**. Outcomes are measured at the firm level. All firms that applied for the Collaborative Innovation Grant (required total sample size is 200 firms) will be randomly divided into two groups: the comparison group (100 firms) and the program group (100 firms). The program group will receive financial assistance to engage in joint applied R&D and innovation projects. The comparison group will not receive any financial support.

**Under the second evaluation design, the specific impact evaluation method to be employed would be a randomized control trial design with randomization of firms that fall within a pre-defined middle range of ranks**. Outcomes are measured at the firm level. To implement the randomization, the following procedure shall be followed:

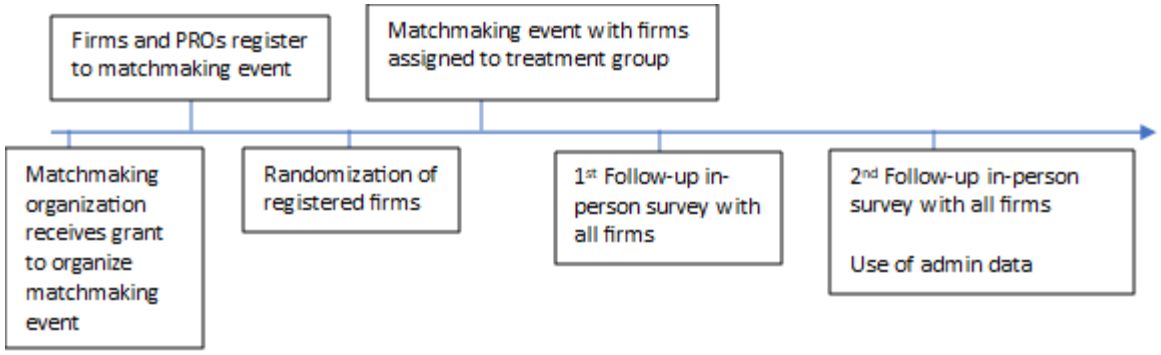
- Eligible projects will undergo an assessment based on five selection criteria, covering aspects such as quality and collaborative potential, Technological and commercial potential, and budget coherence, with scores ranging from 0 to 3. The definitions of these criteria and their respective scores will be developed jointly by the WB team and MCID.
- Eligible projects scoring 0 or 1 in three or more criteria will be considered as very low potential and will be rejected.
- Eligible projects scoring 3 in three or more criteria will directly receive the grant.
- All other eligible projects will be placed in the randomization pool. From that pool, firms are randomly (i.e., lottery) divided into two groups: the comparison group (100 firms) and the program group (100 firms).
- The program-selected group will receive financial assistance to engage in joint applied R&D and innovation projects. The comparison group will not receive any financial support.

## Timing of Outcome Measurements, Data Sources, and Indicators

**The impact evaluation shall make use of three sources of information to measure impacts.** First, program-implementation data, incl. registration forms of firms and scientists and information on attendance and participation in matchmaking events. Second, in-person surveys conducted with all eligible firms and scientists. Third, administrative data and publicly available information capturing relevant firm-level performance indicators.

**Each of the three data sources is used at different points in time during the impact evaluation to measure changes induced by the Collaborative Innovation Grants**. Outcomes will be measured at least at three points of time: before, during, and after the Collaborative Innovation Grant. Measuring or assessing characteristics or outcomes before the disbursement of the grants is also referred to as the baseline or needs assessment. The baseline assessment of firms can be realized within the application form of firms to receive the grant. Outcomes measured during implementation are obtained from in-person surveys with all firms (also referred to as follow-up survey). Program-implementation data should be used to monitor the successful disbursement and implementation of the grants. Finally, an in-person survey with all firms will capture the outcomes after the project period has ended. The final assessment or measurement of outcomes after the intervention has been implemented is referred to as endline. Endline outcomes can also be taken from administrative data. The outcomes collected after the projects have ended are those used for the comparison between the program-selected and the comparison group. Please see Figure 23 for a tentative timeline.

**Figure 23 CIGP evaluation timeline**




**Key outcome indicators are classified into short-term outcomes, mid-term and long-term outcomes.** The short-term outcomes shall help capturing the effects or changes that are measured and observed during the implementation of the initiative and over a relatively brief period of time following the implementation end of the initiative (e.g., weeks or few months after the end of implementation). The mid-/long-term outcomes refer to effects or changes that may take longer (e.g., years after the end of implementation) to manifest. Table 44 lists short-term outcomes which should be measured six months after the grant disbursement. Table 45 list mid-term/long-term outcomes which should be measured 24 months after the grant disbursement. The second column in both tables specifies the data sources from where the indicator should be obtained.

**Table 44 Short-term Key Outcome Indicators**

| Short-term Key Outcome Indicators | Data Sources |
|---|---|
| More positive perceptions about counterpart | In-person survey |
| More business-science exchange of ideas on processes, products, etc. | In-person survey |
| Collaboration agreement developed/ signed (yes/no) | Administrative data |

| | |
|---|---|
| Joint business plan initiated/ developed | Administrative data |
| Firm's increased utilization of research infrastructures | In-person survey |
| Increased size of network with the scientists | In-person survey |
| More transfer of relevant knowledge and technology from research to businesses, and vice versa | Administrative data |
| Joint grant application prepared/ submitted for funding | Administrative data |
| Increased number of scientists engaged in R&D per firm | Administrative data |
| Increased number of innovations started by the firms | In-person survey |
| Increased innovation investments by private sector firms | In-person survey |

**Table 45 Mid-/Long-term Key Outcome Indicators**

| Mid-term/Long-term Key Outcome Indicators | Data Sources |
|---|---|
| Increased number of publications produced based on the collaboration | In-person survey |
| Increased number of joint patents filed | Administrative data |
| Increased number of commercialized products (new/improved) | Administrative data |
| Number of technology transfers realized between participating firms and PRIs/HEIs | Administrative data |
| Higher quality of newly initiated R&D projects | In-person survey |
| Increased firm's revenues | Administrative data |

## Power Calculations

**Power calculations refer to the determination of the minimum sample size needed for a study to detect a meaningful effect.** The calculations require the assumption of a specified level of statistical significance and a desired level of statistical power. Statistical power is the probability that a study will correctly reject a false null hypothesis, indicating the ability of the study to detect a true effect if it exists.

**The power calculations are conducted for short-term outcomes which are considered likely to change.** Table 46 reports the required sample size for three short-term main outcomes for different short-term outcomes based on the baseline average, expected change in outcome, and power.

**Table 46 Power Calculations**

| Outcome | Baseline average | Expected change in outcome | Expected power | Required sample size |
|---|---|---|---|---|
| Innovative enterprises that co-operated on R&D and other innovation activities with PRIs | 4.1% | 15 percentage points | 80% | 142 |
| Percent of firms that introduced a new product/service | 25.4% | 15 percentage points | 80% | 306 |
| Percent of firms that spend on R&D | 9.2% | 15 percentage points | 80% | 192 |

### Risks and Mitigation Strategies

**There is a risk that eligible firms may not participate in the intervention, which could limit the effectiveness of the impact evaluation. This, however, would be in itself an important outcome of the project**. To mitigate this risk, the outreach efforts should be designed to be as engaging and informative as possible, highlighting the potential benefits of collaboration and the specific advantages of the interventions.

**Even if firms receive the Collaborative Innovation Grants, there is a risk that the impact may be limited if the collaborations are not successful or do not lead to tangible outcomes or if the matches do not "fit well"**. Again, this would be an important learning, captured in the firms' and researchers' feedback. To mitigate this risk, firms will have the option to acquire advisory services providing support and guidance to the firms and researchers involved.

**There is a risk that PRIs or scientists may not be interested in collaborating with firms or may not have the necessary expertise or resources to support the collaborations**. To mitigate this risk, the project works closely with recently collected surveys shared by the Ministry to identify potential collaborators and ensure that they are aware of the benefits of collaboration.

**Firms might drop out of the collaboration during its implementation or might not be available for follow-up in-person surveys.** This case, when study group members drop out of the study or data on them cannot be recovered, is called attrition. The ability to detect statistically significant effects relies on low attrition rates. To mitigate the risk of attrition, firms are required to agree during grant application to be contacted again.

**The before-mentioned evaluation designs rely on randomization**. Randomization might not be feasible in some cases due to financial or ethical constraints. In those cases, quasi-experimental methods can be applied.

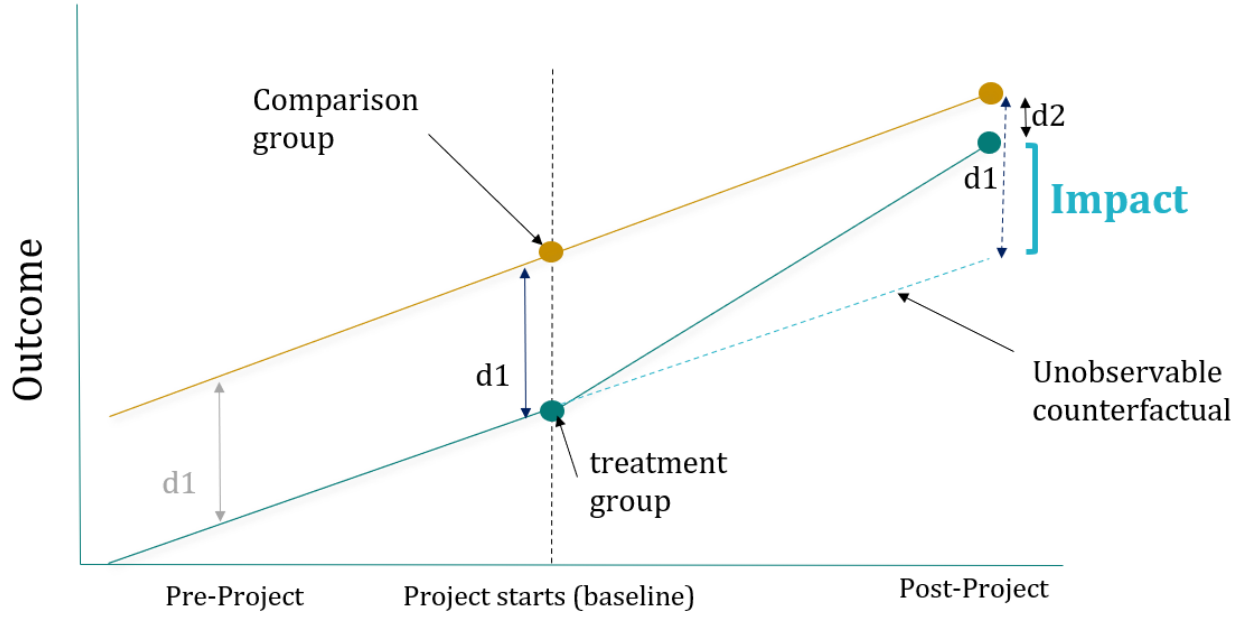
### Difference-in-Difference

**A difference-in-difference (DiD) design estimates project effects through the comparison of changes in outcomes over time between beneficiaries and the comparison group**. In case project participants may have been purposely selected (e.g., the most vulnerable population) or self-selected (e.g., the most motivated), beneficiaries and the comparison group may have on average different characteristics before the program. Therefore, a pure ex-post comparison of both groups would not allow to recover the effects of the program. Instead, we can compare changes in outcomes between the two groups, acknowledging potential initial differences.

**The necessary underlying assumption of DiD is the 'parallel trends assumption'.** This means that the change in outcomes in the treated and comparison groups would have been the same without the intervention, while the actual outcomes can rest on different levels. Thus, a DiD approach accounts for initial observable and unobservable differences between the treated and comparison groups. If initial differences are constant over time in both groups, hence, evolve in parallel, this method enables the causal identification of the impact of the program. This approach is also robust to external shocks, as long as these shocks affect both groups similarly. The parallel trends assumption is illustrated in the figure below. In this fictitious example, we want to measure the effect of an agricultural intervention, using food security as our outcome of interest. Figure 24 shows that the food security level of the treated group and that of the comparison group evolved in a similar manner (i.e., "in parallel") before the implementation of the program and would have

continued to change in the same way in the absence of the program. This is illustrated by the counterfactual (dotted green line), which represents the change in agriculture production of the treated group in the absence of the program. Based on this assumption, the change in trend observed for the treated group after the program can be uniquely attributed to the program. The effect of the program on food security is then estimated by computing the difference between d2 and d1, where d2 is the difference in outcome between the treated and comparison groups after the program and d1 is the difference in outcome between the same groups at the beginning of the program. Hence, the impact of the program corresponds to the DiD interval (orange arrows).

**Figure 24 Parallel Trend Assumptions**




Source: World Bank compilation.

**The common trends assumption can be validated via two strategies.** First, one can use data before the baseline to observe whether the outcome evolves similarly across time. However, such data is rarely available. A second strategy increasingly used is to ensure greater similarity between the groups at the beginning of the program and, thus, relies on the identification of an adequate comparison group. For rigorous impact evaluations, the DiD method will hence typically be employed in combination with other approaches, which support the identification of a comparison group comparable to the program group. In the following, we describe the two most prevalent combinations of DiD with 1) matching or 2) regression discontinuity design (RDD).

### Matching approaches

**Matching consists in using statistical techniques to construct an artificial comparison group.** For each beneficiary individual, we select a comparison individual not receiving any of the interventions, but with the most similar observable characteristics to the beneficiary. The identified characteristics are used to match beneficiaries with non-beneficiaries using Propensity Score Matching. The method predicts the probability to be part of the program for all individuals in the

program and comparison group. This probability is referred to as propensity scores. Then, each program individual can be compared to the comparison individual having the most similar propensity score. This way, for each program individual, the comparison individual with the most comparable characteristics can be identified (see figure below).

**Key characteristics to perform statistical matching can be identified with the project teams using secondary data (administrative data, household surveys and GIS data) and also primary baseline data for all individuals**. Typically, in-depth discussions with the project teams enable to identify the characteristics that contribute to the selection of the beneficiaries (e.g., intervention area, employment status, poverty status). In addition, with the help of secondary data or the expertise and local knowledge of the project team we can select areas or communities which face similar conditions as the selected program beneficiaries. This can include individuals in areas exposed to similar environment, climate, social norms, economic development, population density, etc. These conditions are typically taken into account to avoid violations in the parallel trend assumptions (i.e., DiD approach).

**Regression discontinuity design (RDD)**

**The RDD method can be used if a clear, measurable criterion defines whether an individual may participate in the program or not, and this criterion cannot be manipulated by the individuals**. This method is often used to measure impacts when individuals are selected based on a score. The score can refer to a test result, poverty or vulnerability index. Moreover, the selection can be simply determined by an age range, or residency in a specific location. The threshold for participation could hence lie at the score of 50. Individuals beyond 50 may participate, but those lying below such score may not participate.

**The approach builds on comparing individuals around the threshold on both sides as they are assumed to be similar in observable and unobservable characteristics**. Therefore, it is important that a sufficiently high number of observations are concentrated around the threshold as those who are not cannot be considered as comparable. Hence, this method is particularly dependent on the sample size in order to detect an impact. In the analysis phase, the impact is measured as difference in the outcome of interest between the comparison group on one side of the threshold and the program group on the other side of the threshold.

**In some cases, the threshold does not perfectly determine participation or the exclusion to a program.** For those cases, variants of the RDD design tolerate such imperfect evaluation conditions (e.g., Fuzzy RDD design).

**Instrumental variable**

**The Instrumental variable (IV) approach consists in using a so-called IV which is highly correlated to the treatment but is not directly connected with the outcome**. In other words, the IV captures an external source of variation outside the control of the individual that determines the treatment. Hence, any effect, which can be found for the instrument on the outcome, must be attributed to the treatment and to nothing else.

**It is, however, challenging, to identify those instrumental variables with sufficient proof of no direct correlation with the outcome other than through the treatment**. As depicted in the figure below, the fundamental requirements of an IV are that it influences the treatment (i.e., strongly predicts the treatment, relevant instrument) and that it does not affect the outcome of

interest through any channel except through the treatment (i.e., valid instrument). Nevertheless, despite these requirements, the IV method does not require baseline data, which can be a strong advantage when conducting ex-post evaluations.

# Appendix 4. Survey of Beneficiaries of Romanian R&I Instruments

As part of the Policy Effectiveness Review of Romanian R&I Instruments (World Bank, 2023a), the WB carried out an online survey of the beneficiaries of select R&I instruments (see Table 47 below) to understand beneficiaries' perceptions of key aspects of program design and implementation. This includes beneficiaries' perceptions of application, selection, and contracting processes, support provided by the implementers during project implementation, sufficiency of the time and funding provided for project implementation, key success factors, and perceptions of the overall quality of the program.

The instruments included in the survey were:

- **Partnerships for knowledge exchange**: This is a grant instrument focused on commercialization and technology transfer in universities and PRIs funded through POC and is implemented by MCID's Implementing Body for POC. The beneficiaries included in the survey initiated their projects in 2016 or 2018.
- **Attracting staff with advanced skills from abroad**. This is a grant instrument focused on attracting human capital into the research sector (in Romania universities, PRIs, and firms) funded through POC and implemented by MCID's Implementing body for POC. The beneficiaries included in the survey initiated their projects in 2016.
- **Exploratory research projects**. This is a grant instrument focused on research excellence in universities and PRIs funded through PN3 and implemented by UEFISCDI. The beneficiaries included in the survey initiated their projects in 2017.
- **Demonstrative experimental projects**. This is a grant instrument focused on R&D innovation in universities and PRIs funded through PN3 and implemented by UEFISCDI. The beneficiaries included in the survey initiated their projects in 2017 or 2020.
- **Innovation Vouchers**. This is a voucher instrument focused on R&D innovation and technology adoption in firms funded through PN3 and implemented by UEFISCDI. The beneficiaries included in the survey initiated their projects in 2017 or 2018.

The survey took place between March and May 2023, during which a total of 217 beneficiaries responded to the survey with an overall response rate of 20%. See Table 47 for the total number of beneficiaries surveyed and response rate by instrument.

**Table 47 Instruments included in the beneficiary survey**

| Instrument | Implementer | Objective(s) | Beneficiary(s) | Mechanism | # of projects | Response rate (in %) |
|---|---|---|---|---|---|---|
| Partnerships for knowledge exchange | MORID - POC Unit | Tech transfer, R&D Innovation | HEIs, PRIs | Grants | 54 | 17 |
| Attracting staff with advanced skills from abroad | MORID - POC Unit | Human capital - formation | HEIs, PRIs, Firms | Grants | 51 | 18 |
| | | | | | | |
| Exploratory research projects | UEFISCDI | Research excellence | HEIs, PRIs | Grants | 199 | 20 |
| Demonstrative experimental projects | UEFISCDI | R&D Innovation | HEIs, PRIs | Grants | 568 | 14 |
| Innovation Vouchers | UEFISCDI | R&D Innovation, Technology Adoption | Firms | Vouchers | 273 | 29 |

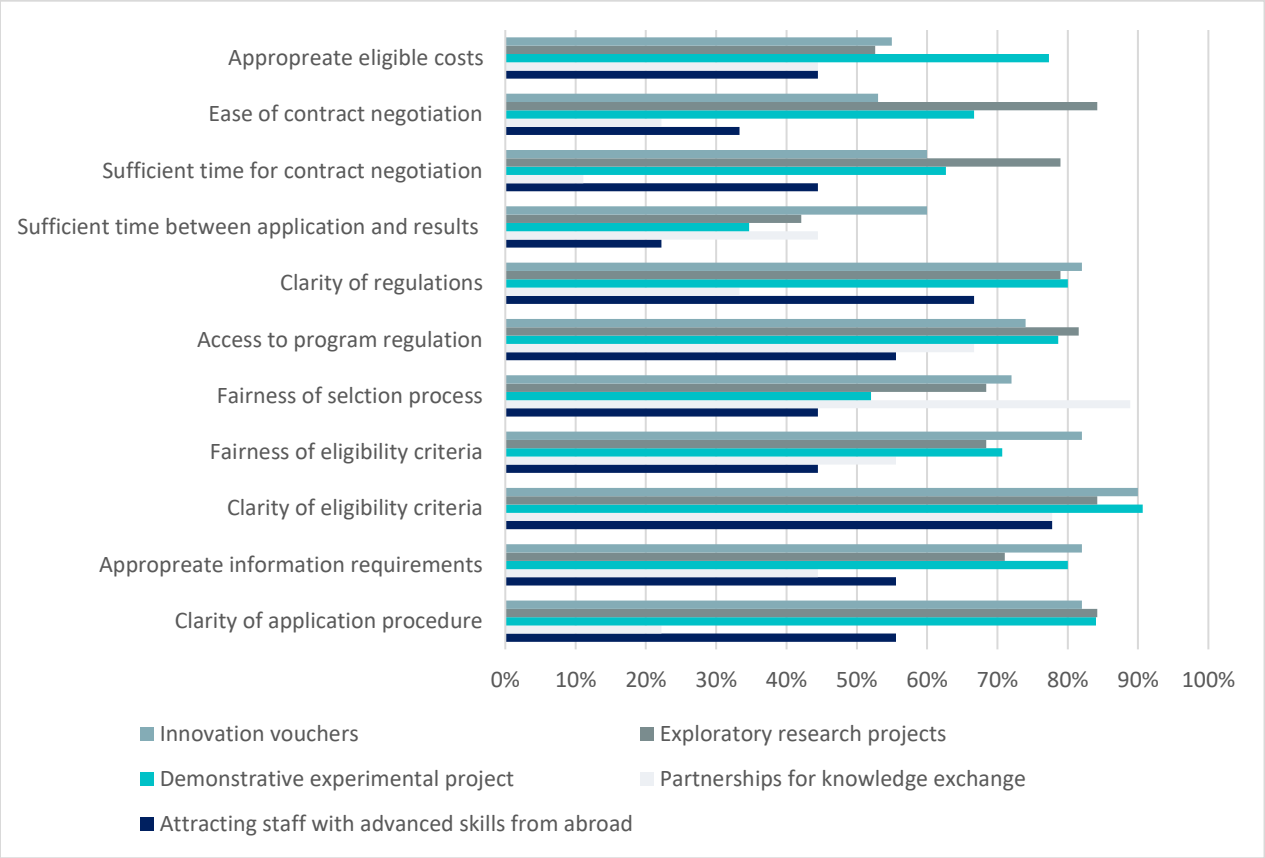
Source: World Bank analysis.

# Survey Results

## *Application processes*

**Respondents were largely satisfied with application processes, but there were several areas for potential improvement**. Satisfaction varied across instruments, but respondents tended to be more satisfied application and selection criteria and accessing information about the instrument and regulations but were less satisfied with the contracting process (see 24 below). Beneficiaries of the three instruments implemented by UEFISCDI (Exploratory research projects, Demonstrative experimental projects, and Innovation Vouchers) were, on average, more satisfied with aspects of the application process than the beneficiaries of the two instruments implemented by the Implementing body for POC (Partnerships for knowledge exchange and Attracting staff with advanced skills from abroad).

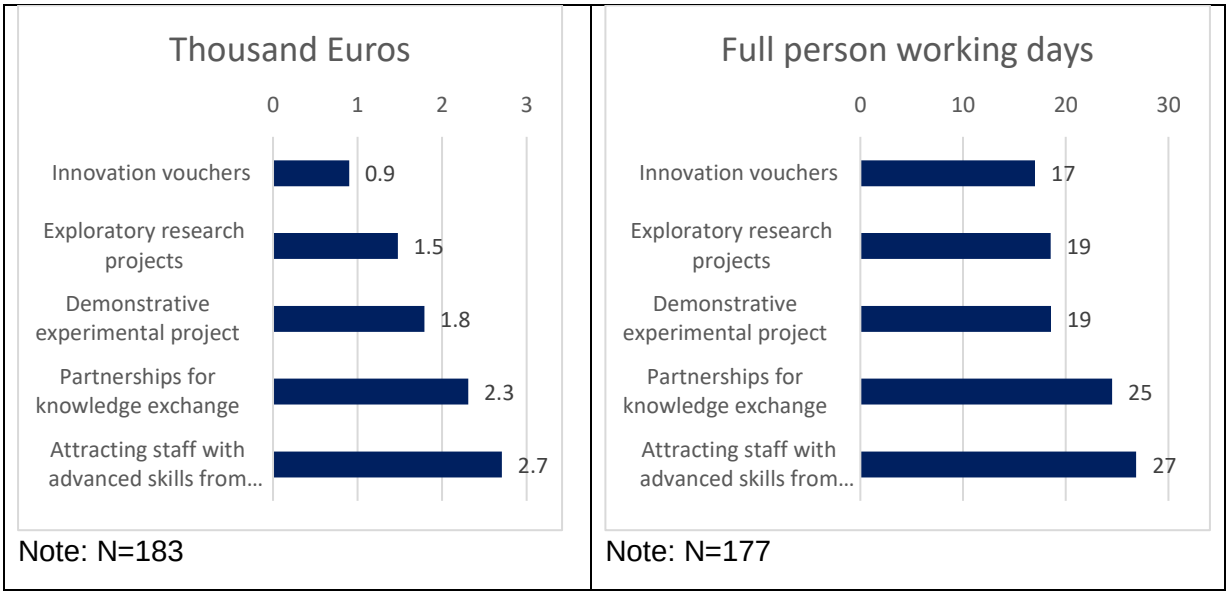
**Figure 25 Satisfaction with Application Process by Instrument**




Source: World Bank analysis.
Note: N=193 | Figure shows percentage of respondents who were satisfied or very satisfied

**Applications for instruments funded under POC were more costly and time intensive than those funded under PN3**. Costs for preparing applications for the three PN3 instruments (Innovation Vouchers, Exploratory research projects, and Demonstrative experimental projects) ranged from EU 900 to EU 1,800, while the costs for preparing the two POC instruments (Partnerships for knowledge exchange and Attracting staff with advanced skills) ranged from EU 2,300 to EU 2,700 (25a). When asked about the time needed to prepare their applications, respondents from the three PN3 instruments said their applications took an average of between 17 and 19 working days to prepare, while respondents from the two POC instruments said their applications took an average of between 25 and 27 days to prepare (Figure 26). Compared to a similar survey of beneficiaries of R&I instruments in Bulgaria, applications for Romanian instrument cost similar amounts and took less time to prepare then Bulgarian instruments.

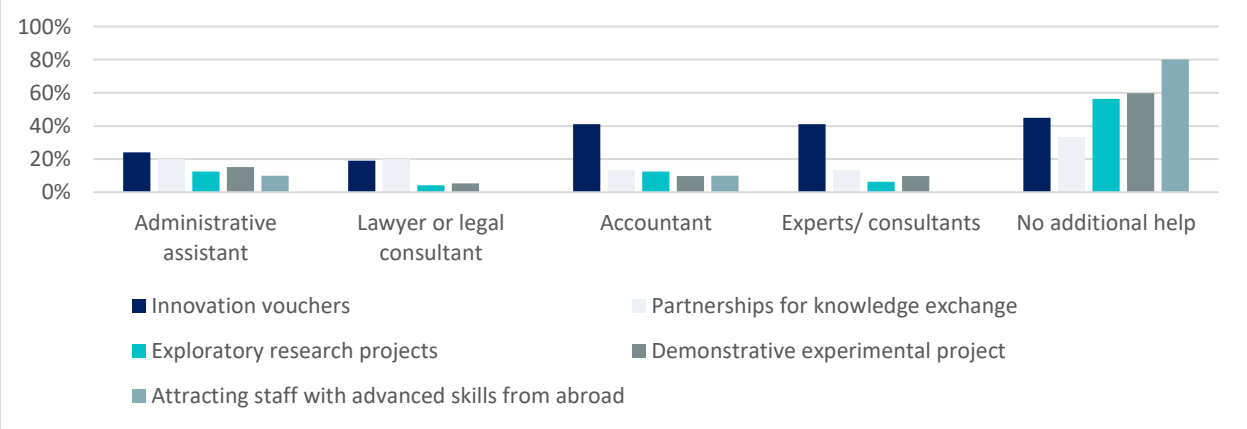
**Figure 26 Average cost and time to complete application**




Source: World Bank analysis.

**More than half the respondents for two instruments (Partnerships for knowledge exchange and Innovation vouchers) needed external support to complete their applications**. 77% of Partnerships for knowledge exchange respondents and 55% of Innovation vouchers respondents required some form of external support to complete their applications, while the majority of respondents from the other three instruments completed their applications without additional support. Given that vouchers are entitlement-based and should have relatively simple application requirements, respondents' use of external services to complete their applications indicates that the application may be overly complex relative to best practices in voucher design. The most common external services used by respondents were accountants and experts/consultants (Figure 27).

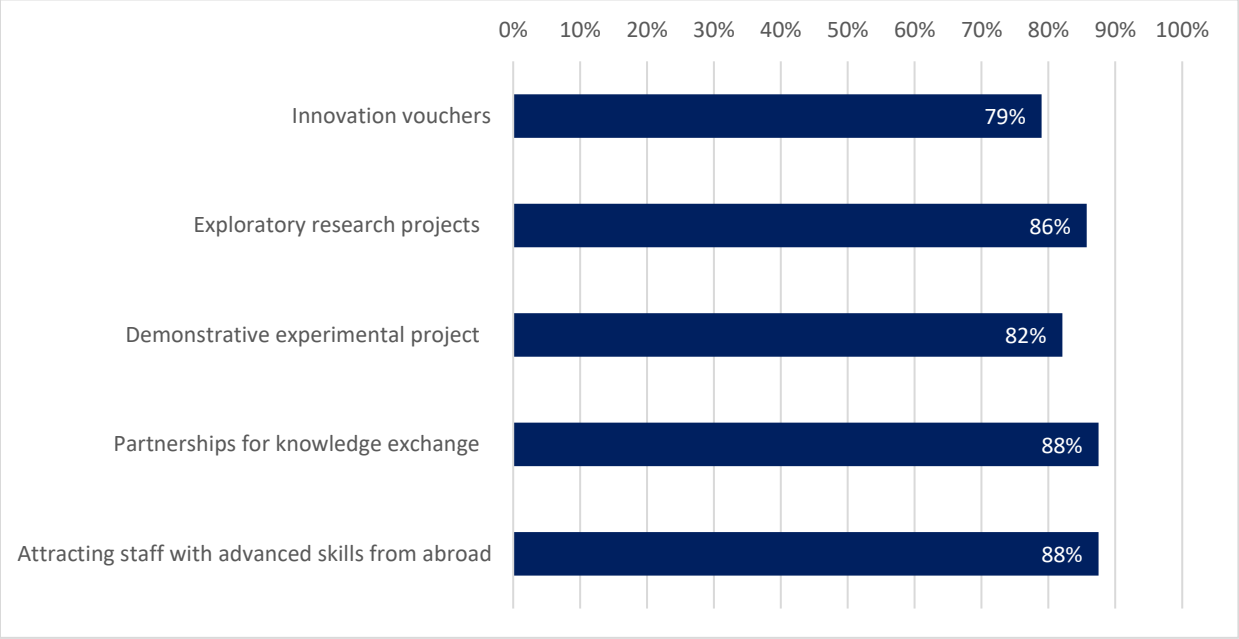
**Figure 27 External services required to complete application**




Source: World Bank analysis.
Note: N=177.

**A large majority of respondents thought the costs for applying to their instruments were adequate compared to the benefits received**. 88% of the respondents from the two POC instruments (Partnerships for knowledge exchange and Attracting staff with advanced skills) said the costs were adequate, while between 79% and 86% of respondents from the PN3 instruments (Innovation Vouchers, Exploratory research projects, and Demonstrative experimental projects) said the costs were adequate (Figure 28).

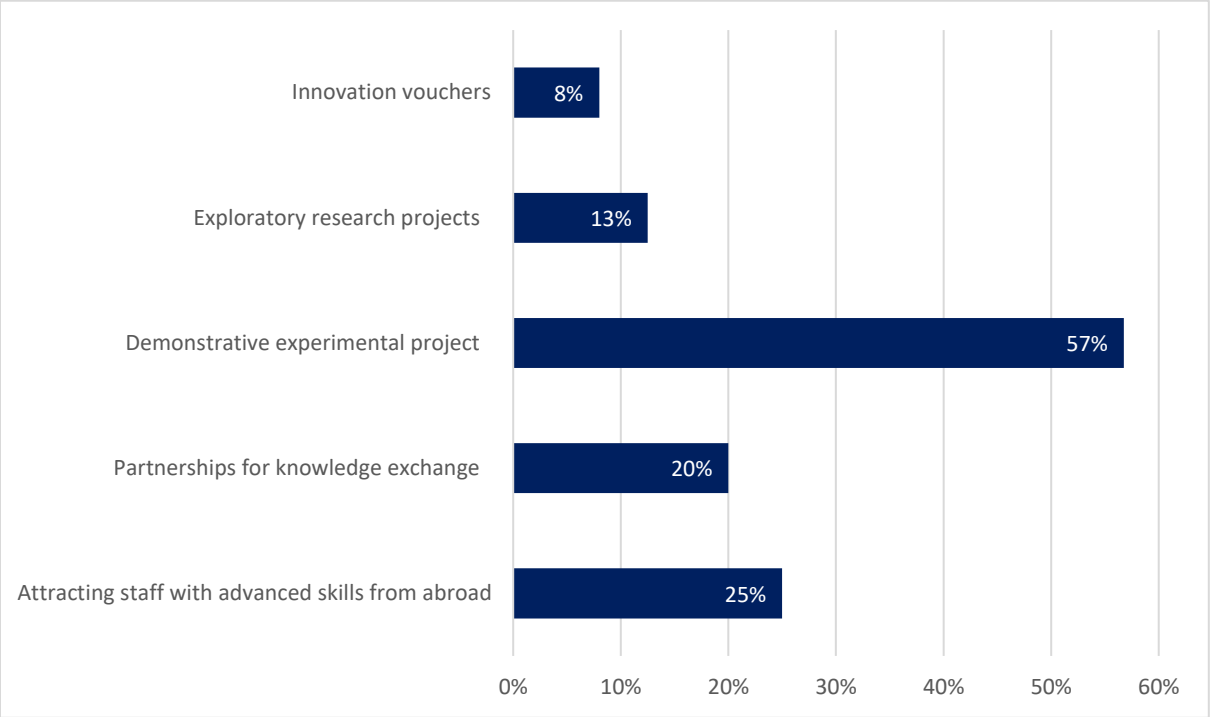
**Figure 28 Share of beneficiaries who thought the costs for applying to the program (monetary and non-monetary) were adequate when compared with the benefits**




Source: World Bank analysis.
Note: N=177.

**About a quarter of respondents thought the eligibility criteria for their instrument should be changed**. When asked whether they thought any of the eligibility criteria for their instrument should be added to, changed or deleted, 26% of respondents across instruments said at least one change should be made (Figure 29). The most common requested changes were that criteria be added to include experience in managing successful research projects and changes to criteria related to how publications are considered (e.g., considering conference publications as well as scientific journal publications for select fields.

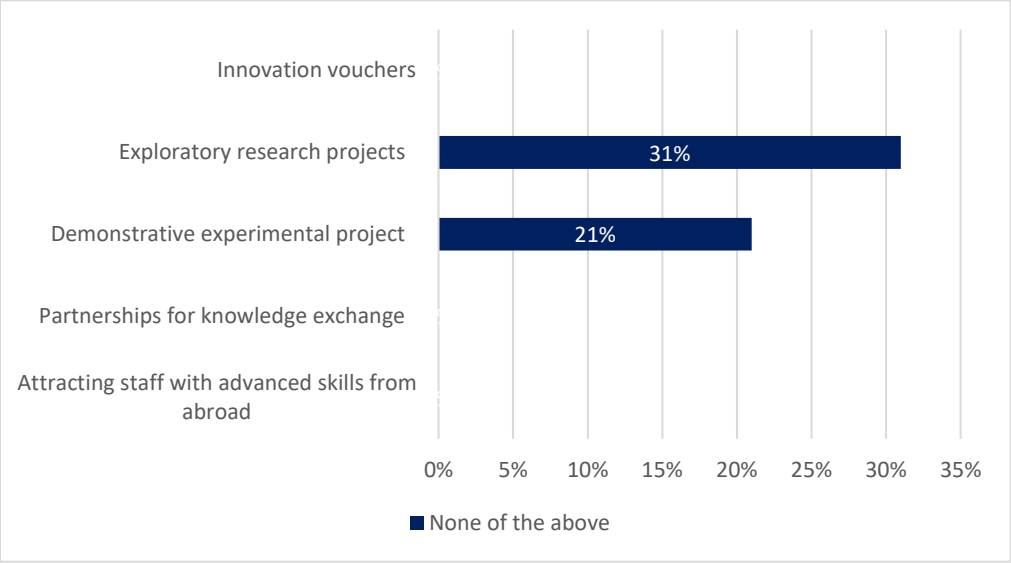
**Figure 29 Share of respondents that think the eligibility criteria should be added, changed, or deleted**




Source: World Bank analysis.
N of cases: 177.

**Less than 10% of respondents thought the selection criteria for their instrument should be changed**. When asked whether they thought any of the selection criteria for their instrument should be added to, changed, or deleted, none of the respondents for three instruments (Innovation vouchers, Partnerships for knowledge exchange, or Attracting staff with advanced skills) wanted to see any changes to the selection criteria for those instruments. 31% of respondents from the Exploratory research projects instrument and 21% from the Demonstration experimental projects instruments thought there should be changes to selection criteria (Figure 30). The most common requested changes were changes to how TRLs are defined in different technology areas and changing how the criteria are weighted for scoring of applications (e.g., higher weighting of the quality of the project idea, less weighting of the background of the team, etc.).

**Figure 30 Share of respondents that think the selection criteria should be added, changed, or deleted**

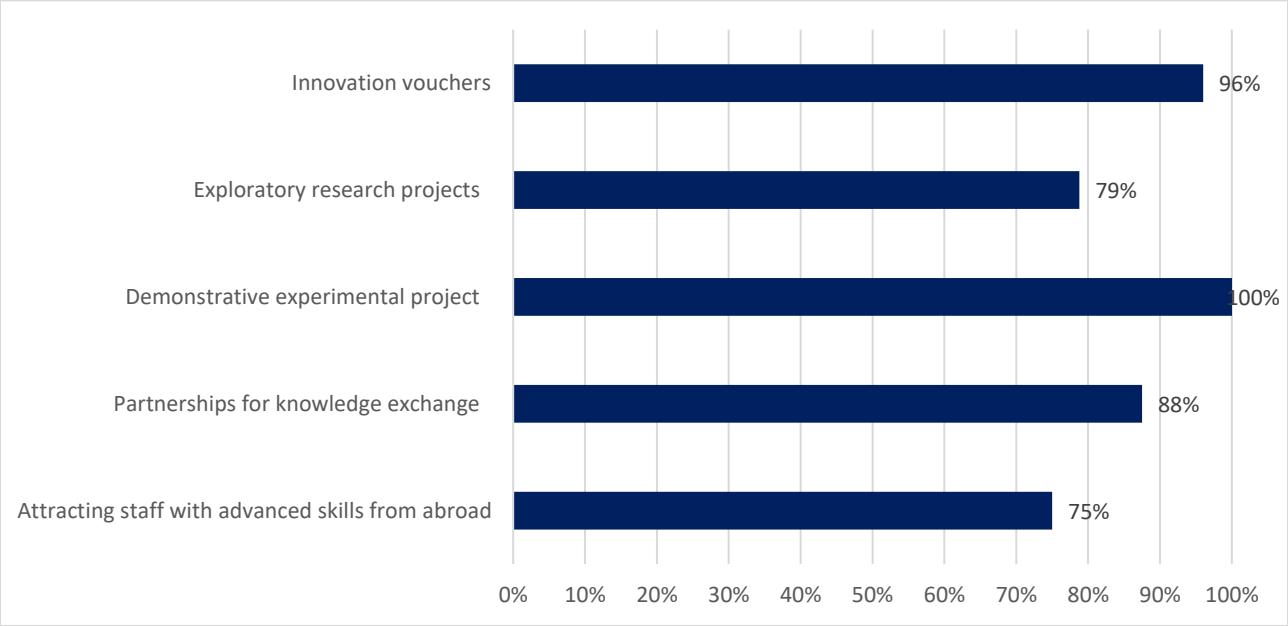



Source: World Bank analysis.
N of cases: 177.

## *Implementation Processes*

**A large majority of respondents said the funding for their projects was delivered according to the terms of their contract**. Attracting staff with advanced skills had the lowest number of respondents (75%) who said payment was delivered per the contract terms, and beneficiaries noted that there were cash flow problems in the initial stages of the instrument (Figure 31). Several beneficiaries across instruments said they had experienced delays – often 3 to 4 months – in receiving reimbursements.

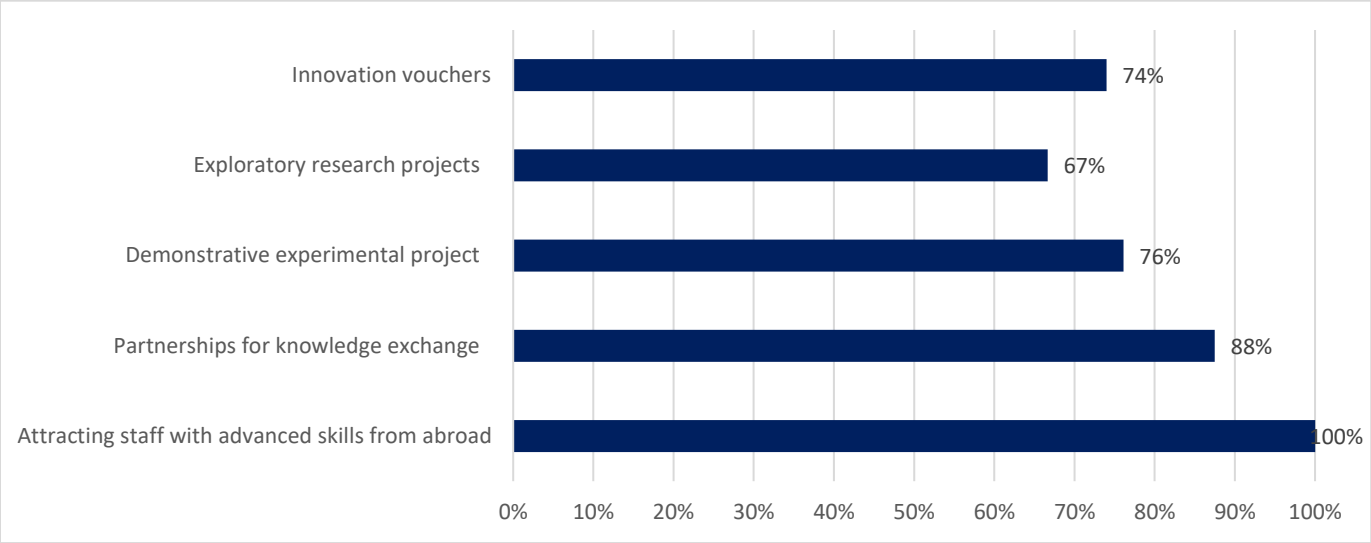
**Figure 31 Share of respondents considering the funding to be delivered according to the terms of the contract**




Source: World Bank analysis.
N of cases: 176.

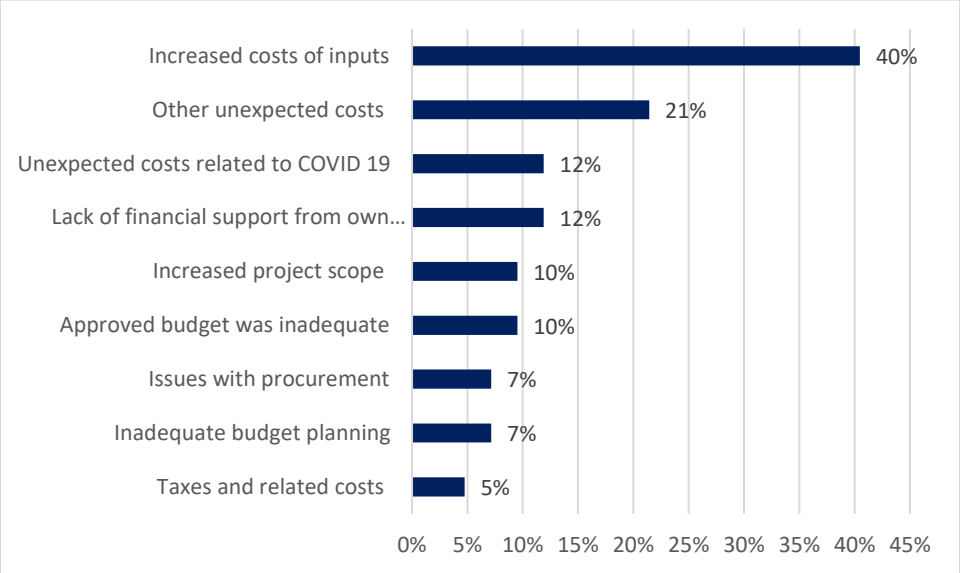
**Most respondents said the funding they received was sufficient to complete their projects**. However, the share of respondents saying they had sufficient funding varied across instruments; the beneficiaries of the two POC instruments (Partnerships for knowledge exchange and Attracting staff with advanced skills) were more likely to say they had sufficient funding than those from the three PN3 instruments (Innovation Vouchers, Exploratory research projects, and Demonstrative experimental projects), as shown in Figure 32. Increased costs of inputs was the most commonly cited reason for budget inadequacy, followed by costs related to COVID 19 and other unexpected costs (Figure 33).

**Figure 32 Share of respondents considering the funding received as sufficient**




Source: World Bank analysis.
N of cases: 176.

**Figure 33 Reasons why support was insufficient**

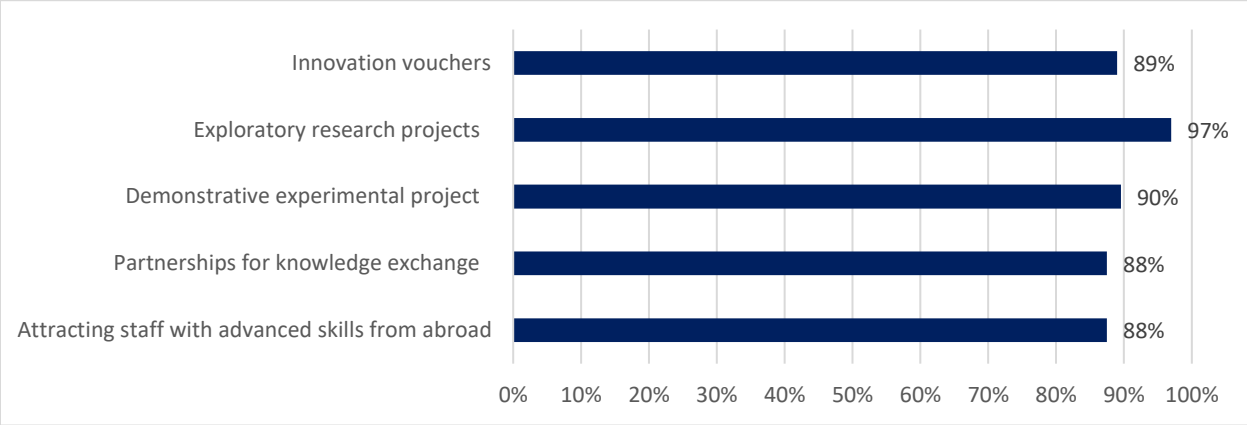



Source: World Bank analysis.
N of cases: 42.

**Similarly, most respondents said the time allotted for implementation was sufficient to complete their projects**. Between 88% and 97% of respondents said the time allotted for implementation in their contracts was sufficient (Figure 34). Unexpected delays due to COVID 19 was the primary reason cited for having insufficient time for project completion, followed by a lack of financial resources and other reasons (Figure 35). Respondents cited time needed to

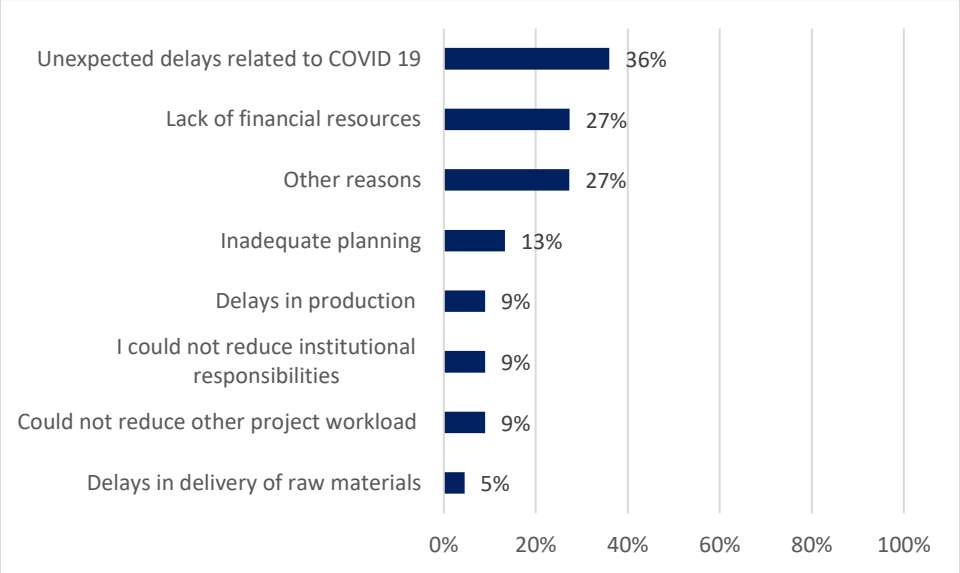
test new materials and delays in the approval and contracting process (which were not reflected in project deadlines) as some of the other reasons for having insufficient time.

**Figure 34 Share of respondents considering the time allotted for implementation was sufficient**




Source: World Bank analysis.
N of cases: 176.

**Figure 35 Reasons why time was insufficient**

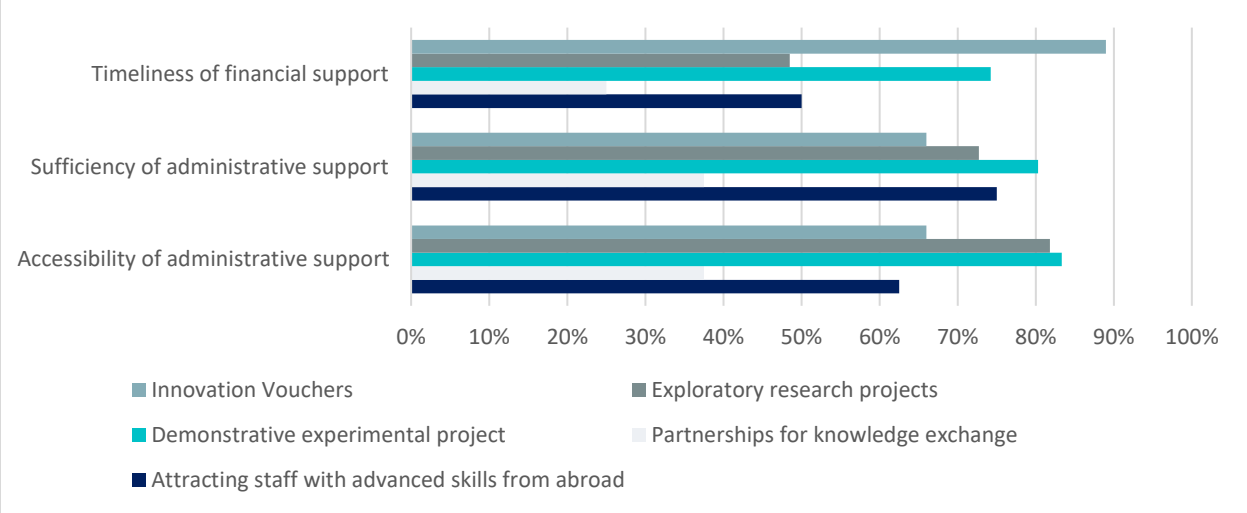



Source: World Bank analysis.
N=22.

**Many respondents were unsatisfied with the support provided during implementation**. This includes fewer than 50% of respondents from the Exploratory research projects, Partnerships for knowledge exchange, and Attracting staff with advanced skills who were satisfied with the timeliness of financial support received. Additionally, fewer than 70% of respondents from Innovation vouchers, Partnerships for knowledge exchange, and Attracting staff with advanced

skills were satisfied with their ability to access administrative support during implementation and fewer than 70% of respondents from Partnerships for knowledge exchange and Attracting staff with advanced skills thought that the administrative support provided was sufficient (Figure 36).

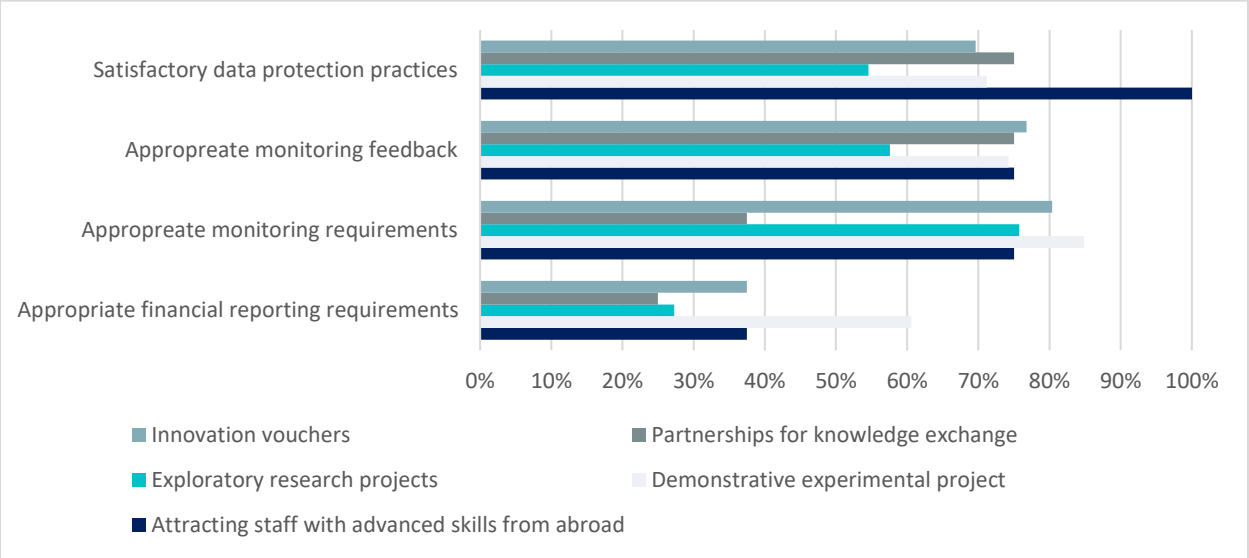
**Figure 36 Satisfaction with support during implementation**




Source: World Bank analysis.
N of cases: 115. | Note: Figure shows percentage of respondents who agreed or strongly agreed.

**Many respondents were also unsatisfied with monitoring processes – particularly financial reporting requirements**. Overall, fewer than 60% of respondents were satisfied with financial reporting requirements, and for two instruments (Partnerships for knowledge exchange and Exploratory research project), fewer than 30% of respondents said they were satisfied with financial reporting. Respondents were more satisfied with technical monitoring requirements, with more than 70% of respondents from most instruments (with the exception of Partnerships for knowledge exchange) saying they were satisfied with them (Figure 37).

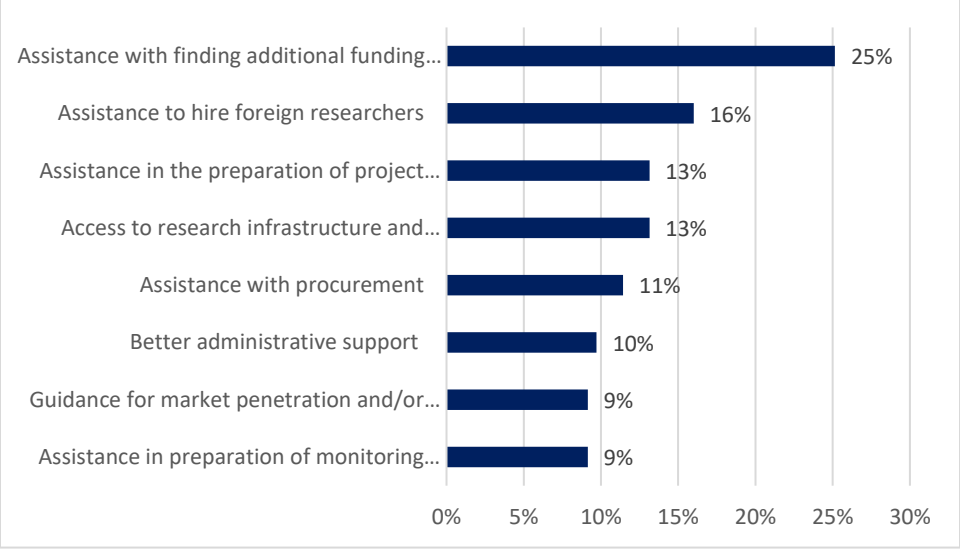
**Figure 37 Satisfaction with Monitoring Processes**




Source: World Bank analysis.
N of cases: 171. | Note: Figure shows percentage of respondents who agreed or strongly agreed.

**When asked about any additional support needed to complete their projects, a quarter of respondents said they needed assistance with finding additional funding sources** (beyond the financial support provided by the instrument). Other additional support requested by respondents included assistance with hiring foreign researchers (cited by 16% of respondents), assistance in the preparation of budgets (13%) and assistance in accessing research infrastructure and equipment (13% of respondents), as shown in Figure 38).

**Figure 38 Additional support needed by respondents to carry out their projects**

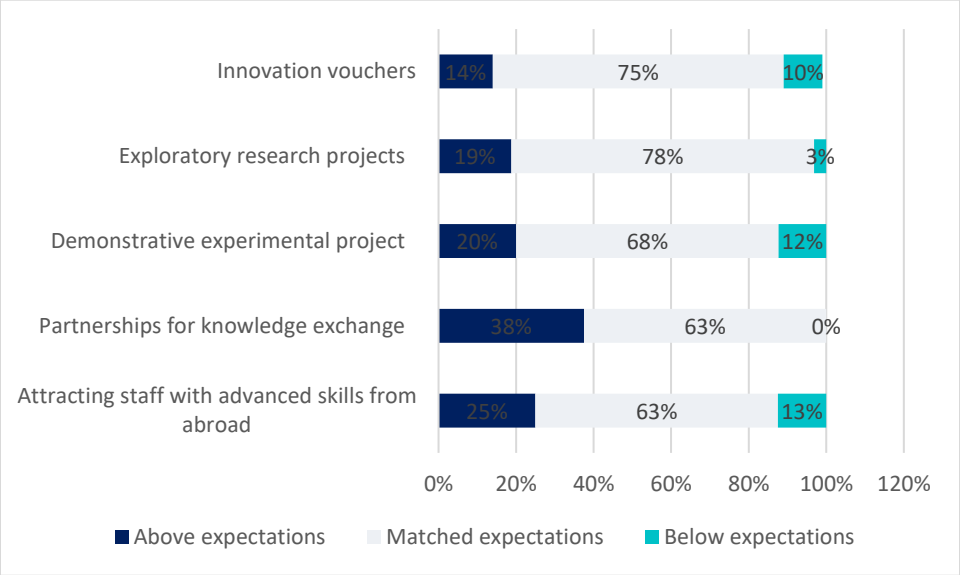



Source: World Bank analysis.
N=175.

# *Project results*

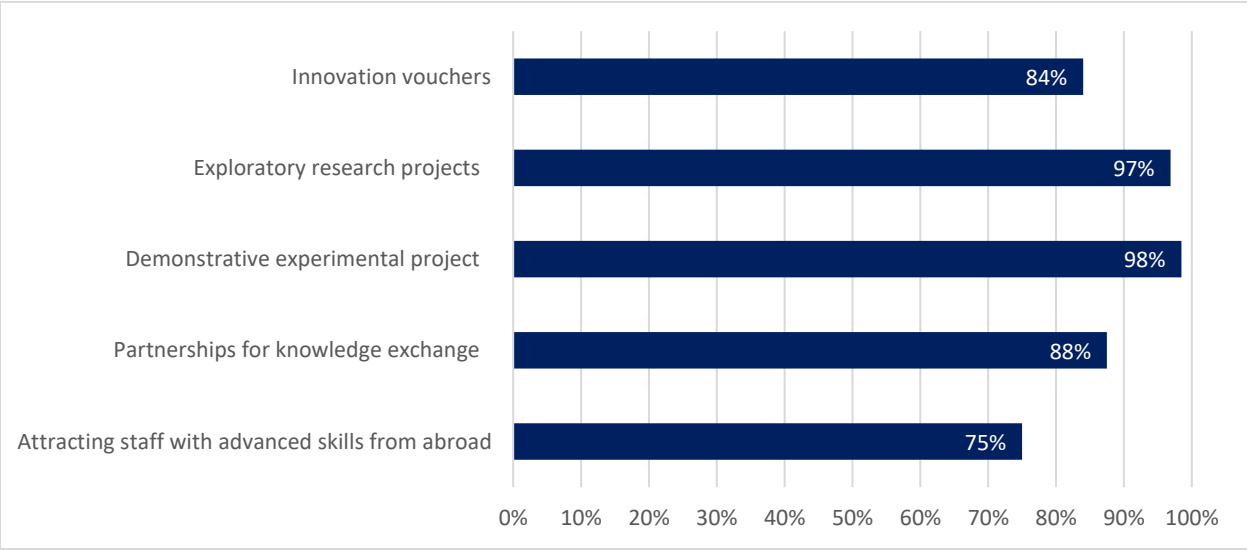
**Respondents were largely satisfied with the results of their projects**. More than 85% of respondents from all instruments said that their project results matched or exceeded their expectations (Figure 39). Relatedly, at least 75% of respondents across instruments said they would participate in the program again as currently implemented (Figure 40).

**Figure 39 Satisfaction with project results**




Source: World Bank analysis.
N of cases: 169.

**Figure 40 Share of respondents willing to participate in the program again as currently implemented**




Source: World Bank analysis.
N of cases: 169.

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