Finanțat de Uniunea Europeană NextGenerationEU

Planul Național de Redresare și Reziliență

NOTE WITH RECOMMENDATIONS FOR SCALABLE MONITORING FRAMEWORK FOR THE R&I SYSTEM

October 2023

MINISTERUL CERCETĂRII, INOVĂRII ȘI DIGITALIZĂRII

THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP

"NRRP. Funded by the European Union—NextGenerationEU"

https://mfe.gov.ro/pnrr/
https://www.facebook.com/PNRROficial/

Disclaimer

This work is a product of the staff of The World Bank. The findings, interpretation, and conclusions expressed in this paper do not necessarily reflect the views of the Executive Directors of the World Bank or the governments they represent. The World Bank does not guarantee the accuracy of the data included in this work and does not assume responsibility for any errors, omissions, or discrepancies in the information, or liability with respect to the use of or failure to use the information, methods, processes, or conclusions set forth. The boundaries, colors, denominations, and other information shown on any map in this work do not imply any judgment on the part of The World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

This report does not necessarily represent the position of the European Union or the Romanian Government.

Copyright Statement

The material in this publication is copyrighted. Copying and/or transmitting portions of this work without permission may be a violation of applicable laws.

For permission to photocopy or reprint any part of this work, please send a request with the complete information to either: (i) Ministry of Research, Innovation, and Digitization of Romania (21-25 Mendeleev str, ZIP Code 010362, Bucharest, Romania) or (ii) the World Bank Group Romania (Vasile Lascăr Street, No 31, Et 6, Sector 2, Bucharest, Romania).

This report has been delivered under the Reimbursable Advisory Services Agreement on Research Modernization in Romania: Improving the Quality of and Relevance of the Research Sector signed between the Ministry of Research, Innovation, and Digitization of Romania and the International Bank for Reconstruction and Development on December 03, 2022. It corresponds to Deliverable 4 under the above-mentioned agreement.

Contents

Acknowledgments 5
Abbreviations and acronyms 6
Executive summary 7
Introduction 16
STEP I. Define policy-makers and program managers' learning objectives from monitoring R&I policies in Romania 29
STEP II. Streamline the governance of monitoring of the R&I system in Romania and mobilize financial and human resources 36
STEP III. Develop R&I instruments and policies' theories of change 43
STEP IV. Define relevant indicators for the monitoring of R&I instruments and policies in Romania 51
STEP V. Harmonize R&I indicator measurement across Romania 57
STEP VI. Set up the structure of the monitoring framework of the R&I system in Romania 61
STEP VII. Determine how to collect data for the monitoring of the R&I system in Romania and ensure its quality 70
STEP VIII. Specify how monitoring data for the R&I system in Romania will be analyzed and used 79
STEP IX. Define a relevant management information system 84
STEP X. Identify suitable evaluation strategies for R&I instruments and policies 93
STEP XI. Determine reporting and dissemination procedures of monitoring results 99
STEP XII. Update previous steps as necessary 103
Summary of key recommendations and planned next steps 105
References 114
Appendix 1. SNCISI 2022–2027 funding sources 116
Appendix 2. Key documentation on the regulatory framework for monitoring R&I funds 117
Appendix 3. List of institutions met for bilateral stakeholders consultations 119
Appendix 4. List of institutions that attended World Bank M&E workshops 120
Appendix 5. World Bank M&E survey questionnaire 122
Appendix 6. Functional analysis questions 129
Appendix 7. Case study. Country-region cooperation on monitoring and evaluation processes: monitoring of Smart Specializations in Poland 131
Appendix 8. Template for the monitoring framework of R&I policies in Romania 134
Appendix 9. Comparison of different data collection modes 135
Appendix 10. Secondary data sources 137
Appendix 11. Quality checklist of the design and implementation strategy of a monitoring platform 140

List of figures

Figure 1 Role of monitoring in achieving policies' end goals 19
Figure 2 Key steps of the design of monitoring framework for the Romanian R&I system 27
Figure 3 Key R&I actors 30
Figure 4 Monitoring R&I policies at different policy levels 34

Figure 5 The five pillars of a theory of change 43
Figure 6 Example of ToC for Program 5.7 of PNCDI IV - Partnership for Innovation 47
Figure 7 Example of ToC for Investment 8, C9, NRRP - Development of a program to attract highly specialized human resources from abroad in research, development and innovation activities 48
Figure 8 View of the monitoring framework template, section "Legend" 65
Figure 9 Preview of the template monitoring framework, section “Indicator-specific categories” 66
Figure 10 Preview of the template monitoring framework, section "Policy-specific categories" 66
Figure 11 Preview of the template monitoring framework, section "Example" 67
Figure 12 Example of visualization of collaboration between R&I actors 81
Figure 13 Relating indicators to common policy objectives: a good example from Horizon Europe 85
Figure 14 Preview of the Horizon Europe dashboard 86

List of tables

Table 1 Example of an indicator reference sheet 53
Table 2 Examples of potential levels of disaggregation of monitoring data 80
Table 3 Summary of recommendations 105

List of boxes

Box 1 Key reading recommendations on monitoring 19
Box 2 Scope of World Bank support to the Government of Romania in research modernization efforts 21
Box 3 Tools of the World Bank’s Policy Effectiveness Review of Science, Technology, and Innovation (PER STI) 31
Box 4 Definition of the ToC’s pillars 44
Box 5 Key reading recommendations on the development of a ToC 44
Box 6 Output vs. outcome indicators 51
Box 7 Poorly defined versus well-defined indicators 54
Box 8 Exercise on improving indicators 55
Box 9 Template for the development of the monitoring framework 64
Box 10 Example of an interactive dashboard from Horizon Europe 85
Box 11 How to design a good dashboard 86
Box 12 Assessment domains of a monitoring platform’s design 88
Box 13 Key lessons learned in implementing a new monitoring platform 88
Box 14 Example from South Korea –R&D Platform for Investment and Evaluation 89
Box 15 Key reading recommendations on impact evaluation methods 93
Box 16 Key reading recommendations on other evaluation approaches 96

Acknowledgments

This report was prepared as part of a project led by Łukasz Marć (Senior Economist) and Natasha Kapil (Senior Private Sector Specialist). The preparation of this report was led by Łukasz Marć (Senior Economist) and Clémentine Sadania (Monitoring Specialist). The core team included Alexandra Avdeenko (Evaluation Specialist), Jakob Gaertner (Monitoring and Evaluation Analyst), and Cristina Serbanica (Policy Analyst). Cecilia Ciocirlan, Magda Malec and Caroline Schimanski provided valuable inputs, and Sinem Oezdemir led organizational aspects. Aarre Laakso provided editorial support. The authors are thankful for the insightful comments provided by the peer-reviewer Andrès Zahler. The team is also grateful for the support extended by Oana Caraba and Mihai Preda. The team benefitted from guidance provided by Anna Akhalkatsi, Reena Badiani-Magnusson, Ilias Skamnelos, and Gallina Vincelette.

The team would like to thank the Government of Romania, and in particular, the Ministry of Research, Innovation, and Digitalization (MCID), with special appreciation to Roxana Apreutesei, Eugenia Marin, Octaviana Marincas, Ramona Moldovan, and Antonio Radoi for their invaluable support. We are also grateful to the Ministry of European Investment and Projects (MIPE); the Ministry of Education (MEDU); the Executive Agency for Higher Education, Research, Development, and Innovation Funding (UEFISCDI); the Ministry of Regional Development and Public Administration (MRDPA) and the Regional Development Agencies (RDAs); and all other ministries and public agencies that provided valuable inputs, data, and feedback.

Abbreviations and acronyms

CAPI	Computer-assisted personal interviewing
CATI	Computer-assisted telephone interviewing
CCSI	Committee for Coordination of Smart Specialization
DPSCDITT	Directorate of Policies and Strategies for RDI and Technological Transfer (Direcția Politici și Strategii CDI, Inovare și Transfer Tehnologic)
EC	European Commission
ESIF	European Structural and Investment Funds
EU	European Union
GDP	Gross domestic product
GSG	General Secretariat of the Government
INS	National Institute of Statistics (Institutul Național de Statistică)
IT	Information technology
KPI	Key performance indicator
M&E	Monitoring and Evaluation
MADR	Ministry of Agriculture and Rural Development (Ministerului Agriculturii şi Dezvoltării Rurale)
MCID	Ministry of Research, Innovation, and Digitalization (Ministerul Cercetarii, Inovarii și Digitalizării)
MEDU	Ministry of Education
MIPE	Ministry of Investments and European Projects (Ministerul Investițiilor și Proiectelor Europene)
MoH	Ministry of Health
NRRP	National Recovery and Resilience Plan
OECD	Organisation for Economic Co-operation and Development
OP	Operational Program
PER STI	Policy Effectiveness Review of Science, Technology, and Innovation
PCIDIF	Smart Growth, Digitalization and Financial Instruments Program
PNCDI	National RDI Plan
PSF	Policy Support Facility
R&D	Research and Development
R&I	Research and Innovation
RCT	Randomized Controlled Trial
RDA	Regional Development Agency
RDI	Research, Development and Innovation
RIS3	Research and Innovation Strategy for Smart Specialization
SMART	Specific, measurable, achievable, relevant, and time-bound
SNCISI	National Strategy for Research, Innovation and Smart Specialization
ToC	Theory of Change
UEFISCDI	Executive Agency for Higher Education and R&I Funding

Executive summary

The ultimate purpose of research and innovation (R&I) instruments and policy monitoring is to inform inputs, execution, outputs and outcomes of instruments and policies aimed at improving R&I. Monitoring thus allows for better, informed decision-making in several ways. First, it facilitates the assessment of the progress of instruments and policy implementation. Second, it enhances understanding of how achieving lower-level aims can contribute to strategic objectives. Third, it helps identify potential drivers and inhibitors (e.g., weaknesses in implementation) of the changes intended by R&I instruments and policies, guiding short- and longer-term actions to improve them. Monitoring accomplishes these three things mainly by increasing the quality and scope of data collected during instruments and policy implementation. Eventually, having a centralized monitoring framework (one that monitors data from all programs) allows making decisions based on lessons learned from different programs.

We offer this document to monitoring stakeholders, from the level of R&I instruments to the strategic level, as a toolkit for improving the monitoring of R&I instruments and policies in Romania. The toolkit is divided into 12 steps required for a well-functioning R&I monitoring system and outlines gaps in Romania. The proposed steps can be organized in three main pillars: (i) Scoping the monitoring framework (Steps 1 and 2); (ii) Developing the framework (Steps 3 to 6); (iii) Implementational aspects of the framework (Steps 7 to 12). Each step provides information about what is needed, why, and how to achieve it. The toolkit provides detailed guidance for setting up or improving existing R&I monitoring systems, from the instrument to the strategic level. Critical recommendations provided throughout the report are summarized in a closing section.

At the same time, this report highlights three high-priority dimensions that demand immediate attention from higher-level R&I decision-makers to enable the implementation of the proposed framework: governance, resources, and accountability:

- **Governance:** Implementing an improved and centralized monitoring framework for the R&I system requires the close coordination of all R&I implementers. In the short term, this includes clarifying roles and responsibilities of monitoring at the strategic level for the Inter-ministerial Committee, the Ministry of Research, Innovation, and Digitalization (MCID) departments, and all R&I implementers. In the future, it will also involve clarifying the roles and responsibilities of the planned R&I Observatory. All relevant line ministries and program managers should endorse MCID's current initiatives in setting up a centralized monitoring platform.
- **Resources:** Monitoring at the strategic level requires consistent indicators collected across programs and projects. Although Romania has taken several steps in this direction, there is room to accelerate the existing initiatives and expand their scope, following this report's recommendations. Adequate human and financial resources must support these efforts both at the strategic and at lower levels to guarantee the provision of high quality data. At the strategic level, this includes budgets for a full-time, experienced monitoring and evaluation (M&E) specialist, an information technology (IT) expert, an outreach specialist, and a data manager.
- **Accountability:** To achieve larger policy impacts for the R&I system, policy makers must commit to complement improved monitoring with the use of monitoring results to inform decision-making at all steps of the policy cycle. A cycle of accountability needs to be set up, from producing high-quality and actionable monitoring results to instruments and policy design and implementation changes, with clear implications for

deviating from these roles and responsibilities. Within an institution, monitoring staff is responsible for timely reporting on the monitoring results directly to policy makers. They should facilitate preparing and disseminating clear and actionable results, following the 12 steps highlighted in this report. In turn, policy makers need to take quick action based on this information. The rationale for instruments and policy adjustments and design should be documented and grounded on past and present monitoring results. Monitoring results (for example, dashboards and reports) must be made public to strengthen policy makers' accountability towards citizens. Granting public access to the future centralized monitoring platform or public sharing of information through the future R&I Observatory is crucial to improve transparency.

Step I. Define learning objectives

An effective monitoring strategy should enable program managers, policy makers, and the strategic level to answer questions encompassing accountability and learning at every policy level. Only one in three respondents to the World Bank's M&E survey with M&E practitioners of R&I and educational programs in Romania were aware of the potential of using M&E results for learning purposes to inform the design or adjustment of a policy intervention. To transition to a more learning-oriented monitoring system, Romania needs to identify all policy levels pertinent to monitoring R&I policies and define policy makers' and program managers' learning objectives at each level of the R&I monitoring system, from projects to the national strategy.

Step II. Streamline governance and mobilize resources

There is scope for better coordination on Romania's monitoring procedures, indicators, and reporting platforms. At least 20 managing authorities and implementing bodies in Romania, including eight Regional Development Agencies (RDAs), have diverse and uncoordinated programs and M&E practices. National-regional coordination is particularly challenging in the 2021–27 programming period because each of the eight development regions has its own planned M&E system. To improve coordination, Romania needs to strengthen the centralized M&E unit for monitoring at the strategic level, assign clear responsibilities to each of its members, and plan for the required skills and budget allocations for monitoring.

Step III. Develop theories of change

The absence of a theory of change (ToC) at the strategic level at the beginning of policy planning can significantly impede line ministries from developing a shared understanding of the steps and risks needed to achieve individual and, eventually, common goals. Identifying potential complementarities and opportunities for synergies across programs and policy instruments is critical. A ToC is a chain of causal steps aimed at understanding the mechanisms through which policy makers intend a policy to generate desired outcomes or long-term goals. This causal chain links an instrument or a policy's inputs and activities to its outputs, outcomes, and final goals. A ToC is required at each policy level, including the instrument, program, funding source and strategic levels. The absence of a ToC impedes the identification of possible risks and the development of appropriate mitigation strategies. As a result, policy makers may miss out on opportunities to optimize their

instruments and policies and enhance their overall impact. Moreover, without a clear understanding of how interventions relate to one another, it becomes challenging to determine how they can work together to achieve common goals.

Moreover, current monitoring frameworks do not directly derive from the TOCs of programs and policy instruments. Indeed, at the strategic level, the National Strategy for Research, Innovation and Smart Specialization (SNCISI) that defines the overall 2030 vision for the Romanian R&I system lacks a fully articulated ToC, limiting the understanding of how Romania's R&I system will achieve its ultimate goals. Without a ToC, SNCISI's existing monitoring framework lacks precision and coherence. The lack of a fully articulated ToC limits the ability to link common indicators to specific programs and policy instruments. Without this linkage, interventions may be evaluated and compared based on inappropriate metrics and, in turn, not designed or adjusted appropriately. At the instrument level, the World Bank's functional analysis of 32 Romanian R&I instruments of the last programming period (2014–20) found that no instrument had a fully articulated ToC (World Bank 2023). For instance, the ToC workshops conducted by the World Bank revealed that links between actions and downstream outcomes often remain unclear, and alternative pathways to outcomes are absent from the discussion.

Romania should develop ToCs from the highest to the lowest policy levels to strengthen instruments and policies' coherence, synergies, and complementarities. Starting with a ToC at the strategic level allows tracing all the steps through which each funding source of R&I policies is expected to contribute to achieving SNCISI's strategic objectives. Then, ToCs should be developed at the level of each funding source, linking each program to the funding sources' objectives. In turn, the ToC of a program should link policy instruments to the program's specific objectives. By bringing together the ToCs of lower policy levels, SNCISI's ToC would provide a clear and coherent overview of the expected contribution of each R&I policy and instruments to the government's end goals. This overview will ease the identification of synergies and complementarities between the R&I instruments. This process should, in turn, inform the monitoring of R&I policies and instruments at the strategic level, which should include an assessment of the extent to which these synergies and complementarities have been realized.

Step IV. Define relevant indicators

Given the de-facto absence of ToCs in policy making, monitoring indicators do not derive from instruments and policies' ToCs, which limits their relevance and ability to inform decision-making. The World Bank's functional analysis showed that outcome and impact indicators of R&I instruments of the last programming period tend to be vaguely specified and insufficiently connected to program activities. In addition, over 40 percent of the analyzed instruments did not track outcomes (World Bank 2023). The ToC workshops organized by the World Bank also emphasized the need for key performance indicators (KPIs) that are more outcome-oriented than output-focused. Moreover, one-third of 23 respondents to the World Bank's M&E survey reported the lack of a clear linkage between the program activities and the M&E indicators as one of their M&E-related work challenges.

To rectify this, Romania needs to define monitoring indicators on the principle that R&I instruments and policies' ToCs should lead to the overall SNCISI ToC. Indicators should be defined for each critical element of instruments and policies' ToCs, covering outputs, short-, medium-, and long-term outcomes, and assumptions. Romania should also use specific, measurable, achievable, relevant, and time-bound (SMART) criteria to assess the quality of indicators. To the extent possible, indicators weakly linked to an instrument or a policy's

intervention should be foregone, whereas indicators should be added on critical steps and assumptions that are not currently captured.

Step V. Harmonize R&I indicator measurement across Romania

Indicators used to monitor Romanian R&I instruments are often inconsistent across programs and funding sources. SNCISI includes a common nomenclature of indicators, but guidance on how they are measured and aggregated from different programs is still to be developed. Although the EU programs use a list of predefined standardized indicators, national R&I programs do not share a common understanding of the indicators' definition and measurement.

Romania needs to harmonize indicators beyond the common indicators of the SNCISI and ensure that all indicators are accompanied by clear definitions and guidance on measuring them. Harmonizing R&I indicators requires ensuring that the terms that define them follow standard definitions in a common dictionary. All indicators aiming at capturing similar metrics need to be measured the same way, and it is essential to ensure that indicators can be disaggregated on dimensions relevant to decision-making. The harmonization process should be led by the strategic level to guide indicators' revision at lower policy levels.

Step VI. Set up a monitoring framework for the R&I system in Romania

R&I monitoring frameworks in Romania do not cover all the information necessary for effective monitoring. To fix this, Romania should use a standardized and well-thought-out monitoring framework. The framework would contain detailed information about each instrument and policy and about each indicator. Indicator-specific properties would describe "what to measure" and "how to measure it." The indicator-specific properties form the monitoring framework's core elements. Core indicator-specific categories necessary for a functioning monitoring system include baseline values, target values, current value, data source, data collection method, ToC level, responsible agents/entities, and indicator definition. This report proposes a structure for the Romanian R&I monitoring framework that includes policy-specific (for different policy levels) and indicator-specific categories and can form the starting point for developing a joint monitoring framework for Romanian R&I policies (See Appendix 8[1].). The centralized M&E unit of the Romanian R&I sector must first prioritize incorporating existing indicators and supplementary information into this structure to facilitate a seamless transition to an enhanced monitoring framework. A pilot could validate the proposed structure and reach agreement on a common monitoring framework for Romanian R&I instruments and policies that could be applied from the instrument to the strategic level.

Step VII. Determine what data to collect, how to collect it, and ensure its quality

For most participants in the World Bank's short M&E survey, a lack of relevant and timely data to assess implementation progress is a critical challenge. The system's

[1] The template presented in is provided as a separate Excel file, which was delivered in its standalone format. Therefore, throughout this report, any reference to Appendix 8 corresponds to the separate Excel file provided.

fragmentation and frequently missing relevant data results in a limited systemic overview of R&I performance and trends in R&I. Relevant secondary data is not always available at the right disaggregation level or freely available.

To help overcome the sparsity of data, especially high-quality data, Romania should increase the use of secondary data for monitoring its R&I system. The wide range of secondary data containing information related to research and development (R&D) has the potential to make M&E more efficient while reducing costs. Romania already uses some indicators from secondary data. However, Romania has not yet exploited the full potential of available secondary data. Eurostat from the European Commission (EC) operates an extensive database covering data related to R&D containing indicators such as employed persons in science and technology and business enterprise expenditures on R&D. On a national level, the relevance of the TEMPO database managed by the National Institute of Statistics (INS) should be considered. Overall, an initial assessment at the instrument and program levels of available secondary data is needed to identify the target population with the highest needs and the need for additional (primary) data where key information on potential beneficiaries and their needs is missing.

Romania's data quality processes focus more on regulatory compliance than relevance to the R&I objectives. Many respondents to the World Bank's M&E survey (43 percent of 23 respondents) claim that ensuring the accuracy and completeness of M&E data is not part of their responsibility, suggesting that they believe processes to ensure high data quality are not intrinsic to M&E systems. Using standardized data collection methods and tools is reported by only 39 percent of respondents as the main data quality tool, and applying regular data quality checks is a systematic practice for less than one-third of the participants. Ensuring high-quality data through a thorough data quality assurance strategy at each policy level, from the instrument to the strategic level, of both primary and secondary data is crucial for informed decision-making and effective program management. In addition, indicators should be cross-validated whenever possible with other available data to assess the accuracy and quality of information.

Step VIII. Specify how monitoring data will be analyzed and used

The lack of a structured approach for data analyses to inform policy decisions can limit the effectiveness of monitoring efforts and impede progress toward achieving policy objectives. Improved monitoring alone will unlikely lead to significant policy impacts on the R&I system. Monitoring results should be used to inform decision-making at all steps of instruments and policy implementation. Monitoring staff should facilitate the preparation and dissemination of clear and actionable results. As a result, decision-makers should commit to taking quick action based on this information. However, the SNCISI does not include a detailed approach for utilizing data on outcome indicators to adjust existing policy instruments and develop future ones. Managing authorities and implementing bodies lack the personnel to translate data into meaningful, timely, and informative reports.

The SNCISI would benefit from a detailed analysis plan for monitoring data at the strategic level. Analyzing monitoring data on R&I policies at the strategic level can support identifying additional features of the centralized monitoring platform that the Directorate of Policies and Strategies for Research Development Innovation and Technological Transfer (DPSCDITT) of the Ministry of Research, Innovation and Digitalization (MCID) is establishing. By clearly communicating the value added of analyses at the strategic level, the DPSCDITT

may gain additional buy-in from R&I implementers, facilitating information sharing and promoting platform use.

The regulatory framework of each R&I policy should include a detailed analysis and learning plan for monitoring data. R&I managing authorities should further commit to deriving lessons from monitoring data. This commitment involves learning from the past (identifying challenges in implementation and suggesting improvements) and for the future (identifying areas with high uncertainty that must be addressed in policy making).

Step IX. Define a relevant management information system

Centralizing data within a comprehensive R&I platform could support the information exchange needs of multiple line ministries and program managers in Romania. The lack of interoperability among existing IT platforms and inconsistencies in monitoring procedures pose significant challenges to achieving this objective. Addressing these challenges will require close collaboration among stakeholders and a concerted effort to develop standardized monitoring procedures and interoperable IT systems. Recent efforts by the MCID to establish a centralized monitoring framework (hereafter referred to as 'the DPSCDITT platform') that integrates data from all R&I programs are a promising start. The DPSCDITT platform aims to harmonize data on R&I from multiple database management systems for national, EU, and regional funding operating in Romania, with each system adapted to different data volumes and the intended use of the information. According to the draft methodology of the DPSCDITT platform, which is under development, the platform's purpose goes beyond monitoring the progress of R&I policies, leaving the door open for additional data supporting R&I planning and decision-making. Data will be automatically extracted from existing sources to the extent possible based on the interconnection and interoperability with primary information systems. This initiative aims to improve the uptake of the DPSCDITT platform among program managers and to foster transparency regarding the progress of R&I interventions.

The proposed template for the monitoring framework of the Romanian R&I sector (Appendix 8) serves as a foundation for the architecture of the DPSCDITT platform. The template builds on the draft methodology of the DPSCDITT platform. The proposal in this report complements this initiative by providing a comprehensive list of crucial information that should accompany the monitoring indicators of the R&I system and putting these elements in an actionable structure.

A transparent and concrete operational plan should accompany the methodology of the DPSCDITT platform. Implementing the DPSCDITT platform would benefit from more explicit governance, a clear political commitment of each involved ministry and RDA, and a more concrete and structured way forward. The finalization and maintenance of the DPSCDITT platform requires adequate financial and human resources.

Step X. Identify suitable evaluation strategies

Impact evaluations complement monitoring by adding a deeper layer of understanding of the causal impact of the implemented activities. We define evaluation as the systematic and objective assessment of instruments, programs, or policies to measure their effectiveness and impact. Among evaluations of the performance of investments, impact evaluations emphasize causality, attempting to clearly link policy activities with their intended or

unintended impacts. Whereas monitoring focuses on tracking progress by providing and analyzing ongoing data, impact evaluations delve into the underlying causes and effects, offering a rigorous assessment of policy and instruments impacts. Together, monitoring and impact evaluations form a comprehensive framework for assessing and managing interventions.

Despite the rigor of impact evaluations, not all policies and instruments can or should be subject to an impact evaluation. Rigorous impact evaluations should be applied where an agency seeks to learn how to improve implementation or adjust it to new circumstances. They cannot be applied for instruments or programs that have not finalized the logic of what to test and why. (The first step is setting up a coherent, logical, and realistic ToC.) Impact evaluations require resources (for personnel and data collection) and, most importantly, commitment to share relevant information and be open to change. They may not be applicable when instruments or programs have a few targeted beneficiaries, which limits the application of statistical methods. They should be applied ideally for lower-level policy questions that allow capturing variation in implementation. (High-level changes in national legislation are hard to evaluate.) In such situations, several other evaluation methods are available.

Evaluation culture in Romania is still in its infancy, with large differences in evaluation practices between the national and the EU-funded programs. The Policy Support Facility (PSF) report points to the absence of rigorous evaluations of individual research organizations, R&I programs, and instruments. This conclusion is corroborated by the World Bank's functional analysis, which shows that almost no evaluations of individual R&I instruments were done in the previous programming period. Furthermore, the functional analysis reveals that evaluation results are rarely used to learn and improve R&I policy instruments. Because of their regulatory requirements, EU-funded programs are more commonly evaluated, though they still frequently fall short of seeking rigorous evidence on causal mechanisms of change. Overall, scope for improving evaluation practices is evident for both MCID and the EU, with the need to improve their rigor and make the results timely, available, and relevant for decision-making. To our knowledge, no rigorous impact evaluation of R&I policies has been conducted in Romania.

Many existing policies at different policy levels are suitable for impact evaluation. The necessary condition for an impact evaluation—finding and establishing a comparison group that does not receive the instrument or policy being evaluated—is often fulfilled naturally: the number of beneficiaries is limited by the available funds. Furthermore, programs and instruments are phased in over time and not rolled out simultaneously, allowing analysts to compare early and late beneficiaries. Moreover, a certain score frequently serves as a cutoff for receiving funding; with sufficient observations, such cutoff scores can be exploited for identifying comparison groups. Change in practices requires openness to explore possibilities to embed impact evaluations and a culture that embraces learning as a key goal of policy making.

Step XI. Determine reporting and dissemination plans

Large variations in reporting practices exist between program implementors, and reporting at the strategic level is yet to be implemented. For instance, the Executive Agency for Higher Education and R&I Funding (UEFISCDI) publishes detailed annual reports on the state of implementation of the instruments of the National RDI Plan (PNCDI) under their management. MCID has recently started to issue public activity reports, but these focus more on inputs and processes than on R&I outputs and results obtained. Despite various

commitments made in strategic documents, regular reports on the implementation of SNCISI are still missing. Consequently, comprehensive and conclusive evidence of progress toward the strategic goals is scarce and incomplete. There is still space for harmonizing and adjusting the reporting requirements to the needs of an overall M&E system.

Reporting on monitoring R&I policies at the strategic level and for dissemination should follow best practices. Creating a functional centralized monitoring system requires harmonizing existing monitoring systems at the program level and clarifying reporting flows at the SNCISI level. At the strategic level, the Research Law stipulates that the newly created Inter-ministerial Committee for Science, Technology, and Innovation should issue and make public an annual report with conclusions and recommendations for the R&I system. To achieve greater coherence in reporting and monitoring, the annual report prepared by the Inter-ministerial Committee should be corroborated with the periodic reports on SNCISI implementation. The annual report could also provide evidence of progress toward achieving country-specific recommendations, supporting Romania's reporting on R&I in the context of the European Semester. Broad dissemination of the annual report is strongly encouraged to inform and empower decision-making at all levels and inform the research sector. It is essential to create and distribute a summary tailored specifically for the general audience to communicate the content of the annual report to citizens. The R&I Observatory (to be developed with support from the World Bank) could decisively improve the policy intelligence function and shed light on Romania's R&I strengths and areas of excellence.

Step XII. Update previous steps as necessary

Designing an effective monitoring strategy is dynamic and iterative, seldom following a straight path, requiring frequent updates. This report provides a 12-step toolkit for developing new and improving existing monitoring frameworks from the instrument to the strategic level. Upon completing all elements of the monitoring strategy, by going from Step 1 to Step 11 (with a potential for some of these steps to occur simultaneously) regular updates are required to incorporate additional needs as technical requirements are clarified and to align indicators and plans with changes in actual instruments and policy implementation and instruments and policy implementation plans. At each policy level, repeating the whole cycle, Steps 1 to 12, at least twice a year to assess the needs for any updates will ensure a consistent and frequent assessment of the monitoring system. It allows for promptly identifying any emerging challenges, opportunities for change, or trends and addressing them quickly. The regular repetition of the cycle enhances organizational learning and promotes continuous improvement because subsequent iterations can incorporate feedback and lessons learned from previous cycles.

INTRODUCTION

Introduction

Overview of the R&I system

Romania has experienced robust economic growth recently, but limited innovation capacity impedes development. Romania's growth rate averaged 3.8 percent over the last two decades, more than doubling the living standards of Romanians. However, further socio-economic development will depend on seizing opportunities brought by green and digital transitions that have the potential to boost productivity and environmental sustainability (World Bank 2022). The limited innovative capacity of the Romanian economy—resulting from chronic underinvestment and skills shortages—may continue to limit further progress and convergence with the European Union (EU) average. Romania ranks last in the EU on the European Innovation Scoreboard (EC 2022a), with particularly low performance on business process innovation, collaboration between research and industry, and public and private expenditures on research and development (R&D). The Romanian Government has recognized the challenge of low R&D activities, given that R&D drives innovation, and has been reflecting the importance of R&D in periodic national strategies for research and innovation (R&I).[2]

The recently developed *National Strategy Research, Innovation and Smart Specialization* presents a significant opportunity for the Romanian R&I system, focusing on excellence, performance, and public-private cooperation in its Vision 2030. The Ministry of Research, Innovation, and Digitalization (MCID) has drafted the *National Strategy for Research, Innovation, and Smart Specialization 2022–2027* (abbreviated SNCISI) to outline Vision 2030 for the Romanian R&I system. This vision emphasizes the importance of recognizing and supporting excellence, rewarding performance, and fostering public-private cooperation in R&I. SNCISI expresses four main strategic objectives: (i) developing the national R&I system; (ii) integrating Smart Specialization[3] innovation ecosystems into global value chains; (iii) promoting business engagement in innovation; and (iv) enhancing internationalization and European and international collaboration. SNCISI outlines thematic priorities, focusing on Smart Specialization priorities and the Strategic Research Agenda addressing societal challenges. This effort is nationwide because each of Romania's eight development regions has adopted a Research and Innovation Strategy for Smart Specialization (RIS3), and these strategies are integrated within SNCISI.

Although R&D funding in Romania has been inadequate in the past, substantial planned investments reinforce Vision 2030, setting expectations high for a more promising outlook. Despite the 2006 Research Law's mandate to allocate 1 percent of GDP for R&D annually, government budget allocation for R&D reached only 0.16 percent of GDP in 2021. Vision 2030 targets are accompanied by premises for their realization, including commitments to increase public R&D spending to 1 percent of GDP by 2027 and to ensure the convergence of the structure of R&D expenditures of the national R&I system with that of other countries in the EU. The estimated budget for SNCISI during the 2022–2027 period of approximately €16.6 billion—about 1 percent of GDP—(see Annex 2 of SNCISI) was defined to meet this objective. The budget covers national R&D funds, R&I allocations from European Structural and Investment Funds (ESIF) encompassing the Cohesion Policy programs, and R&I investments

[2] GO 57/2002 Government Order on scientific research and technological development (Research Law).
[3] Smart Specialization is a location-based strategic concept aimed at promoting structural transformation towards knowledge - and innovation-driven growth, where regional development priorities are set based on the potential success of existing knowledge and technologies. Please find more information here: https://s3platform.jrc.ec.europa.eu/what-we-do.

and reforms planned through the National Recovery and Resilience Plan (NRRP) (see Appendix 1 for a full list).[4] Overall, the R&I ecosystem has improved its capacity for accessing funds as more beneficiaries collect experience in accessing European or national funds.

Fragmentation is a crucial challenge for the Romanian R&I system. The R&I system involves a variety of actors, funding sources, and managing authorities (see Appendix 1). Research organizations' institutional setups and funding formulas differ greatly, generating complexity and challenges in the coordination and alignment of R&I monitoring practices. Multiple changes in the R&I governance system following governmental changes further added to this complexity. At the time of writing, the State Authority for R&I in Romania is MCID. It coordinates government policies for R&I at the national level and develops, updates, and ensures the institutional framework for the implementation of SNCISI, including the monitoring of R&I policies at the strategic level. MCID is also the managing authority for the National Research Development and Innovation Plan (PNCDI) and is an intermediate body for parts of some programs funded through ESIF and NRRP.[5] The Romanian Academy functions autonomously and manages the institutional funding programs for the public research institutes under its coordination. The Ministry of Education (MEDU) is the central authority responsible for public education, training, and research at the university level. Other ministries manage R&D sectoral plans (for example, the Ministry of Agriculture and Rural Development (MARD) and the Ministry of Health (MoH)). Still others finance the R&I system (the Ministry of Investments and European Projects (MIPE), the Ministry of Finance, and others). The Executive Agency for Higher Education and RDI Funding (UEFISCDI) implements the largest part of PNCDI programs, whereas the Regional Development Agencies (RDAs)[6] oversee the management and implementation of the regional RIS3.

Establishing a single R&I coordination structure is essential to enhance the impact of public funds on the R&I system. Horizontal coordination between different ministries and agencies with a role in the R&I system and vertical coordination between national and regional R&I actors are major challenges. Until recently, the lack of a single R&I coordination structure resulted in insufficient oversight of the R&I system. Limited oversight is a missed opportunity to strengthen the synergies and complementarities of R&I instruments and policies and share lessons learned across managing authorities and intermediate bodies. Many consultative bodies—including the Committee for Coordination of Smart Specialization (CCSI), created in 2019—have supported MCID in its work. Yet, CCSI provides advice for the management of Smart Specialization and is not concerned with other R&I policies. The new Inter-ministerial Committee for Science, Technology and Innovation that became operational in June 2023 should fulfill this coordination role. The Committee works under the coordination of the Prime Minister and has the decision power to establish, monitor, and adjust national priorities for research, development, and innovation. Moreover, the Committee is expected to coordinate national, sectorial, and regional priorities on R&I along with the private sector and civil society. In terms of monitoring, MCID will host the Secretariat of the Committee, which will work closely with other MCID units to monitor and evaluate the implementation of SNCISI and oversee the evolution of the national R&I system. Currently, the Directorate of Policies and Strategies for Research Development Innovation and Technological Transfer (DPSCDITT) of MCID leads

[4] Appendix 1 highlights the main funding sources for SNCISI, along with the managing authorities and implementing bodies responsible for SNCISI's execution.

[5] In this report, we refer to a managing authority as the entity responsible for the management and oversight of a specific policy. Typical tasks include coordinating activities, allocating resources, and ensuring compliance with regulations and guidelines related to the initiative it oversees. The managing authority may be a national ministry, a regional authority, or another public body. An implementing body is an entity usually contracted by a managing authority. In some instances, it corresponds to a specific unit of the managing authority dedicated to this role. The role of an implementing body is responsible of the implementation of a specific policy by performing the activities to generate the outputs of a measure (for example, manage beficiary selection, organize stakeholder meetings or provide services to beneficiaries).

[6] RDAs are the executive bodies of the Regional Development Councils, the main decision-making entities at the regional level (NUTS2) in Romania. The eight RDAs act as managing authorities for the Regional Programs 2021–2027, which allocate about EUR 2.2 billion in total to RIS3 priorities (see Appendix 1).

responsibilities over the design, implementation, and update of monitoring at the strategic level.

Throughout the report, "evaluation" refers to the systematic and objective assessment of instruments, programs, or policies to measure their effectiveness and impact. In this report, we do not use "evaluation" to refer to the assessment of applications (to determine the suitability of individual project proposals for funding).

Coordinated efforts on R&I decision-making require relevant evidence, calling for a monitoring and evaluation (M&E) framework for the whole R&I system in Romania. Authorities should continuously adjust ongoing R&I instruments and policies based on the results of rigorous M&E. R&I instruments and policies can achieve larger impacts by making decisions informed by relevant evidence. However, having relevant evidence requires a complete, coherent, and actionable monitoring framework for the R&I system. Existing monitoring frameworks in Romania need to focus on timely learning and operational decision-making, to guide short- and longer-term adjustments of instruments and policy implementation. The limited centralization and comparability of information from monitoring R&I funds to date is a missed opportunity to strengthen the relevance, synergy, and complementarity of R&I instruments and policies.

What is monitoring, and why does it matter?

- Effective monitoring provides timely, actionable, and credible evidence, allowing decision-makers to make rational short- and longer-term adjustments of instruments and policy implementations.
- Monitoring consists of routinely collecting, analyzing, and reporting information on instruments and policy implementation and target beneficiaries.
- In best practice environments, monitoring guides decision-making through all five primary phases of an instrument or policy cycle: monitoring can be used, for example, to inform targets (during the design phase), to ensure that an instrument effectively reaches its intended audience (during the launch phase), to identify early implementation challenges (during the early stages of implementation), to ensure the instrument, the program or the policy hits its medium-term targets (during the remaining implementation period), and to take stock of achievements on longer-term targets (during the completion period).

Monitoring of public policies is the continuous assessment of instruments and policy performance. It consists of routinely collecting, analyzing, and reporting information on instruments and policy implementation and its target beneficiaries. Monitoring data is not limited to information obtained from instruments and policy implementation. It should also include need assessments, surveys, and secondary data that may guide instruments and policy design, define indicator targets and baseline values, and test the hypotheses underlying the instruments and policies' intervention logics.[7] These pieces of evidence enable policy makers and implementers to quantify implementation progress and identify challenges. They can use this information to make timely instruments and policy design and implementation adjustments. Box 1 provides key reading recommendations on monitoring.

[7] A policy's intervention logic refers to the process through which the policy's interventions will achieve the policy end objectives.

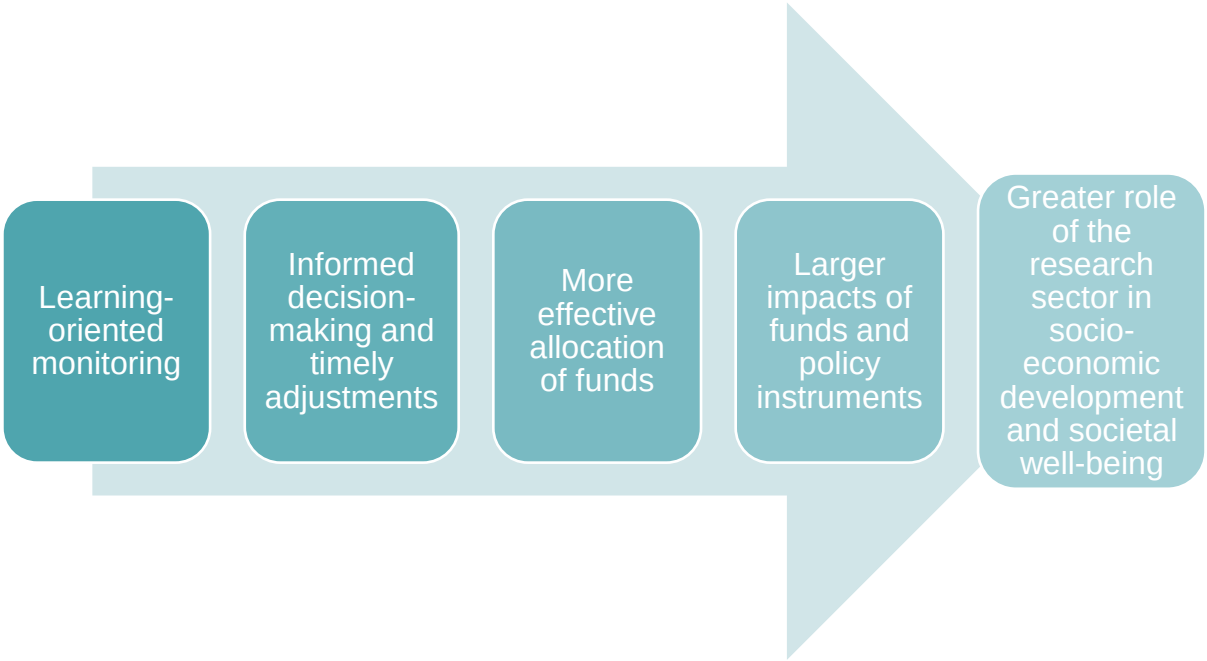
Box 1 Key reading recommendations on monitoring

- ✓ Bjärkefur, K., de Andrade, L. C., Daniels, B., & Jones, M. R. 2021. Development research in practice: The DIME analytics data handbook. World Bank.
- ✓ European Commission. 2022. Study to support the monitoring and evaluation of the framework programme for research and innovation along key impact pathways: Indicator methodology and metadata handbook.
- ✓ Goergens, M., & Kusek, J. Z. 2009. Making Monitoring and Evaluation Systems Work: A Capacity Development Tool Kit. World Bank.
- ✓ Kusek, J. Z., & Rist, R. C. 2004. Ten steps to a results-based monitoring and evaluation system: A handbook for development practitioners. World Bank.
- ✓ USAID. 2013. Monitoring and Evaluation Platforms Considerations for Design and Implementation Based on a Survey of Current Practices. Discussion Note.

Source: World Bank.

Good monitoring focuses on near real-time learning. The effectiveness of public policies relies on critical factors that are often outside decision-makers' direct control. Public policies are continuously confronting new societal challenges in an evolving environment. Their effects on policy instruments' relevance and impact are uncertain. Although these elements fall beyond decision-makers' control, they can react by quickly adapting current policies and instruments and formulating new solutions acknowledging these challenges. Effective monitoring provides timely, actionable, and credible evidence to guide these decisions. As such, monitoring should be seen as a necessary complementary activity to achieve policies' objectives, as illustrated by Figure 1.

Figure 1 Role of monitoring in achieving policies' end goals



Source: World Bank

Evaluations complement monitoring by adding a deeper layer of understanding to the monitoring process. Whereas monitoring focuses on tracking progress by providing and analyzing ongoing data, evaluations delve into the underlying causes and effects offering a rigorous assessment of instruments and policy impacts. Together, monitoring and evaluations form a comprehensive framework for assessing and managing interventions (more on evaluations, including impact evaluations, can be found in Step 10).

The monitoring of the R&I system should guide decision-making throughout all stages of an instrument or policy cycle. These stages fall into five primary phases, each of them discussed further below: (i) design, (ii) launch (e.g., calls are initiated), (iii) initial stages of implementation (e.g., selected beneficiaries start implementing projects), (iv) the remaining implementation period (e.g., over the timespan of the projects), and (v) completion (e.g., completion of the projects that received funds from the policy instrument or the end of the policy's financing period). It is essential to view these phases as a continuous cycle, with valuable lessons learned from each phase influencing the design of future instruments, programs and policies.

Previous and current evidence should inform the design of new instruments, programs and policies, or the adjustment of previous ones. During the design (or re-design) stage, policy makers should incorporate insights gained from M&E results of previous instruments and programs and information on emerging patterns and trends of the R&I ecosystem. The design of new policy instruments should rely on regular quantitative and qualitative assessments of the needs of the target beneficiaries and the enabling conditions for implementation success. These assessments can guide policy makers in identifying areas where interventions could have larger impacts. Furthermore, evidence generated by these assessments can define indicator baseline values and inform the definition of targets. This stage is also the time to plan and design instruments and policy evaluation strategies, including the definition of required indicators and resources, to implement alongside instruments and policy implementation (see more on evaluations in Step 10.).

During the launch of a new policy instrument, monitoring data can serve as a valuable tool for evaluating the extent to which the instrument effectively reaches its intended audience. Policy instruments relying on calls may fail at attracting R&I actors that could benefit most from these interventions. Beyond the application rates, the characteristics of applicants should be collected during application and compared with those of the entire target population, collected during the needs assessment or available secondary data, as part of monitoring data. The under-representation of some groups may be related to uneven mobilization of the call or specific features of the call (such as the targeting criteria). The instrument implementers should consult underrepresented but eligible groups to understand barriers to application. Relevant target groups may be further screened out at the selection stage. A careful comparison of the characteristics of selected and rejected applicants, obtained from application forms, innovation surveys or other secondary data, may shed light on underlying challenges that complementary instruments and policies should address or question the relevance of the selection criteria.

During the second stage of policy implementation, after beneficiary selection, monitoring emphasizes tracking outputs and short-term outcomes.[8] Monitoring output indicators provides insights into whether allocated funds are utilized as intended and identifies initial implementation delays or challenges. In such delays, decision-makers should examine the justifications beneficiaries provide to identify initial barriers to implementation. Decision-makers should assess whether they can use this information to overcome these barriers through policy adjustments, such as greater mobilization efforts or a change in the eligibility criteria. Once outputs have been achieved, attention should shift towards observing short-term outcomes. If these outcomes are not being realized as expected, it becomes necessary to validate critical assumptions by leveraging contextual and system-level indicators. Conducting a quantitative or qualitative survey on a representative sample of beneficiaries can supplement this assessment. Swift adjustments are warranted if the instruments' or overall policy's logic

[8] Outputs are the direct and immediate results of the activities conducted by an instrument or policy. Short-term outcomes refer to the immediate changes that occur as a direct result of the outputs. See Step 3 for more detail on these concepts.

demonstrates early signs of failure. If no action is taken at this stage, the policy will unlikely achieve its other targets.

During the remaining implementation period, the primary focus should be on attaining the medium-term targets in the instruments and policy. Testing the instruments and policy's critical assumptions is crucial if the medium-term objectives are not achieved. At the policy level, this implementation stage represents a valuable opportunity to compare the outcomes of alternative or complementary intruments. To make this comparison, data can be complemented with information on potential outcomes that would have been realized without the policy, ideally captured in a rigorous evaluation of the respective intruments (more on evaluation in Step 10.).

After the end of instruments and policy implementation, it is time to take stock of the overall instruments and policy performance and prepare for the next policy cycle. At the policy level, the completion stage corresponds to the end of the financing period. For a policy instrument, it may correspond to the completion of projects that received funds from the instrument. Monitoring data can be used to inform on the achievement of longer-term targets. Evaluations, designed from the onset of instruments or policy design, should be concluded to further disentangle the instruments' or policy's contribution from other factors. Lessons learned during the implementation period should inform the design of future instruments and policies.

Background and objectives of the report

- This report comprises the main deliverable for activity (a) of Pillar III of the Research Modernization in Romania project: support for developing a monitoring framework for the R&I system to support evidence-based policy making.
- It provides inputs to and guidance for developing a complete, coherent, and actionable monitoring framework for the R&I system in Romania based on best practices for designing and implementing a monitoring framework focused on operational decision-making.
- The report takes an adaptive learning approach that requires learning from prior actions and disseminating knowledge widely.

This report provides inputs to and guidance for developing a complete, coherent, and actionable monitoring framework for Romania's R&I system. This report contributes to the third pillar, "Generating evidence for better policy making," of the MCID and World Bank project *Research Modernization in Romania: Improving the Quality and Relevance of the Research Sector*. Pillar III encompasses three main activities: (a) providing inputs for the development of a monitoring framework for the R&I system, (b) designing two impact evaluations for R&I investments, and (c) establishing an R&I Observatory. The present report is the main deliverable for the first activity. It focuses on the monitoring side of M&E. See Box 2 for more details on the support provided to research modernization efforts.

Box 2 Scope of World Bank support to the Government of Romania in research modernization efforts

The scope of the Reimbursable Advisory Services (RAS) agreement on Research Modernization in Romania: Improving the Quality and Relevance of the Research Sector includes capacity building and establishing new R&I institutions, such as an innovation

agency and an R&I Observatory. The activities to be carried out by the World Bank under the project are organized into three components:

- **Component 1: Support for research sector modernization reforms and investments.** Work under this pillar includes, among other activities:
    - Recommendations and inputs for recalibration of the policy mix and identification of procedural bottlenecks in the design and implementation of R&I policies;
    - Recommendations detailing a plan for financing industry-academia linkages and technical assistance in the design of a pilot intervention encouraging collaborative research;
    - Analysis of the effectiveness of intermediary institutions (for example, technology transfer offices, digital innovation hubs, innovation clusters, incubators, accelerators) and recommendations for strengthening their institutional capacity;
    - Support for the development of evaluation and transformation plans of Public Research Organizations (PROs) to increase research excellence and relevance; and
    - Inputs and recommendations to integrate Romanian research organizations in the European research area.
- **Component 2: Capacity building to design and implement R&I reforms and investments.** Work under this pillar includes, among other activities:
    - To improve logical frameworks and policy linkages, MCID under the NRRP will organize workshops on the development of a theory of change (ToC) for R&I reforms and investments;
    - A cross-country analysis of research sector reforms and a series of country showcases will build the capacity of the MCID's PSF delivery unit and other relevant stakeholders to design and implement R&I policies;
    - Support for the design and establishment of an innovation agency, including examples of global good practices, capacity building support, and recommendations for the agency's governance, advisory team, operational procedures, programs and instruments, and monitoring and evaluation procedures; and
    - Support for the development of a co-investment fund for startups to attract private sector investments into innovative early-stage companies.
- **Component 3: Support for generating evidence for better policy making.** Work under this pillar includes, among other activities:
    - Support for the development of a monitoring framework for the R&I system to support evidence-based policy making (the topic of this report);
    - Support for the establishment of an R&I Observatory, which will gather evidence on Romania's R&I support policies and investments for better strategic governance and policy making; and
    - Performance of two impact evaluations of select R&I investments to inform research sector modernization reforms in Romania and other countries.

The project will provide support until 2026. The project was initiated in 2022, and many of the key activities will take place in 2023 to support the Government of Romania in

achieving its ambitious research sector reforms; however, the project will include ongoing support for capacity building, monitoring and evaluation, and knowledge sharing until 2026.

The Policy Support Facility (PSF) panel's key recommendations on M&E (EC 2022b) highlight the importance of reforming the monitoring of the R&I system.[9] The present report offers inputs that the Government could use for implementing its Recommendation 3.1:

> *"Design and implement the monitoring system for R&I, envisaged in SNCISI and covering the whole R&I system, based on interoperability of national and Cohesion Funds systems. The evaluation component should be institutionalized and could be organized by the same body in charge of monitoring, provided that it relies on independent experts (EC 2022b)"*

Implementing this recommendation is part of Romania's commitment to modernize its research sector.

This report seeks to promote best practices for designing and implementing a monitoring strategy of the whole R&I system focused on improving operational decision-making in a learning environment. Continuous learning through monitoring is inherent to Smart Specialization policies. Smart Specialization priorities are defined through the so-called Entrepreneurial Discovery Process, consisting of an ongoing dialogue between national and regional R&I actors. Smart Specialization adopts an experimental approach to policy design, focusing on exploring and discovering policy solutions through trial and error within unique circumstances to which monitoring contributes (World Bank 2021a).[10] Adaptive management, consisting in the timely adjustment of instruments and policy implementation plans based on timely evidence, is not reserved for Smart Specialization but can benefit the whole R&I system. Broadening the benefits of adaptive management requires a profound transformation of how Romania monitors its R&I system, from the instrument to the strategic level, expanding the focus on accountability to learning.

The report gathers key principles for selecting a few informative indicators that allow decision-makers to track the steps of the instruments and policies' intervention logic and the core assumptions beneath the instruments and policies. The report points to the necessary ingredients of an actionable monitoring framework to guide decision-makers and monitoring staff from the instrument to the strategic level in defining or collecting information on these indicators. It discusses the coordination structure of monitoring, information management, and the importance of committing to actions based on evidence. This report complements a previous report[11] developed by the General Secretariat of the Government (GSG) in collaboration with the World Bank (World Bank 2018), providing general guidelines for monitoring Romanian national strategies by emphasizing the R&I system.

The present document guides decision-makers and monitoring staff in their efforts to enable monitoring of the R&I system of Romania at the strategic level. Coordinated decision-making must be supported by the centralization and comparability of information across all funds. Lessons learned should not be limited to the policy instrument or program level but must be shared across managing authorities and intermediate bodies. This diffusion of knowledge requires establishing a joint monitoring framework for the whole R&I system.

[9] The PSF Open Report outlines the result of an independent review of Romania's R&I system conducted between 2021 and 2022 by a panel of independent experts. As part of the NRRP, Romania committed itself to implement 80 percent of the recommendations included in the PSF Report.

[10] The 2021 World Bank report provides proposals for designing a complementary M&E system serving this objective, with case studies in Poland Pomorskie and Romania North-East. The 2021 report deals with the monitoring of RIS3. In contrast, the present report encompasses the whole Romanian R&I system, with specific guidance for harmonizing and centralizing information from the monitoring of public R&I funds.

[11] World Bank (2018): *Component D: Strategy Unit Monitoring Guide*. This report was part of the Advisory Services Agreement on *Assistance to the Government of Romania on Establishing a Strategy Unit*.

The SNCISI lays the ground for such a framework by outlining critical principles for the M&E of the SNCISI implementation at the strategic level. The DPSCDITT under MCID has taken several steps to centralize monitoring data on the R&I system and to harmonize R&I indicators. This report provides support and additional guidance to these ongoing initiatives.

Report preparation activities and limitations

- The assessment of the monitoring of the Romanian R&I system primarily builds on documentation review and in-depth stakeholder consultations, as well as on the World Bank's surveys and ToC workshops.
- Additionally, a survey of M&E practitioners in Romania gathered information on M&E practices and training needs.
- Future analysis should complement this assessment by better understanding monitoring practices at the Romanian Academies of Science and public research institutes.

The assessment of current monitoring practices of the Romanian R&I system in this report primarily builds on a review of the monitoring regulatory framework of different funds for R&I and on a series of in-depth stakeholder consultations.[12] This report benefits from a thorough desk review of crucial available documentation on monitoring Romania's R&I policies, with a list of critical resources in Appendix 2. Stakeholder consultations between January and June 2023 aimed at shedding light on the actual monitoring practices, information flow, and challenges faced by managing authorities and intermediate bodies. These exchanges contributed to identifying perceived strengths and weaknesses of the monitoring systems, missed opportunities and potential for improvement. Stakeholders were selected to represent major institutions responsible for the primary funding sources of R&I in the current programming period. Stakeholders' availability to participate in these meetings determined the final pool. As a result, the views gathered in these consultations may not represent all R&I stakeholders, with potential biases in the obtained responses. These bilateral consultations were complemented by two interactive workshops[13] held in Bucharest in March and May, during which insights and feedback were gathered from participants.[14] The first workshop aimed at promoting best practices and eliciting current challenges in monitoring research and education. The second workshop was dedicated to the validation of initial recommendations for the monitoring of the R&I system. We incorporated participants' feedback into the conclusions of this report.

Two surveys conducted by the World Bank with Romanian program managers of R&I policies, including the functional analyses of 32 key R&I instruments, and 12 ToC sessions created further sources of knowledge for the assessment of the current monitoring processes and frameworks. An M&E online survey was sent in March 2023 to over 80 stakeholders (with 23 responses) responsible for monitoring of R&I and educational programs in ministries, RDAs, and implementing bodies. The survey sought to elicit actual M&E practices (for example, collection of baseline values, use of M&E in decision-making,

[12] Appendix 2 provides a list of key documents that were reviewed and Appendix 3 the list of stakeholders that were directly consulted.
[13] These events are parts of a series of World Bank M&E capacity-building workshops. The series was initiated in December 2022 with a workshop on impact evaluation that highlighted the relevance of good monitoring for evaluation. The workshop in May was called *Workshop on Monitoring and Evaluation to support Evidence-Based Decision-Making* and in May 2023 *Workshop on Recommendations for the Monitoring of the Research and Innovation System*. Recordings and PowerPoint slides available upon request from the World Bank.
[14] The list of institutions represented in these workshops is provided in Appendix 4.

data quality assurance strategies) and training needs (for example, familiarity with key monitoring concepts, topics on which they would like to receive more training).[15] This survey complemented a series of semi-structured interviews conducted with program managers between November 2022 and February 2023. These interviews were part of a functional analysis[16] covering 32 key R&I policy instruments (out of 76 instruments mapped) of the 2014–20 programming period. They were used to collect data on the instrument design, implementation, and inter-institutional integration to conduct an in-depth assessment of the quality of the selected instruments' design, implementation, and governance. The functional analysis had four dimensions directly related to monitoring: monitoring and evaluation at design and during implementation, as well as learning evidence and process monitoring. Other critical dimensions of the functional analysis provided insights into important enabling factors of a sound monitoring system (for example, ToC, information management, program management, staff and training, and variables related to governance). In addition to those activities, the World Bank conducted in 2022 and 2023, 12 ToC workshops with key staff members of the MCID's PSF unit to enhance capacities in identifying gaps, reducing overlaps, and optimizing synergies across R&I NRRP's reforms and investments and thereby enabling MCID staff in improving design, implementation, governance and prioritization. The workshops aimed to strengthen MCID's internal capacity for modeling the logic of interventions and using ToCs to identify specific gaps or areas for reforms and investments. The workshops highlighted current limitations in using evidence in policy design and uncertainties about policies' intervention logic, resulting in difficulties setting up ToCs.

Future analysis should complement this assessment by better understanding monitoring practices at the Romanian Academies of Science and public research institutes. The conclusions of this report may be influenced by uneven access to information on the monitoring practices of Romanian R&I policies. Additional consultations and information exchange with crucial R&I actors, including the Romanian Academies of Science and public research institutes, can augment the present work.

Report outline

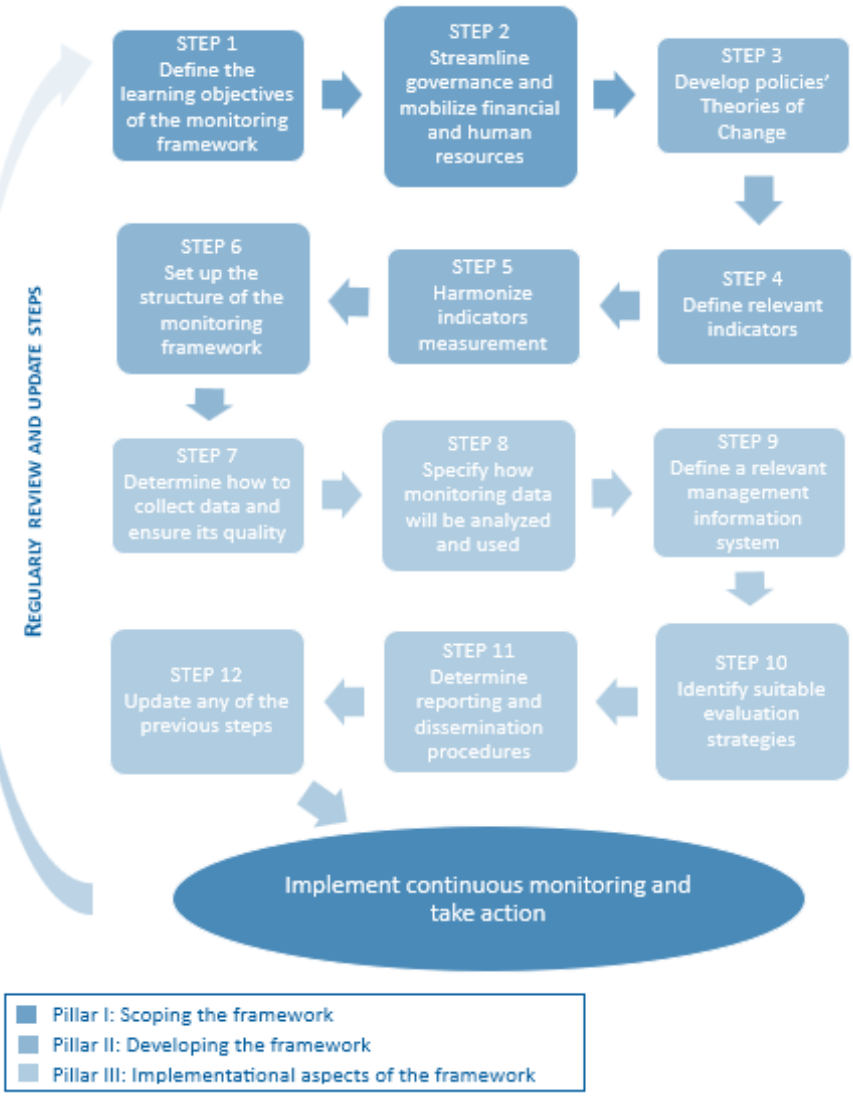
The report lays out 12 key steps that guide the design of the monitoring framework for the R&I system in Romania (Figure 2) before summarizing critical recommendations in a closing section. The 12 steps aim at providing close guidance to decision-makers and monitoring staff at different policy levels, from the instrument to the strategic level, in setting up or updating their monitoring framework. In the reality of their work, some of these steps may occur simultaneously rather than one after the other. The last section of the report gathers critical recommendations for implementing an improved and joint monitoring framework for the R&I system in Romania and sheds light on the next steps.

The proposed 12 steps can be organized in three main pillars: (i) Scoping the monitoring framework (Steps 1 and 2); (ii) Developing the framework (Steps 3 to 6); (iii) Implementational aspects of the framework (Steps 7 to 12). The first pillar relates to scoping the monitoring framework by the objectives (Step 1) and governance (Step 2) of the monitoring framework. Step 1 relates to setting the framework's foundation by defining what decision-makers should learn from monitoring R&I policies. Step 2 is concerned with the institutional structure of the monitoring of Romanian R&I policies, including the required financial and human resources, without which the framework cannot be implemented and effectively used for decision-making. The second pillar is concerned with the development of

[15] The full questionnaire of this survey is available in Appendix 5.
[16] The functional analysis questions can be found in Appendix 6. The results of the functional analysis will be available in the World Bank's Romanian Research and Innovation Policy Effectiveness Review (World Bank 2023) in September 2023.

the framework per se. Steps 3 to 5 provide guidance on indicator development, the core elements of any monitoring strategy, from policies' ToCs to advising on harmonizing R&I indicators definition and measurement. Once indicators are defined, one needs to determine the structure of the monitoring framework to highlight the need for information for a thorough and actionable monitoring strategy, which is the topic of Step 6. After reaching an agreement on a common structure, other key ingredients of the monitoring framework should be defined. This is part of our third pillar, which encompasses key implementational aspects of the framework. Step 7 provides insights on selecting relevant data sources before turning to data quality assurance plans. Step 8 discusses what to do with the reliable monitoring data that has been collected. Step 9 relates to the management of this information, with a focus on a digital monitoring platform. Although this report focuses on monitoring, for completeness, Step 10 provides some information on evaluation. Step 11 focuses on reporting and dissemination procedures for bringing relevant evidence to decision-makers and R&I actors. Figure 2 illustrates the idealized linear process from Step 1 to Step 11. Of course, each new step may affect previous ones, making the process non-linear in practice. Some of these steps may also occur simultaneously. As such, the last step highlighted by this report (Step 12) refers to the need to update any of the 11 first steps based on identifying additional needs. These steps are followed by the effective implementation of the monitoring framework, resulting in continuous monitoring and rapid action based on rigorous evidence. Monitoring plans require flexibility and regular updates to best fit evolving needs and policy design and implementation changes.

Figure 2 Key steps of the design of monitoring framework for the Romanian R&I system



Source: World Bank.

Each of the 12 steps starts with general recommendations based on best practices, followed by an assessment of Romania's situation and specific recommendations relevant to the Romanian's context. Each section of this report is organized in three parts. It first provides information on best monitoring practices in the form of general recommendations that apply beyond the Romanian context, whose key messages are summarized at the beginning of the section in a blue box. General recommendations are followed by an assessment of Romania's situation provided in a yellow box. This assessment led to the formulation of specific recommendations relevant to the Romanian's context and complementing international best practices. Each section concludes with a summary checklist, enabling monitoring staff to confirm step completion. This checklist includes a list of outputs expected after completing the respective step.

STEP I

STEP I. Define policy-makers and program managers' learning objectives from monitoring R&I policies in Romania

- The monitoring framework of the R&I system has two key objectives: accountability and learning. Effective monitoring should enable program managers, managing authorities, and the strategic level to answer questions encompassing both accountability and learning at each policy level.
- The monitoring framework should encompass four essential functions:
    - Comprehensive coverage of R&I public funds, ensuring that the whole width and breadth of funding available is monitored for rational reallocation based on data through the generation and gathering of indicators that are valuable at each relevant policy level.
    - Vertical aggregation of monitoring results at various policy levels, ensuring oversight of the R&I system, and facilitating learning on synergies and complementarities of policy instruments and adaptation throughout the monitoring process by sharing lessons learned upwards.
    - Horizontal comparability of instruments performances across funds, allowing sharing lessons across different means of funding and, therefore, rational decisions about shifting or applying for funding.
    - Assessment of physical and human capacities (e.g., infrastructure, human resources) for progress and evolution of the R&I ecosystem, providing data-driven opportunities for improving the R&I ecosystem as a whole.

General recommendations

The monitoring framework should fulfill two key objectives: (i) strengthening accountability and transparency and (ii) learning to disseminate lessons on good practices to guide the adjustment of instruments and policies. The first objective refers to how public resources are used and to identifying deviations from instruments and policy implementation plans. The second objective focuses on understanding what works and what does not work to identify challenges and opportunities to allocate resources better.

To reach its objectives, the monitoring framework of the R&I system should cover four essential functions. They are (i) comprehensive coverage of R&I public funds, (ii) centralizing monitoring results at various policy levels, (iii) the comparability of policy performances across funds, and (iv) an assessment of the capacities for progress and evolution of the R&I ecosystem. In terms of coverage, the R&I monitoring framework should enable tracking performance and identifying implementation challenges and achievements of each R&I fund during the whole implementation period and ideally beyond.[17] The other three functions of the monitoring framework of the R&I system are discussed below.

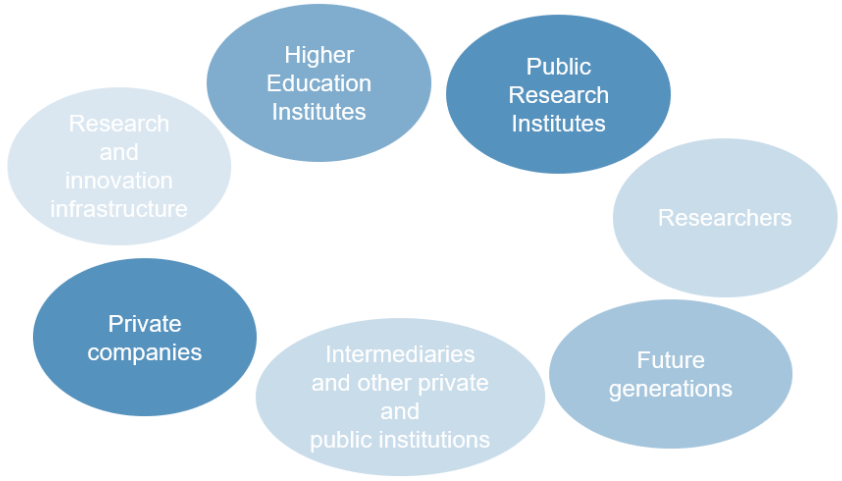
[17] Good monitoring should also set the ground for tracking longer term impacts by setting up structures that could be used beyond the instrument or policy's implementation period. For instance, provided consent, information on beneficiaries could be used to conduct follow-up surveys.

Monitoring the R&I system involves several policy levels, from the project level to the overarching strategic level. The monitoring of the R&I system should occur bottom-up (starting from the lowest level at which data are available, such as the beneficiary or institution) and aggregating up to the level of the strategy. This approach ensures that data collection and reporting are grounded in the actual implementation context, that a comprehensive understanding of the entire system is developed through the aggregation of information from beneficiaries at the project level to higher levels (*vertical aggregation*), and that learning on synergies and complementarities of policy instruments and adaptation throughout the monitoring process is facilitated by sharing lessons learned upwards. Each policy level has a set of objectives to achieve by the end of the policy cycle. The information collected from direct beneficiaries[18] is used at each policy level to assess whether the objectives related to this level were met.

Monitoring should enable the comparison of the performance of national R&I instruments. Comparability of performance (*horizontal comparison*) enables sharing lessons across the various R&I instruments regarding which instrument features promote progress and what bottlenecks may exist. Furthermore, authorities may design complementary policies. Difficulties in reaching one instrument's objectives may affect the progress of other instruments and policies. Detecting these risks across instruments on time may enable prompt and relevant adjustments in instruments design.

The monitoring framework of the R&I system should collect information on the capacities of the system. Monitoring at the strategic level should provide a complete overview of the R&I infrastructure by collecting information on the number and essential characteristics of its actors (represented in Figure 3) ranging from universities and public research institutes to future generations (pupils and students), their R&I performance, and how the R&I capacities evolve. Monitoring the R&I ecosystem requires studying the specific evolution of sectors and domains of interest (the Smart Specialization domains and the Strategic Research Agendas) to best adapt policies to an evolving environment. This demanding function could be attributed to an R&I observatory.

Figure 3 Key R&I actors



Source: World Bank.

Contextual and system-level indicators must complement information obtained from direct beneficiaries. Output and outcome indicators use data collected from direct beneficiaries. In addition, context indicators can shed light on the role of contextual factors (for

[18] Direct beneficiaries refer to individuals or groups who directly receive or benefit from a policy or intervention. Indirect beneficiaries are individuals or groups who may not directly receive the policy or intervention but still experience positive effects or spillover benefits as a result.

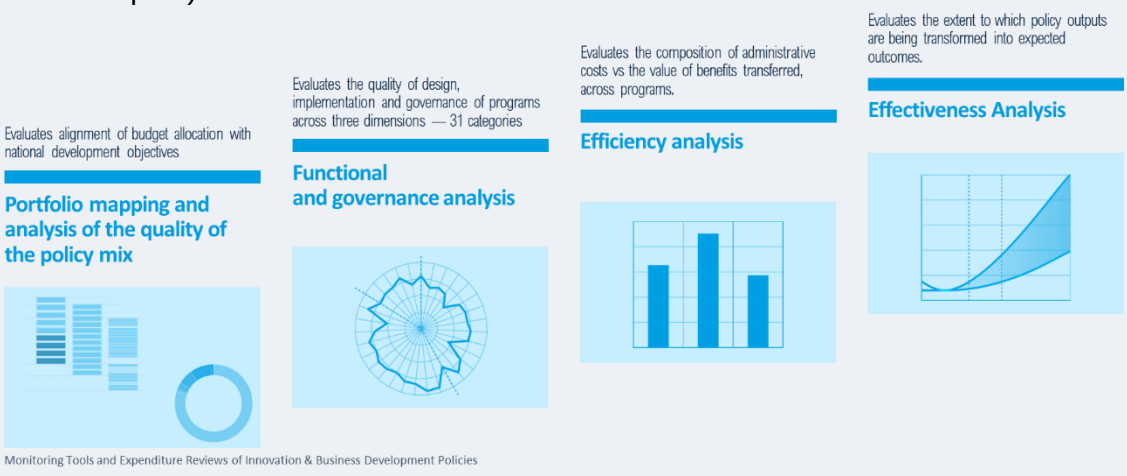
example, economic growth or emerging technologies) affecting policies' performance. System-level indicators provide insights into the indirect effects of public funds on non-beneficiaries. Both types of indicators should cover the national and regional levels. Although these indicators could be collected at the strategic level, they should be disseminated to relevant R&I program managers to guide the design and adjustments of programs, policy instruments, and calls.

The World Bank's Policy Effectiveness Review of Science, Technology, and Innovation (PER STI) provides useful tools that could be adopted by the strategic level to complement the monitoring of R&I interventions. The tools (previously called Public Expenditure Review of STI) that this methodology promotes emphasize learning by using the performance of a country's portfolio of R&I instruments. They include an analysis of the R&I policy mix, a functional analysis of R&I support instruments, efficiency analysis, and effectiveness analysis (Box 3 provides more information on the tools that are part of the PER STI).

Box 3 Tools of the World Bank's Policy Effectiveness Review of Science, Technology, and Innovation (PER STI)

The World Bank's PER STI provides tools to assess a country's policy mix and should be used to provide monitoring data for R&I interventions.

- **Analysis of the R&I policy mix**: This analysis consists of cataloging every policy instrument supporting R&I and analyzing their characteristics. The portfolio mapping exercise provides the basis for evaluating the coherence between R&I policy needs and the makeup of Romania's portfolio of R&I support instruments, identifying fragmentation and unnecessary overlap. Decision-makers can also use this approach to monitor the portfolio of instruments.
- **Functional analysis of R&I support instruments**: This analysis examines the quality of design, implementation, and governance of innovation policy instruments compared to best international practices across 31 categories and helps to identify trends of instruments' management strengths and weaknesses. This approach can be used as a tool to understand the progress in improving functionalities of instruments going forward.
- **Efficiency Analysis**: This analysis assesses how efficient R&I instruments are in using inputs and generating outputs and results.
- **Effectiveness Analysis**: This analysis evaluates the extent to which R&I policy outputs are being transformed into expected outcomes (using methods discussed in Step 10).



Source: World Bank 2023.

Source: World Bank.

An effective monitoring strategy should enable program managers, managing authorities, and the strategic level to answer a set of questions encompassing both accountability and learning at each policy level. The following questions are of special interest:

-Accountability-

1. (At instrument and programming levels) Are the funds used as intended (that is, to finance its planned activities)?
2. (At instrument and programming levels) Were the planned activities implemented?
3. (At instrument and programming levels) Were these activities implemented on time?
4. (At all levels) Were short-, medium- and long-term targets achieved on time?
5. (At all levels) Can the focus (e.g., program manager) achieve coming targets based on actual progress?
6. (At instrument level) Did these activities effectively reach the target beneficiaries?

-Learning-

Effectiveness and efficiency of instruments and policy implementation

7. (At instrument and programming levels) What caused deviations from initial implementation plans? Could the identified challenges to implementation have been avoided? Can they be addressed to improve the rest of the instrument and policy implementation? When implementation followed initial plans, could anything have been done more effectively or efficiently?
8. (At instrument and programming levels) What internal factors (for example, policy features, planning and timing of the call, clarity and usability of the application user interface) and external factors (for example, economic situation) eased implementation and the realization of outcomes? Can supporting internal factors be promoted for the rest of the implementation?
9. (At instrument level) To what extent do the various target groups benefit (in terms of changes in outcomes) from the instrument? Why, if any, are differences observed? Could they have benefited more, and how?

Outreach and uptake

10. (At instrument level) To what extent did the instrument reach the various target groups (for example, defined by location, size of the firm/organization, age, or gender)? Why, if any, are differences observed? What can ensure a far-reaching inclusion of all target beneficiaries (for example, simplifying eligibility criteria or increasing mobilization efforts)?
11. (At instrument level) Were the right target groups chosen, or could another group have benefited more from the investments while being similarly in need?

Risks and synergies

12. How can changes in the R&I ecosystem, not foreseen at instrument policy design, affect their implementation? Are any adjustments required?
13. (At programming, funding source and strategic levels) To what extent do the various R&I instruments and policies complement each other?

14. (At programming, funding source and strategic levels) Is there any duplication of R&I investments? Do some type of beneficiaries benefit from several investments while others do not benefit much or at all despite being eligible?

15. (At strategic level) Is there any crowding-out effect of R&I policies on private investments that would have happened without public support? Do we observe any important changes in the amount of private R&I funding following the R&I policies?

Takeaways for the next programming cycle

16. (At funding source and strategic level) What lessons can be drawn for the next policy cycle? How was learning generated, and how could it be improved?

Current practices in Romania

SNCISI sets favorable grounds for establishing a harmonized monitoring of R&I interventions in the 2021–27 programming period. SNCISI foresees a mechanism for a centralized monitoring system that covers the whole R&I system. It defines the principles and actions needed to this end, namely the standardization of primary data collection, the interoperability between existing IT platforms, and the improvement of M&E capacities and data transparency. The system envisaged under SNCISI is based on a common nomenclature of indicators (Annex 1 of SNCISI) that incorporates both system-type indicators (with data from national and international statistics) and outcome indicators collected at the program level from each R&I funding source listed in Appendix 1. In addition, the plans for the centralized monitoring system being implemented by DPSCDITT under MCID consider the need for a common data collection mechanism on national and regional RIS3 priorities. Greater interoperability with national registers on R&I organizations, R&I personnel, and research infrastructures is also expected.

Monitoring frameworks often have little emphasis on promoting learning. The World Bank's functional analysis of 32 Romanian R&I instruments of the last programming period (2014–20) point to a focus of monitoring frameworks on measuring project-level outputs and ensuring administrative compliance among beneficiaries, with limited information on how instruments design and implementation could be improved to reach larger impacts. The majority (61 percent, N=23) of respondents to the World Bank's M&E survey with Romanian stakeholders responsible for monitoring of R&I and educational programs indicated that the main role of data in monitoring and evaluating programs is "informing decision-making and program improvements." Nevertheless, this result contrasts with reported experience, with only one-third (35 percent) of respondents being aware of the use of M&E results to inform the design or adjustment of a policy intervention.

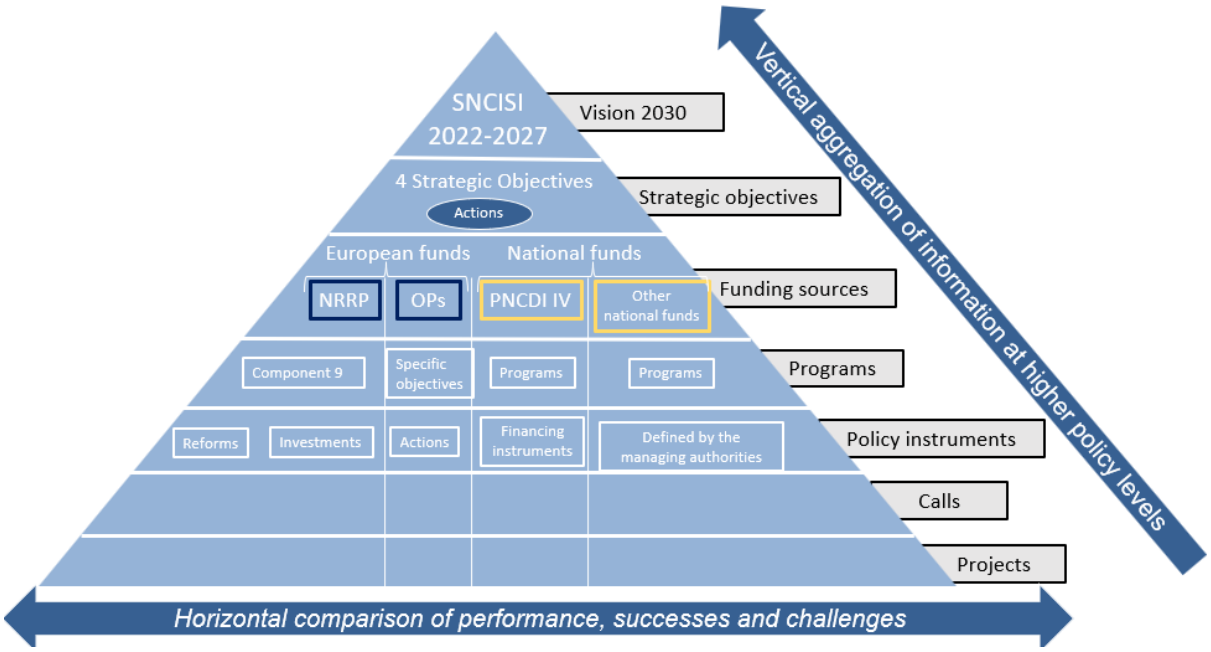
Specific recommendations for the R&I system in Romania

Monitoring the R&I system in Romania can benefit from better integrating M&E results at different policy levels. The pyramid in Figure 4 displays seven policy levels. The first policy level (at the top) is the overarching strategic level corresponding to Vision 2030 for the Romanian R&I system. Strategic objectives and a set of actions follow at the second policy level.[19] Currently, the monitoring of strategic objectives and actions is under the responsibility of DPSCDITT of MCID. The third policy level comprises various funding sources having their own goals and contributing to the SNCISI strategic objectives. The R&I funding sources of the

[19] The monitoring of actions differs from that of the strategic objectives because it does not rely on the aggregation of information from lower levels.

2021-27 programming period fall into four main categories: the European Funds made of (1) NRRP and (2) Operational Programs (OPs), and national funds made of (3) the PNCDI IV, and (4) other national funds. The managing authorities of these funding sources are responsible for integrating monitoring data collected by intermediate bodies at lower levels in charge of program and instruments implementation (see Appendix 1 for the list of managing authorities and intermediate bodies of the Romanian R&I system). The fourth policy level comprises.[20] Although these four levels are defined for all R&I policies, several R&I programs further subdivide into three additional levels: those of the policy instrument[21] calls for projects, and projects themselves that beneficiaries execute.[22]

Figure 4 Monitoring R&I policies at different policy levels



Source: World Bank.

CHECKLIST - Step 1: DEFINE THE POLICY-MAKERS AND PROGRAM MANAGERS' LEARNING OBJECTIVES FROM MONITORING OF R&I POLICIES

- ✓ All relevant institutions and agencies that are managing or implementing programs related to R&I are mapped by the strategic level
- ✓ All programs related to R&I are mapped by the strategic level
- ✓ All policy levels relevant to the monitoring of R&I policies are identified by the strategic level
- ✓ The monitoring strategy of each relevant policy level (from the instrument to the strategic level) outlines the questions that the monitoring of R&I policies needs to answer to best inform decision-making

[20] The program level corresponds to components for NRRP (whereby the monitoring of R&I focuses on component 9) and to specific objectives for OPs.
[21] The policy instrument level corresponds to reforms and investments for NRRP, to actions for OPs, and to financing instruments for the PNCDI IV. For some programs, the policy instrument level is equivalent to the program level.
[22] While calls and projects are part of a policy instrument, monitoring indicators are defined for each of these levels.

STEP II

STEP II. Streamline the governance of monitoring of the R&I system in Romania and mobilize financial and human resources

- Establishing a centralized M&E unit with authority and clear responsibilities is crucial for harmonizing indicators across programs and projects and facilitating effective monitoring at the strategic level. This unit should have the authority to promote new monitoring processes, gather necessary information, and ensure collaboration among managing authorities.
- Sufficient skilled human resources and adequate and stable funding are vital for an efficient and effective monitoring system. At the minimum, the M&E unit of a Ministry or implementing body should include an M&E specialist, an information technology (IT) expert, an outreach specialist, and a data manager, with M&E focal points in other departments.
- Strengthening the monitoring roles and responsibilities of the Inter-ministerial Committee for Science, Technology, and Innovation and continuing coordination under the CCSI are important to lead the harmonization of monitoring of R&I policies and enable the implementation of an actionable centralized monitoring system.

General recommendations

Monitoring at the strategic level requires consistent indicators collected across programs and projects to better inform on the contribution of the R&I policy instruments and programs to the achievement of the national strategic objectives. The use of consistent indicators across multiple entities and sources facilitates communication, benchmarking, and data integration and analysis at higher policy levels. A centralized M&E unit with authority and clear responsibilities is crucial for harmonizing indicators across programs and projects, facilitating effective monitoring at the strategic level. A centralized M&E unit is necessary to define and implement the steps to harmonize the definition and measurement of monitoring indicators in a consultative manner. This unit needs the authority to promote new monitoring processes and request necessary information from all managing authorities and implementing bodies. Clear responsibilities should be assigned to this unit and each managing authority to contribute to this common objective.

Sufficient skilled human resources are vital for an effective and efficient monitoring system. A monitoring system cannot function without enough properly trained and dedicated staff and funding. Addressing capacity gaps through structured capacity development programs and dedicated training is highly recommended. In addition to a centralized M&E unit, each funding source (or policy plan) should be supported by an M&E unit. At a minimum, every M&E unit needs four key roles: an M&E specialist, an IT expert, an outreach specialist, and a data manager.

- The skill profile of an **M&E specialist** includes, at a minimum, the ability to conduct institutional analysis and needs assessment, conceptualize system design and applications, define and collect indicators, design and implement surveys, understand sampling, and understand and use methodological tools. This person should also be able to effectively utilize the knowledge generated through M&E (Goergens and Kusek 2009).

- A full-time **IT expert** should manage each monitoring platform.[23] The IT expert will adjust and maintain the platform based on users' evolving needs and feedback, define Terms of Reference to introduce more substantial changes, and interact with software developers during the implementation. The IT expert should also be available for daily support of the platform users. The profile of the IT expert requires a blend of technical expertise, problem-solving skills, and an understanding of monitoring and data analysis. The expert should demonstrate proficiency in programming languages (such as Python, Java, or JavaScript), database management, data integration, and data visualization tools. She should be familiar with cloud computing platforms, have a sound understanding of data protection regulations, and be able to apply and ensure them.

- The effective uptake of new monitoring platforms by its intended users (which may include managing authorities, program managers, and beneficiaries) necessitates appropriate promotion. Promotion is the role of an **outreach specialist**. The skill profile of an outreach specialist includes a combination of technical, communication, and marketing skills. This person will promote the monitoring platform and engage with potential users to drive adoption and usage. An outreach specialist should have a good understanding of the monitoring platform's technical aspects. This person should be able to demonstrate the platform's features, functionalities, and advantages to its potential users. This knowledge will enable them to address technical queries and provide support during onboarding. Moreover, an outreach specialist should collect feedback from users to ensure that the platform responds to their needs and identify areas for improvement. Excellent written and verbal communication skills will be essential for creating promotional materials, giving presentations, listening to feedback, and engaging in outreach activities.

- The work of M&E specialists can greatly benefit from the support of **data managers**. The role of a data manager is critical in ensuring that monitoring data is accurate, consistent, complete, and reliable. This person establishes and maintains data quality standards and processes to enhance data integrity and usability. A data manager demonstrates a strong background in statistics and significant experience collecting, compiling, and dealing with large amounts of data. Proficiency in database management systems, data integration tools, data quality tools, and data visualization tools is essential. Additionally, familiarity with statistical programming languages such as Python and R can benefit data analysis and automation tasks.

It is crucial to designate individuals as focal points for M&E in the different departments in charge of different funding sources within managing authorities and within implementing bodies, as well as to create an interdepartmental M&E coordination group. In addition to the funding source and strategic levels, an M&E specialist is needed at each program (grouping one or several instruments) level. At the program level, this person will be responsible for ensuring that information for each indicator is gathered and entered into the monitoring framework promptly, managing the framework and keeping it up-to-date (for

[23] A monitoring platform is an online centralized informatic system that facilitates the collection, management, analysis and reporting of monitoring data. More information on monitoring platforms can be found in Step 9.

example, if new policies are designed), preparing regular (for example, monthly) summary reports for implementing bodies and reporting at the funding source level. The M&E specialist of the funding source level is responsible for reporting at the strategic level. This person would also serve as a focal point for the M&E specialist at the strategic level. These focal points act as liaisons between the central unit and specific departments or teams, and between teams, facilitating the collection and dissemination of relevant data, but also of practices, gaps and initiatives. Furthermore, establishing an interdepartmental M&E coordination group that convenes regularly (for instance, every quarter) can significantly enhance the effectiveness of M&E efforts. This group brings together focal points and the centralized M&E unit, ensuring harmonization, fostering collaboration, sharing insights, and ensuring alignment with overall objectives.

Institutions must focus on not only knowledge building but also knowledge retention within their organizational frameworks. High staff turnover rates can challenge knowledge retention. Therefore, it is imperative to establish robust procedures to enhance knowledge retention. These measures include recording training sessions and creating detailed workflows and operation manuals.

A high-quality monitoring system requires adequate and stable funding. The monitoring plan needs to be well-linked to the institutional budgeting mechanism and should consider all costs (for example, salary, procurement, consultancy, and operational expenditures). The largest costs are related to the staff costs of (at least) the four specialists, conducting surveys, and developing and maintaining advanced data management systems (such as an IT monitoring platform). The existence of adequate incentives for individuals involved in ensuring monitoring system performance also needs to be carefully considered in the resource mobilization process.

Current practices in Romania

Most participants in the World Bank's short M&E survey see a lack of relevant and timely data to assess the progress of implementation as a key challenge. Due to the fragmentation of the system and the non-availability of some relevant data, there is a limited systemic overview of R&I performance and trends in R&I. The national R&D system currently consists of 550 active units, 249 of which are public research organizations and universities, and 301 private R&D units. Public interventions in the R&I sector consist of many programs involving multiple ministries and agencies (listed in Appendix 1). The R&I system lacks a single coordination body and centralized evidence on programs' implementation. The World Bank's functional analysis, based on 32 key instruments in the previous programming period, pointed to implementors' lack of awareness of similar instruments outside of their institution's portfolio despite some examples of designed synergies between instruments (World Bank 2023). In this environment, a lack of information exchange and awareness about administrative data sources is a missed opportunity for timely, evidence-based decision-making.

Better coordination and alignment of monitoring systems remain a major challenge for the national R&I programs, especially given the large number of managing and implementing institutions. At least 20 managing authorities and implementing bodies, including eight RDAs, should coordinate their efforts under the SNCISI framework (see Appendix 1) with diverse programs and M&E practices. National-regional coordination is particularly challenging in the 2021–27 programming period because each of the eight development regions has its own planned M&E system. The roles for monitoring programs in the PNCDI IV between MCID and its implementing agencies represent another challenge to coordination within the same funding source. Great scope for better coordination on procedures, indicators, and reporting platforms is evident. With the increased number of programs in PNCDI IV (PNCDI III had five programs, whereas PNCDI IV has 10), the coordination of monitoring processes under PNCDI IV should be reinforced. Apart from

PNCDI IV, the Romanian Academy and the branch academies have their own monitoring systems aligned to the provision of specific legislation (founding laws and statutes, rules governing the organization and operations of academies). The Scientific Sections of the academies monitor the research activity of the R&D institutes while using their internal procedures and standards. In turn, the ministries that manage R&D sectoral plans and the MEDU—which provides financial support for university research—use their own monitoring structures and reporting systems. Overall, the monitoring procedures are nonuniform, and public availability of monitoring results is scarce (see also Step 11).

The multi-level governance system for Cohesion Policy programs and the NRRP includes clear monitoring roles defined through EU legislation but still requires better coordination. At the OP level, managing authorities and intermediate bodies have dedicated monitoring units that collect indicators at the project level, aggregate them at the program level, prepare reports, and inform the upper decision-making levels. The Common Provisions Regulation no. 1060/2021 sets out the overall EU legal provisions on M&E in the 2021–27 period. The regulation describes the functions and composition of the Monitoring Committees and the rules for transmitting data to the European Commission (EC), the procedures for evaluations, and those for ensuring the visibility, transparency, and communication of the funds' results. Despite this clear regulatory framework, there is space for improving coordination between different OPs under the specific objectives of the Partnership Agreement 2021–2027. Improving coordination is all the more necessary given that the R&I interventions associated with Smart Specialization priorities are covered in many more OPs[24] than in the previous programming period (see also Appendix 7 for Polish experiences). As regards the NRRP, EC Regulation no. 241/2021 sets out clear M&E procedures and the division of responsibilities between the Member States and the EC. However, the NRRP is a new mechanism, and putting in place its implementing framework and coordinating it with the EU is an ongoing process.

Effective implementation of SNCISI's plans for the monitoring of the R&I system at the strategic level requires adequate budget and human resource allocations and a clear political commitment. The previous national RDI Strategy (2014–20) had ambitious monitoring plans that were never put into practice. There have been many institutional changes in the structure of MCID and insufficient resources allocated to implement the Strategy during the period concerned. For the current programming period, political will and clear commitments under the NRRP to set up a single R&I coordination body, including a centralized M&E unit, and a centralized monitoring framework could be important enablers of change. Having a functional M&E system in place is also part of the "enabling condition" applicable to Cohesion policy 2021–2027, and this could also be a determining factor for change soon.

Recruiting and retaining skilled staff is a particular challenge in the national environment. About half (48 percent, N=23) of respondents to the World Bank's M&E survey reported not receiving specific training on designing good M&E systems. This survey with M&E practitioners of R&I and educational programs highlighted needs and interest in receiving training on key concepts of monitoring, such as the development and selection of relevant indicators (selected by 57 percent of respondents), setting up a ToC (39 percent), data interpretation (4 percent), and strategies to use M&E data in decision-making (74 percent). In terms of capacities, UEFISCDI stood out and succeeded over time in encouraging the formation of an analytical organizational culture. In contrast, other administrative departments within MCID (PSF, the General Directorate of NRRP Management, and DPSCDITT) or other R&I organizations encounter challenges in staff retention and recruitment. On the administrative side, several steps have been taken to increase the analytical capacity of the staff, such as the establishment of a new Digitalization Task Force for Implementation and Monitoring of Reforms and Investments within MCID.

[24] Namely, the Smart Growth, Digitalization and Financial Instruments Program (PCIDIF), eight Regional OPs, the Education and Employment Program, and the Just Transition Program.

Specialized training for all departments is needed to ensure an efficient process of data aggregation for SNCISI.

Specific recommendations for the R&I system in Romania

The monitoring roles of the Inter-ministerial Committee for Science, Technology and Innovation should be reinforced. A centralized monitoring framework must clearly define monitoring roles at the strategic level and effective inter-ministerial coordination. In line with the NRRP commitments, MCID has recently made a legislative amendment to establish the Inter-ministerial Committee for Science, Technology and Innovation[25] as a decision-making body under the Prime Minister. The Committee will have the mandate to ensure strategic coordination between all entities that play a role in the Romanian R&I system. It shall also align national, sectoral, and regional priorities for R&I and Smart Specialization. MCID will host the Secretariat of the Committee, which will work closely with other MCID units to monitor and evaluate the implementation of SNCISI and oversee the evolution of the national R&I system. Each entity in the Committee will appoint a member to cooperate with the Secretariat at the technical level. All entities in the Committee should be assigned clear monitoring roles and responsibilities for reporting at the strategic level. The entities will also provide inputs and insights for the R&I Observatory[26] to be developed soon. The R&I Observatory will centralize information on R&I activities in Romania and provide analysis of the R&I system covering the economic context, main actors, funding trends, human resources, and policies to address R&I challenges in national and regional strategies.

Romania could strengthen coordination on monitoring for Smart Specialization under the CCSI. The CCSI includes representatives of MCID, MIPE, RDAs, UEFISCDI, and other ministries with a role in the Smart Specialization agendas. The CCSI was very active and provided constructive feedback on Smart Specialization formulation at the national level while seeking to improve complementarity between national and regional priorities. The PSF review suggested that CCSI could play a positive coordination role at the implementation level, complementing the Inter-institutional Committee's role at the strategic level (EC 2022b). SNCISI also mentions the important role of CCSI in the governance of Smart Specialization, in entrepreneurial discovery processes, monitoring, evaluation, and update of Smart Specialization priorities. Having the CCSI involved in defining appropriate indicators associated with priority domains and in the monitoring, evaluation, and update of RIS3 could facilitate the transition to a joint and centralized monitoring framework.

A centralized monitoring framework requires strong coordination between the national and regional levels. Coordination between national and regional entities is crucial to ensure alignment between the objectives of regional strategies and national strategies' objectives. Thus, avoiding duplication of efforts or activities is key. Effective cooperation is also needed to fulfill the seven enabling conditions of Smart Specialization.[27] It is worth noting that the challenges in national-regional coordination regarding Smart Specialization are not unique to

[25] The Committee includes the Prime Minister, 12 ministers, the general secretary of the Government and the president of the Romanian Academy. The Committee will also involve several observers, including the heads of MCID's consultative bodies, the president of the "Gheorghe Ionsecu-Sisesti" Academy of Agricultural and Forestry Sciences, representatives of UEFISCDI, RDAs, employers' confederations, and the private sector.

[26] *"Establishing an R&I Observatory, to map Romania's best R&I strengths in international context and to study national developments in light of EU and international trends"* is among the 30 recommendations made by the EC's PSF team and endorsed by MCID (EC 2022b). The R&I Observatory is expected to foster the use of policy intelligence and serve the needs of MCID in terms of instrument and policy implementation. It is expected to take over the responsibilities of the centralized M&E unit, with increased capacity to undertake analyses and independent research. The World Bank will support the establishment of the Observatory.

[27] See Annex IV of the Regulation (EU) 2021/1060 (24.07.2021).

Romania. Poland also faces similar challenges, as described in the case study provided in Appendix 7. This short study outlines Poland's experience with Smart Specialization and highlights key pending challenges. Based on Poland's longer experience and a review of international practices in implementing Smart Specialization policies, the study proposes ways forward to ease cooperation between the two levels, as well as between region, stressing the importance of regional self-agency, cross-regional and inter-stakeholder cooperation, and disparities in capacities.

Clarifying and coordinating the monitoring responsibilities at the MCID level is essential. Currently, there is limited coordination and information exchange across the departments of MCID. M&E practices are not well harmonized across the different units. With the increased number of programs being directly managed by MCID, improving internal coordination and the coherence of monitoring systems should be prioritized. Soon, it will be essential to clarify the M&E responsibilities at the MCID level, including allocating clear roles for managing the centralized monitoring platform, selecting focal points on M&E in program departments, and creating an interdepartmental M&E coordination group. The centralized M&E unit of the strategic level should be sufficiently empowered to collect data from all relevant levels. It should have functional relationships with CCSI and the Secretariat of the Inter-ministerial Committee for Science, Technology and Innovation.

Within MCID, the unit managing the centralized monitoring strategy and platform should be sufficiently resourced and empowered. The MCID is developing a centralized platform to back the centralized monitoring system of SNCISI 2021–2027. The centralized platform is expected to have national and regional modules and draw data from existing R&I databases and platforms, such as MySMIS and EVoC,[28] but also from other sources. The DPSCDITT is currently in charge of the development of the platform. Sufficient resources should be secured to guarantee the further development and maintenance of the platform after the finalization of the MCID project. As indicated at the beginning of the chapter, this includes considering a minimum of four additional internal full-time positions: M&E specialist, outreach specialist, data manager, and IT expert.

Monitoring staff should receive relevant training opportunities to improve their knowledge of best practices. Our assessment of current monitoring practices, including challenges and learning needs of M&E staff, of the Romanian R&I system identified four key learning needs of M&E staff: (i) developing a policy's ToC and using this tool to define monitoring indicators, (ii) using representative surveys in monitoring, (iii) analyzing data, and (iv) effectively communicating lessons to foster evidence uptake in decision-making. Training documentation and recording could be stored and shared with new staff for better knowledge retention. The high turnout for the workshops organized by the World Bank and the active participation of participants demonstrates that monitoring staff have a genuine interest in strengthening their skills. Additional training sessions should supplement these efforts in the future.

CHECKLIST – Step 2: STREAMLINE GOVERNANCE AND MOBILIZE FINANCIAL AND HUMAN RESOURCES

- ✓ A centralized M&E unit at the strategic level is identified
- ✓ Clear responsibilities are assigned to each of its members
- ✓ The required skills and budget for monitoring at each policy level are planned for, from the instrument to the strategic level

[28] MySMIS2021 is the IT system developed for the management of ESIF 2021–27 programs, managed by MIPE. EVoC is the online platform developed and managed by UEFISCDI that ensures the implementation of (part of) projects financed from the PNCDI IV.

STEP III

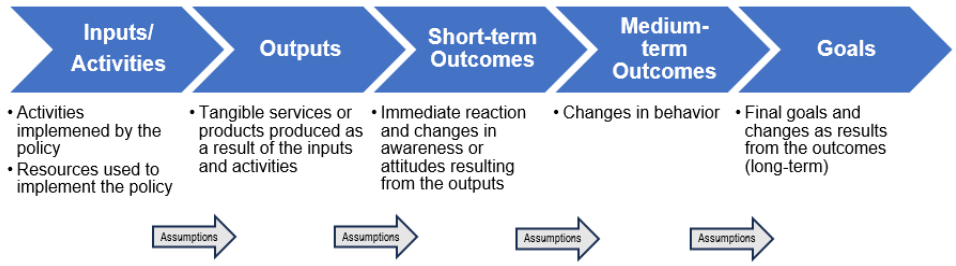
STEP III. Develop R&I instruments and policies' theories of change

- A ToC results from a reflective process that identifies the causal chain between inputs, activities, outputs, outcomes, and goals of an instrument or of a policy, providing a clear understanding of how policy makers expect change to occur through this instrument and policy.
- The realization of the different steps of a ToC relies on specific assumptions that connect the steps and help identify the need for planning or potential implementation risks.
- Developing a ToC requires stakeholder involvement, critical thinking, and flexibility to adapt to changing contexts. Ideally, decision-makers should develop ToCs as the first stage of the design phase. If implementation has already started, it is still beneficial to develop ToCs because they may indicate the areas that decision-makers need to adapt to and will guide the improvement of the current monitoring framework.
- The development of ToCs should start at the highest strategic level, linking the top-level ToC afterward with ToCs at the funding levels, which in turn link with ToCs developed for each program and policy instrument.
- At the strategic level, SNCISI defines the overall 2030 vision for the Romanian R&I system, but it lacks a fully articulated ToC. At the instrument and program level, fully articulated ToCs are scarce. Thus, current monitoring frameworks do not directly derive from instruments and programs' ToC.

General recommendations

A ToC should be developed at each policy level, from the instrument to the strategic level, as a chain of causal steps aimed at understanding the mechanisms through which policy makers intend an instrument or a policy to generate desired outcomes or long-term goals. Instruments and policies' ToCs represent a key starting point for developing or updating an instrument or policy's monitoring framework, while strengthening an instrument or policy design. The ToC illustrates a causal chain linking inputs and activities of a policy to its final goals. The typical model of a ToC consists of five pillars (depicted in a schematic diagram, as shown in Figure 5): inputs, activities, outputs, short-term and mid-term outcomes, and goals. Box 4 provides further information on each of these pillars. Arrows interconnecting these pillars represent the pathways of change. The key reading recommendations in Box 5 provide additional guidelines on developing a ToC.

Figure 5 The five pillars of a theory of change



Source: World Bank.

Box 4 Definition of the ToC's pillars

Inputs/Activities: Inputs or activities are the resources, efforts, and actions invested in a policy to bring about the desired change. These can include financial resources, personnel, equipment, training programs, workshops, awareness campaigns, and other individual activities necessary to achieve the intended outcomes.

Examples of inputs: number of staff involved in policy design and implementation, budget available to disrupt grants

Examples of activities: call for proposals to deliver grants for international researchers willing to conduct research in Romania

Outputs: Outputs represent the direct and immediate results of the activities conducted within a policy. They are tangible and observable products or deliverables that demonstrate the completion of specific tasks.

Examples: selected researchers receive grants, and the foreign researchers move to Romania to conduct research

Short-term Outcomes: Short-term outcomes refer to the immediate changes that occur as a direct result of the outputs. These outcomes are often related to changes in knowledge, attitudes, skills, and behaviors among the target population. Although short-term outcomes are not the program's ultimate goals, they play a crucial role in achieving the larger objectives.

Example: foreign researchers share knowledge with colleagues of their host research institute and collaborate with local researchers

Medium-term Outcomes: Medium-term outcomes are the intermediate changes that occur due to sustained efforts and progress from short-term outcomes. These outcomes indicate progress toward the overall goal and often involve shifts in social norms, policies, or organizational practices.

Example: foreign researchers share knowledge beyond the institute in seminars, workshops, and scientific publications

Goals: Goals are a policy's broad, long-term aspirations or objectives. They describe the ultimate impact or change that the policy aims to achieve. Goals are usually overarching and may require significant time and effort to accomplish.

Example: greater research excellence in Romania

The ability to move from one pillar to another relies on assumptions. **Assumptions** are the underlying beliefs, conditions, or factors that are considered to be true but have not yet been fully proven or tested. Assumptions may involve external factors, stakeholder behavior, or contextual influences that must align for the theory to work as expected.

Examples: program organizers assess proposals in a timely fashion, there is no barrier to the move of a foreign researcher's family, there are adequate funds and equipment to conduct innovative research

Box 5 Key reading recommendations on the development of a ToC

- ✓ Innovations for Poverty Action. (2016). Guiding Your Program to Build a Theory of Change.
- ✓ Taplin et al. (2013). Theory of Change Technical Papers: A Series of Papers to Support Development of Theories of Change Based on Practice in the Field.

- ✓ Resources from the Center for Theory of Change. Available at https://www.theoryofchange.org/
- ✓ The World Bank's Presentation with the Summary of Theory of Change workshops.[29]

Policy makers should use ToCs as a key tool for improving strategic planning while designing new instruments and policies. Developing a policy's ToC requires an in-depth analysis of the instrument or policy's intervention logic. It encourages critical thinking and reflection on the causal pathways and assumptions about how change will occur. A clear understanding of the underlying theory and logic enables responsible agencies to make informed decisions about adjusting strategies, activities, or approaches as needed. The ToC is, thus, a tool for improving strategic planning: it identifies and prioritizes activities, resources, and partnerships necessary to achieve the desired outcomes. Setting up a ToC helps to align efforts and resources among different policies and entities.

A ToC needs to be set up in a participatory manner involving many stakeholders, including project managers, program managers, and monitoring units. Their involvement fosters engagement, timely feedback, collaboration, and shared ownership of an instrument or a policy, resulting in more relevant and effective interventions. This exercise can unravel external rules and regulations that can affect the expected performance of the planned interventions.[30] This clarity of purpose that a ToC establishes ensures that all stakeholders understand the underlying logic and rationale behind the intervention.

A ToC should be regularly revised and updated. A ToC should be revised throughout the policy implementation to account for changing contexts, emerging evidence, and lessons learned. The need to revise the ToC implies that stakeholders have to reconvene and re-evaluate the ToC for a given policy frequently (for example, every six months) and enrich it in light of new information. Thus, program teams should meet regularly to review their ToCs (based on monitoring data and other information), validate assumptions, and adjust policies where needed. It is important to allocate financial and human resources to this process of ToC revision from the beginning.

Policy-makers can benefit from developing an instrument or policy's ToC, even after the start of the instrument or policy implementation. It is never too late to develop an instrument or a policy's ToC. Ideally, a ToC would be developed as part of the instrument or policy design before the onset of instrument or policy implementation. However, even if an instrument or policy has been in place for some time and was initially developed without a ToC, creating a ToC allows policymakers to identify potential gaps or areas of improvement. **A ToC should be used to uncover the key assumptions on which an instrument or policy relies to reach their objectives.** The causal pathways between the pillars of the ToC hold under specific assumptions. Answering the question "What preconditions, and requirements are needed for the theory to work?" helps to understand under which circumstances these assumptions, and thus the causal links, can hold or break. Assumptions are an essential part of the ToC and of monitoring frameworks. It is best practice to spell out the underlying assumptions explicitly. An example might be, "Beneficiaries have sufficient resources (for example, time and personnel) to apply for funding." Instruments and policies must not be built

[29] Available upon request from the World Bank.
[30] World Bank's recent analytical work pointed to a lack of implementors' awareness of relevant regulatory constraints that could impact the performance of their instruments during the last programming period (World Bank 2023). Implementors were generally not proactive in taking action to mitigate negative factors. External regulations, such as State Aid and public procurement regulations, have impacted the implementation of a number of instruments. Participatory ToC workshops at the design combined with clear responsibilities on the monitoring of the regulatory environment related to the instrument and program could support addressing this limitation.

upon critical assumptions with a low likelihood of being true during implementation. If the risks associated with these assumptions are high, it is necessary to re-evaluate the intervention.

Current practices in Romania

At the strategic level, SNCISI defines the overall 2030 vision for the Romanian R&I system, but it lacks a fully articulated ToC. Links between program inputs, activities, outputs, and outcomes are unclear. Without a ToC, SNCISI's existing monitoring framework lacks precision and coherence. Notably, it limits the ability to link its common indicators to specific programs and policy instruments. Without this linkage, inteorventions might be inappropriate or ineffective given the goals of the SNCISI. Interventions may be evaluated and compared based on inappropriate metrics. The absence of a ToC at the strategic level at the beginning of policy planning can significantly impede line ministries from identifying potential complementarities and opportunities for synergies across programs and policy instruments. Without a clear understanding of how interventions relate to one another, it becomes challenging to determine how they can work together to achieve common goals. Moreover, the absence of a ToC impedes the identification of possible risks and the development of appropriate mitigation strategies. As a result, managing authorities may miss out on opportunities to optimize their programs and policies and enhance their overall impact.

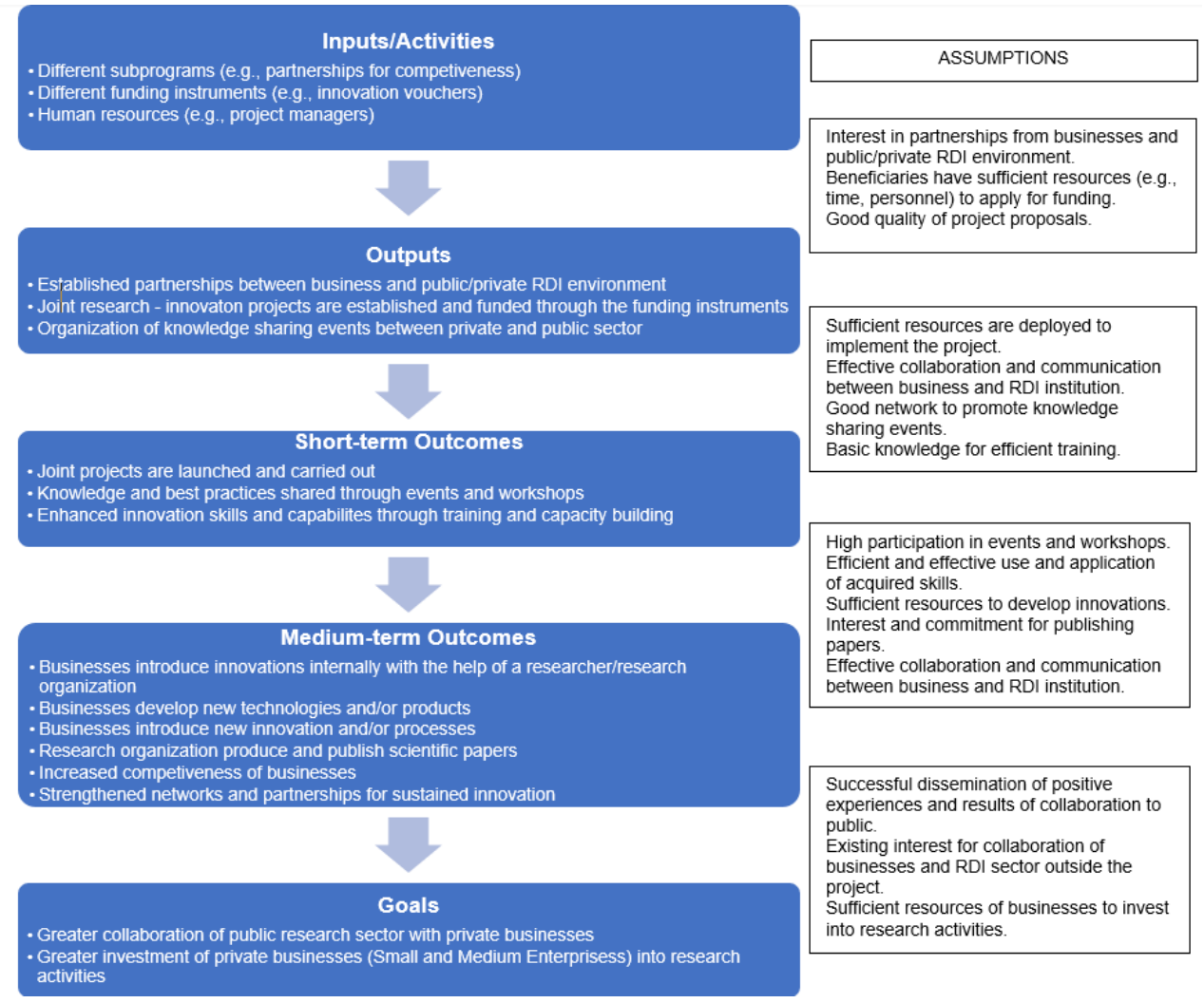
Current monitoring frameworks do not directly derive from programs and policy instruments' ToCs. National R&I programs do not have explicit ToC, while ESIF programs have performance frameworks defined according to the EU rules (EU Regulation 1060/2021). Nevertheless, while EU regulations require the development of a ToC at the priority axis level, they do not require ToCs for individual instruments. The OPs' performance frameworks cover output and results indicators linked to specific objectives. However, they could benefit from a more explicit logical connection between these indicators and the time sequence over which changes in these indicators are expected. Although the NRRP (Component 9) exhibits more coherence in monitoring practices and procedures, these are not entirely designed according to a results-based framework. For instance, the ToC workshops conducted by the World Bank revealed unclear links between actions and downstream outcomes and the absence of alternative pathways to outcomes.[31] Explicit links between the indicators and the national R&I programs' intervention logic are also missing. At the instrument level, a recent analysis found that no instrument in the Romanian R&I portfolio of the last programming period (2014–20) had a fully articulated ToC (World Bank 2023).

Specific recommendations for the R&I system in Romania

Here, we illustrate the development of a ToC using two examples from the Romanian R&I policy portfolio. The selected policies are the program "Partnership for Innovation" (Program 5.7) from the PNCDI IV (Figure 6) and the Investment 8 "Development of a program to attract highly specialized human resources from abroad in research, development and innovation activities" from Component 9 of the NRRP (Figure 7). Both examples were selected due to their relatively high financial size and importance. The ToC of Investment 8 builds on the outputs of the ToC workshop led between the World Bank and MCID's PSF Unit. The ToC of Program 5.7 is based on the World Bank review of accessible documentation and current understanding of the program's intervention logic. As such, these ToCs should only be used for illustrative purposes.

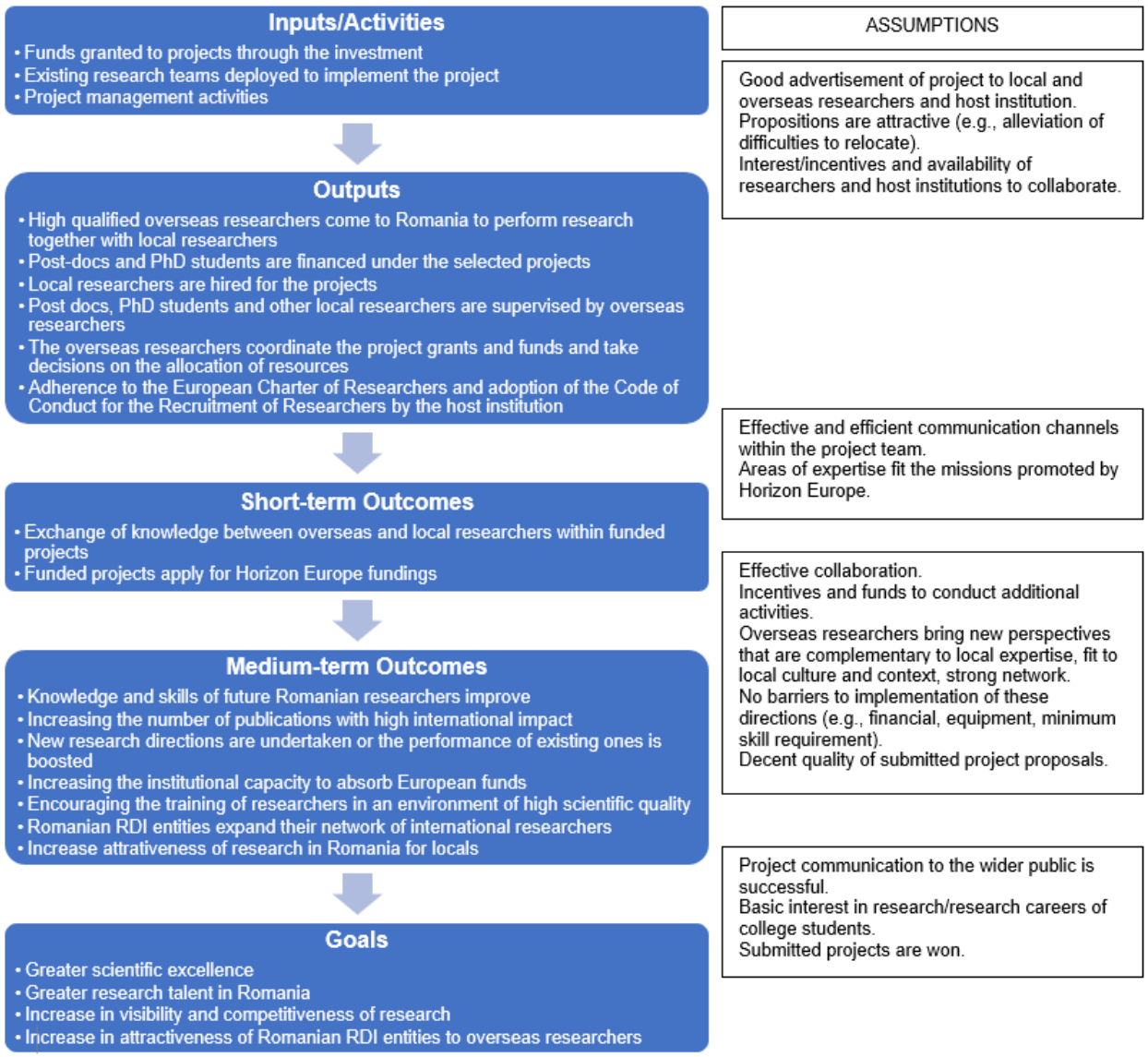
[31] PowerPoint slides available upon request from the World Bank.

Figure 6 Example of ToC for Program 5.7 of PNCDI IV - Partnership for Innovation



Source: World Bank.

Figure 7 Example of ToC for Investment 8, C9, NRRP - Development of a program to attract highly specialized human resources from abroad in research, development and innovation activities



Source: World Bank.

To strengthen the coherence, synergies, and complementarities of policies, the ToC should be developed from the highest to the lowest policy levels. Starting with a ToC at the strategic level allows tracing the expected changes toward realizing the strategic objectives induced by each funding source. Then, developing ToCs should be executed at the level of each funding source, linking each program to the funding sources' objectives. In turn, the ToC of a program should link policy instruments to the program's specific objectives. By bringing together the ToCs of lower policy levels, the SNCISI's ToC would provide a clear and coherent overview of the expected respective contribution of each R&I policy to the government's end goals. This overview will ease the identification of synergies and complementarities between the R&I instruments. This process should, in turn, inform the monitoring of R&I policies at the strategic level, which should include an assessment of the extent to which these synergies and complementarities have been realized. Policies that follow the same objectives should be monitored together because challenges in one instrument's implementation will directly affect the ability of other instruments to achieve their objectives.

CHECKLIST – Step 3: DEVELOP INSTRUMENTS AND POLICIES' ToCs

- ✓ Clear and comprehensive ToCs are developed for each relevant policy level (instrument, program, funding source and strategy), outlining the instruments and policies' goals, intended outcomes, the pathways to achieve them and their key underlying assumptions
- ✓ ToCs at strategic level are linked with ToCs at funding, at program and at policy instrument levels
- ✓ The ToCs are aligned with the instruments and policies' objectives and stakeholders' expectations
- ✓ The ToCs are shared with and validated by relevant stakeholders
- ✓ ToCs are regularly validated and revised, leading to the adaptation of policy interventions

STEP IV

STEP IV. Define relevant indicators for the monitoring of R&I instruments and policies in Romania

A ToC serves as a framework for identifying indicators—indicators should be defined for each element of the ToC, encompassing inputs, activities, outputs, outcomes, goals, and assumptionsto ensure transparency and progress assessment.

- The selection of indicators should prioritize key performance indicators (KPIs). The selection should be confirmed by revisiting the ToC.
- The relevance and completeness of selected indicators must be verified by following the CART principles: credible, actionable, responsible, and transportable.
- Indicators should adhere to the SMART criteria (that is, being specific, measurable, achievable, relevant, and time-bound).
- SNCISI includes a common nomenclature of indicators, but guidance on how to measure them and how to aggregate them across different programs is still to be developed.

General recommendations

A ToC not only serves as a practical tool for policy design and planning but also plays a vital role as a foundational framework for monitoring. The ToC serves as the foundation for developing relevant indicators to assess the progress of a policy. By having a clear ToC and relevant indicators, decision-makers can assess whether the intervention is likely to achieve the intended outcomes and make informed decisions for adaptation and improvement based on a careful analysis of changes in these indicators.

The elements of a ToC reflect constructs that need further definition to be measurable. Each element reflects a step in an instrument or policy's intervention logic that needs to be translated into indicators to enable the measurement and verification of a change most likely induced by this instrument or policy. Indicators should encompass the whole ToC: inputs, activities, outputs, outcomes, goals, and assumptions. Measuring indicators at each stage of the causal chain (including assumptions) ensures transparency in assessing progress toward strategic objectives. It is pivotal to not only focus on outputs but also think about outcome indicators (see Box 6). Indicators need to be adapted as the ToC changes, which includes changes made in the ToC after adjustments in interventions.

Box 6 Output vs. outcome indicators

Output and outcome indicators, both needed to monitor the performance of an intervention, are frequently mixed up.

Outputs:

- Outputs are the immediate result of an intervention.
- They are the realization of the planned activities.

Examples: Number of proposals funded by the project, Number of doctoral students receiving support to obtain a doctorate, Number of events organized to promote technology transfer.

Outcomes:

- Outcomes are changes induced by the outputs.
- They depend on the responses of the target beneficiaries (that is, how they react to the policy interventions).
- Short-term, medium-term, and longer-term outcomes may be necessary based on the time needed to observe change.

Examples: Number of doctoral students graduating due to project implementation, Number of researchers employed in enterprises after project completion, Value of private investment in R&D after project completion.

Source: World Bank.

Although indicators should be defined for each element of the ToC, selecting and prioritizing indicators is crucial. Collecting too much data may make the system unmanageable, drive up the cost of the process, and inhibit monitoring units from singling out essential information. Therefore, it is crucial to define KPIs. KPIs are carefully selected by eliciting strategic steps and assumptions in an instrument or policy's intervention logic. KPIs are directly linked to key objectives and are therefore well-suited to measure the performance or progress of an instrument or a policy. On the contrary, the collection of too little data may limit the scope for actionability and learning from monitoring. As a rule of thumb, one should consider at minimum one indicator per core activity of the instrument or policy, two indicators per pillar of the ToC related to this activity, and one for the most crucial assumption between each of these pillars.

The selection of indicators should be confirmed by revisiting the ToC. Rethinking a ToC ensures that current indicators clearly link to crucial strategic stages of the ToC. Strategically important indicators for decision-making, learning, and accountability should be prioritized. These indicators provide critical information to stakeholders, funders, and program managers to assess progress, make informed decisions, and demonstrate instruments and policy effectiveness. The reassessment of the ToC might result in adding, modifying, or dropping indicators. Sometimes, indicators already agreed upon with the funding authority cannot be modified. It is never too late to develop a policy's ToC (as indicated in Step 3) and streamline existing indicators with the ToC.

It is essential to verify the relevance and completeness of an existing set of indicators. A reference for guiding the selection of relevant indicators is the CART principles (Gugerty and Karlan 2018). These principles emphasize that indicators and data collection systems should be:

- **Credible**: Gather data that meets high quality standards, ensuring comparability across different instruments and policies. This data should be suitable for accurate and appropriate analysis.
- **Actionable**: Acquire data that can be used promptly to inform specific actions. The data should be available within a timeframe that allows policy makers to take action, and policy makers should be committed to implementing those actions.
- **Responsible**: Ensure that theinformation gained from collecting the data outweigh the costs (including opportunity costs) associated with its collection.
- **Transportable**: Gather data that has the potential to generate knowledge and insights applicable to other projects or countries. The data should have transferable value beyond its immediate context.

The final selection of indicators should aim for a balanced set of indicators that cover different dimensions or aspects of the intervention while considering the feasibility of measurement. The feasibility of measuring selected indicators needs to be checked, including data availability, data collection methods, resources required (cost-benefit), and timeframe. The final selection among feasible indicators should lead to a set of indicators that allows decision-makers not only to assess whether the policy met its objectives, but also at which stage of the policy's intervention logic challenges or intermediate achievements may have been met.

A good indicator should clearly reflect what is being measured. The SMART criteria can be used to assess whether an indicator is well-defined. SMART stands for:

- **Specific**: The indicator must have a precise and narrow definition, clearly stating what needs to be measured.
- **Measurable**: The indicator should be capable of being quantified, observed, analyzed, tested, or challenged. It should allow for objective assessment and provide tangible data for evaluation.
- **Achievable**: The measurement of the indicator, including data collection, should be straightforward and cost-effective. Obtaining the necessary information without significant resource constraints should be practical and feasible.
- **Relevant**: The indicator must be a valid measure of the outcome of interest. It should establish a clear and meaningful relationship between what is being measured and the associated theoretical quantity in the ToC framework.
- **Time-bound**: The indicator must be linked to a specific timeframe, usually aligning with the frequency or horizon at which it is measured.

An indicator reference sheet can be used to provide complete and clear information on an indicator's measurement. Table 1 provides an example.[32]

Table 1 Example of an indicator reference sheet

Indicator reference sheet
Indicator ID:
Name of indicator:
Level of the theory of change[33]:
Specific policy objective:
Description
Precise definition:
Unit of measure (e.g., percent of households, units):
Data type (e.g., integer, decimal, percentage, proportion/ratio, currency):
Disaggregated by (e.g., gender, geography):
Rationale for the choice of indicator:
Plan for data collection
Data source:
Method of data collection and construction:
Reporting frequency (e.g., monthly, quarterly, annually):
Targets
Rationale for targets:

Source: Adapted from USAID 2016.

[32] Guidelines on developing indicator reference sheets can be found at: https://usaidlearninglab.org/resources/recommended-performance-indicator-reference-sheet.
[33] The ToC level captures the specific pillar (input, output, outcome, impact, assumption) of the ToC at which the indicator is defined.

Current practices in Romania

Monitoring indicators do not derive from policies' ToC, risking their relevance and ability to inform decision-making. A functional analysis of 32 R&I instruments of the last programming period (2014–20) showed that outcome and impact indicators tend to be vaguely specified missing a clear linkage between those indicators and program activities. In addition, over 40 percent of the analyzed instruments did not track outcomes at all (World Bank 2023). The need for key performance indicators that are more outcome-oriented as opposed to output-focused was also emphasized during the ToC workshops organized by the World Bank[34]. Moreover, 30 percent of 23 respondents to the World Bank's M&E survey reported a lack of clarity between the program activities and the M&E indicators as one challenge of their M&E-related work. Related to the EU programs, alignment between RIS3 priorities defined at the national and regional levels and the definition of appropriate indicators for RIS3 domains remain challenges that need to be tackled in the near future (more on national-regional coordination challenges can be found in Appendix 7, which describes the case of Poland).

Specific recommendations for the R&I system in Romania

Define monitoring indicators on the principle that R&I instruments and policies' ToCs should lead to the overall SNCISI ToC. R&I instruments and policies' ToCs are powerful tools to verify whether the current monitoring indicators of the R&I system are effectively capturing the critical steps of the instruments and policies' intervention logic. After fully articulating SNCISI's ToC and existing instruments and policies' ToCs (see Step 3), the set of currently defined indicators should be revised. To the extent possible, indicators weakly linked to an instrument or policy's intervention should be foregone, whereas indicators should be added on critical steps and assumptions that are not currently captured. This exercise would help clarify the different steps through which every instrument and every policy contributes to Vision 2030, resulting in the elaboration of a ToC of R&I policies at the strategic level. Linking each existing indicator to the SNCISI-specific objectives would support understanding how these objectives were or were not achieved.

Use the SMART criteria to assess the quality of indicators. To guide this assessment, Box 7 and Box 8 give examples of good and bad indicators and of how to use SMART criteria to improve the definition of existing indicators.

Box 7 Poorly defined versus well-defined indicators

Good or bad?

Poorly defined indicators	Well-defined indicator (SMART criteria)
Research output	Number of peer-reviewed research articles published in Q1 journals
Knowledge sharing	Number of publications in Q1 and Q2 journals (co-authored by research organizations and enterprises)
R&D spending	Annual R&D spending as a percentage of total revenue

Source: World Bank.

[34] Final PowerPoint slides available upon request from the World Bank.

Box 8 Exercise on improving indicators

How could existing indicators be improved following the SMART principles?

Existing indicator	SMART principle	Improved indicator
Number of projects submitted by Romanian research organizations in national research, development and innovation (RDI) programs	**Specific:** Provide more details about the types of projects and the specific research organizations included in the indicator. **Time-bound:** Specify the time frame for measuring the indicator, e.g., annually or funding cycle.	Annual number of R&D projects submitted by Romanian public and private research organizations in national RDI programs
Number of internationally co-authored scientific papers, indexed in Web of Science	**Measurable:** Define the criteria for identifying and counting internationally co-authored papers. **Time-bound:** Specify the time frame for measuring the indicator	Annual number of peer-reviewed scientific papers with international co-authorship (involving authors from other countries), indexed in Web of Science
Number of entities having adhered to the Charter and the Code	**Specific:** Provide more details about the Charter and the Code being referred to in the indicator. **Measurable:** Define the criteria or process for determining whether an RDI entity has adhered to the Charter and the Code. **Time-bound:** Specify the time frame for measuring the indicator	Number of RDI entities that have officially signed and implemented the [specific name of the Charter] and [specific name of the Code] since the launch of the reform

CHECKLIST – Step 4: DEFINE RELEVANT INDICATORS

- ✓ At each policy level, indicators are defined for each key element of this level's ToC and cover outputs, short-, medium-, and long-term outcomes, and assumptions
- ✓ All indicators follow the SMART principles
- ✓ Indicators are accompanied by indicator reference sheets
- ✓ Indicators are coherent across policy levels (instrument, program, funding source and strategy)

STEP V

STEP V. Harmonize R&I indicator measurement across Romania

- An indicator menu gathers indicators and information in a harmonized manner, enabling comparison, revision, and streamlining of existing indicators for better selection and design of indicators in the future.
- Common indicators, relevant disaggregation levels, a common dictionary of terms, and pre-defined answer options for categories can be employed to promote harmonization, comparability, and consistency in indicator measurements across policies and levels.
- A central authority should be responsible for centralizing information.

General recommendations

The definition of consistent R&I indicators ensures efficiency and consistency in data collection, analysis, and reporting and enables comparisons across different entities, regions, or time periods, facilitating benchmarking and performance assessments. Consistent indicators enhance communication and transparency by providing a shared language and understanding. They facilitate the effective communication of complex information, enabling stakeholders to easily comprehend and discuss the status and progress of a policy. Also, consistent indicators facilitate data integration and analysis. When multiple entities or sources collect data using common indicators, it becomes easier to aggregate and analyze the data across levels, enabling effective monitoring at the strategic level.

Make a single authority responsible for centralizing information. The monitoring of policies might be decentralized. In other words, different entities may be in charge of monitoring different policies. The assembly of all existing indicators is a necessary step toward harmonizing them. Therefore, a central entity should gather indicators and information and act as a contact to answer questions related to the usage of indicators and the monitoring framework in general.

Centralize all indicators and corresponding information in an "indicator menu." A monitoring framework database fed by the different program units acting as the 'indicator menu' can support indicator selection, harmonization, and comparability. An indicator menu lists all indicators and relevant information used to monitor a specific policy field within the R&I sector. It allows applying filters (based on the additional information provided for each indicator) to list indicators fulfilling the filtering conditions and to check for similarities and differences among indicators and their measurement.

Use the indicator menu to harmonize the indicators. This menu can ease the identification of inconsistencies in indicators' definition and measurement and help identify the need for additional relevant and necessary information for each indicator. Indicators aiming at capturing similar metrics (for instance, publications) should be defined the same way. Furthermore, indicators under a similar specific objective and level of the ToC should be compared to assess the scope for harmonization. The indicator menu, thus, supports the revision, streamlining, and harmonization of existing indicators by aligning them and their measurements across policies. Only indicators fulfilling the SMART and CART criteria should be kept in the menu. In

the next policy period, decision-makers can use the indicator menu to select the best-fitting and best-designed indicators.

Authorities can use common indicators to promote the adoption of a concise set of consistent indicators. Common indicators refer to sets of widely recognized and used measures or metrics agreed upon and accepted within a specific context. For example, the EC and the Organisation for Economic Co-operation and Development (OECD) provide a set of common indicators for the R&I sector.[35] Authorities can also define common indicators for related sets of interventions under an overarching policy objective. These indicators provide a consistent approach to measuring progress. To limit reporting burden, program managers should be able to select common indicators that directly link to the policy's intervention logic from a list provided at higher policy levels.

Defining relevant disaggregation levels is another approach to streamlining indicators. The definition of disaggregation levels allows combining indicators under a single 'overarching' indicator. The disaggregation levels can then be tailored to capture each policy's specificities. The disaggregation and aggregation of indicators allows tailoring them to specific circumstances and happens at two levels: (1) the (dis-) aggregation of indicators across different policy levels to assess the current status of a policy on a higher or lower strategy level (for example, policy instrument versus call level), and (2) the disaggregation of indicators for distinct subsets or sub-groups (for example, male versus female) allowing for a more nuanced analysis of the policy status. In both cases, monitoring units can effectively capture the primary objectives of each policy measure through indicator disaggregation. Enabling disaggregation in this way ensures that the monitoring framework remains adaptable and applicable to the particular context, facilitating the accurate assessment of the intended outcomes of a policy.

Develop a common dictionary of terms used in R&I indicators' definitions to promote the harmonization of indicator measurements. The definitions determined in this dictionary should, where possible and useful, follow standards set by international organizations (such as the EC and OECD) to ensure consistency between EU and national funds and to be able to make international comparisons.

Current practices in Romania

Indicators used to monitor Romanian R&I instruments and policies are often not consistent across programs and funding sources. SNCISI includes a common nomenclature of indicators, but guidance on how they are measured and aggregated from different programs is still to be developed. The common nomenclature of indicators in SNCISI incorporates two types of indicators: (i) system-type indicators (on the strategic level), with data provided by national and international statistics databases, and (ii) outcome indicators collected at the program level, with input from direct beneficiaries. Although the EU programs use a list of predefined standardized indicators, national R&I programs do not share a common understanding of the indicators' definition and measurement. The measurement of outcome and impact indicators in the PNCDI IV is not defined. Furthermore, the extent to which indicators listed in the PNCDI IV overlap with common indicators from the EU is not clear.

[35] The EC has a set of common indicators related to the objectives of the NRRPs. The indicators are defined and explained in a supplementary handbook. Two of the indicators directly refer to R&I: "Common indicator 8: Researchers working in supported research facilities" and "Common indicator 9: Enterprises supported (of which: small – including micro, medium, large)".

Specific recommendations for the R&I system in Romania

Harmonize indicators beyond the common indicators of the SNCISI. Step 6 proposes a structure for the monitoring framework for the R&I system in Romania. The structure serves as an indicator summary table that will include all Romanian R&I indicators and supplemental information about each. Each column of that table provides information on the indicator and the policy it monitors. Indicators and accompanying information will be entered in the rows of this table. Once the information on existing indicators has been entered into the structure, the filled structure can be used to create an indicator menu that will facilitate the harmonization of R&I indicators as described above. DPSCDITT can use the indicator menu to assess the extent to which the definition and measurement of indicators are consistent. Proposals for harmonizing R&I indicators and their measurements should follow as a natural extension of assessing the comparability of existing indicators. The proposals should consider that the harmonization of indicators is influenced by seeking alignment with indicators required by the EC (whenever relevant). The indicator menu can guide the selection and definition of additional common indicators defined for each specific policy objective and stage of the ToC, structuring and complementing the current list of common outcome indicators of the SNCISI. Notably, it can guide the definition of common output indicators, which are currently missing from the SNCISI.

Ensure that the SNCISI common indicators are accompanied by clear definitions and guidance on measuring them. To ensure consistent measurement of the common indicators, accompany each indicator with an indicator reference sheet (as displayed in Table 1) and a clear list of definitions of terms. To be comparable, all program managers should follow similar procedures for data collection (including, when relevant, the selection of respondents), verification, and aggregation. The DPSCDITT could contribute to setting standards by developing guidelines to be adhered to by all program managers. This information could be centralized in an operational manual describing in detail all monitoring processes of the SNCISI.

CHECKLIST – Step 5: HARMONIZE INDICATOR MEASUREMENT ACROSS PROGRAMS

- ✓ The terms used to define R&I indicators follow common definitions laid out in a common dictionary of terms
- ✓ All indicators aiming at capturing similar metrics are measured the same way
- ✓ Indicators can be disaggregated on dimensions relevant for decision-making

STEP VI

STEP VI. Set up the structure of the monitoring framework of the R&I system in Romania

- The structure of a monitoring framework consists of core elements (for example, baseline values) and additional elements (for example, policy goals).
- Consultation with managing authorities of R&I funds is essential to validate the relevance, clarity, and completeness of the monitoring framework structure.
- The process of entering indicators and information into the monitoring framework should be conducted by responsible units within each program.

General recommendations

Once the selection of indicators is final, set up the monitoring framework around those indicators. The essential elements of a monitoring framework provide information necessary for the measurement of each indicator. Indicator-specific properties describe "what to measure" and "how to measure it." The indicator-specific properties form the monitoring framework's core elements and must be part of the monitoring framework independent of the policy. The monitoring framework structure includes the following indicator-specific properties:

1. The ***baseline value*** is the data or measurement collected before policy implementation. It establishes a benchmark or captures the relevant outcome as a starting point. This value captures the status or level of the indicator before any policy activity has taken place. It allows for comparing subsequent data points to assess progress and change. To obtain baseline values, one collects data from the group targeted by the policy using appropriate methods and tools before the intervention begins. Data collection can involve surveys, interviews, observations, existing records, or other data collection techniques. Indicators referring to the direct outputs of a policy (for example, the number of projects financed by the program) should have a baseline value set to null.

2. The ***target value*** is the desired or expected value of an indicator that an intervention or program aims to achieve within a specific timeframe (for example, the total number of researchers receiving funds by the end of policy implementation). Target values should be aligned with policy goals and objectives and must be set during policy planning. Target values can be revisited and refined as needed. They are a basis for assessing whether an intervention is on track to achieve its intended goals. By comparing actual data against the target values, stakeholders can determine whether the intervention is meeting expectations and take corrective actions if necessary. To define meaningful targets, factors such as the policy's objectives, available resources, context, and stakeholder expectations should be considered. Targets should be realistic yet ambitious and should reflect the desired level of improvement or change.

3. The **frequency** at which the current value of the indicator will be collected. Quarterly, every half a year, or yearly are commonly used frequencies to collect information. Setting the periodicity of measurement depends on various factors. It should balance timely information needs, the practicality of data collection, and the nature of the indicator itself (from when and how often changes are expected to be observed).

Flexibility in monitoring frequency may also be necessary, allowing for adjustments based on emerging needs, changing circumstances, or new insights gained during the monitoring process. At the end of program implementation, the achieved value must be recorded.

4. A ***data source*** refers to the origin or location from which data is collected or obtained to measure the selected indicator. Data sources can be a representative sample of (potential or actual) beneficiaries, in the case of primary data, or the name of the survey or dataset and that of the institution that collected this information, in the case of secondary data. Data sources provide the raw information necessary for tracking progress and informing decision-making. The selection of appropriate data sources depends on indicator requirements, data availability, resources, and ethical considerations. (See Step 7 for more information on existing and potential data sources.)

5. The ***data collection method*** determines the methods and tools for collecting data from the identified data source. It encompasses surveys, existing databases, direct observations, interviews and/or document reviews (see Step 7 for a detailed discussion on data collection methods).

6. The ***ToC level*** captures the specific pillar (input, output, outcome, impact, assumption) of the ToC at which the indicator is defined (see Box 4 in Step 3). The ToC level should also be accompanied by a *ToC unique identifier* that allows linking the indicator to its exact position within the ToC diagram.

7. The ***responsible agents/entities*** oversee the monitoring and reporting of information on this indicator. In addition to the institution and position of the person in charge, the management of the framework will benefit from having the exact name and contact details (e-mail address and phone number) of the person in charge.

8. An ***indicator definition*** should be clear so that interpretation and unit of measurement of the indicator is consistent across different monitoring staff.

In addition to recording data about each indicator, a monitoring framework records information about the instrument or policy being monitored obtained from managing authorities and program managers. These additional elements facilitate the horizontal comparisons and vertical aggregation mentioned in Step 1, enabling oversight and further analyses at different policy levels. The additional elements of the framework should be tailored to the learning objectives and intended use of information of the users of the monitoring framework. The list of required information should be defined at the on-set of the development of the monitoring strategy of R&I policies, both at the centralized (national) and at the decentralized (regional) levels. Examples of policy information typically recorded in a monitoring framework—as they apply to Romania—include the following:

1. The ***instrument and policy goals and objectives*** need to be clearly defined. Two levels of objectives could be defined: both the general and specific strategic objectives of the SNCISI to which this instrument or policy contributes. Although the SNCISI's action plans link funding sources to these objectives, these links would need to be clarified at the program and policy instrument levels. One challenge relates to linking the objectives of regional policies with national ones. Although additional objectives could be added to the list of specific objectives within the framework, effort should be made to align the specific objectives of regional and national policies because both sets of policies contribute to a similar governmental vision for the R&I system. A clear linkage of key common indicators to each of the SNCISI strategic objectives could support this alignment.

2. The ***geographical scope*** of the policy should capture whether the policy is implemented nation- or region-wide. If the implementation is realized at a regional level, the regions should be specified. This is particularly important to compare indicators across regions and assess the contribution of regional policies to national objectives.
3. The ***type of beneficiaries*** specifies the target population of the instrument or policy, such as researchers, firms, or universities.
4. The ***responsible authorities*** capture which ministry or agency is responsible for the policy. This category could be divided into further categories following the lifecycle of a policy. For example, the categories could include preparation (policy design and launch), selection (project selection), implementation (monitoring and reporting), and post-implementation (final reporting).
5. Properties with information about the ***financial aspects*** of a policy (for example, allocated and executed budget) could be helpful. Comparing the allocated and executed budget provides information about the stage of implementation of the policy. Relating this information to the current indicator value and the target value provides useful insights for the cost-efficiency of the policy.
6. The inclusion of properties such as ***Smart Specialization domains*** and ***Strategic Research Agendas*** enables a more detailed analysis of specific sectors of interest within the monitoring framework. Project beneficiaries should provide this information based on the latest defined list of domains and agendas.
7. An ***indicator's unique identifier*** is a unique number or string that allows identifying the indicator across different policies or sources. The unique identifier should be defined from the list of common indicators at the strategic and program level and from the indicator menu, grouping indicators commonly used by EC and OECD. For indicators that do not belong to any list, a new unique identifier should be created.

Confirm the relevance, clarity, and completeness of the structure of the monitoring framework with managing authorities of R&I funds. Reaching agreement on the structure of a monitoring framework is an essential first step in the implementation of a monitoring framework. The structure of the monitoring framework is flexible and should evolve to meet additional needs and incorporate feedback from the framework users.

Current practices in Romania

Existing monitoring frameworks of R&I policies do not cover all information necessary for effective monitoring. Harmonization between indicators used under different programs is a pressing need, and it should be accompanied by reaching agreement on realistic targets. The definitions of program and policy instrument targets tend not to be based on thorough assessments of the situation of target beneficiaries.[36] At present, national R&I programs do not include well-defined baselines and target values for the selected indicators, which will make it difficult to track progress toward goals' achievement. More than a third (39 percent, N=23) of respondents of the World Bank's M&E survey reported having never collected baseline values of their policy's key indicators.

[36] Previous programming periods in the EU have shown that ex-ante surveys are typically conducted at the OP level, covering multiple instruments. As a result, the specification of targets is often not appropriately linked to individual instruments' projects (Blažek and Vozáb 2006; Smismans 2015; de Jong and Muhonen 2020).

Specific recommendations for the R&I system in Romania

This report proposes a list of elements that should define the structure of the monitoring of the R&I system in Romania. Developing a common structure for the monitoring framework is a crucial element of centralizing information from all R&I funding sources. This common structure will be used to gather all indicators used to monitor Romanian R&I policies and necessary supplemental information on each of these indicators. The proposed structure encompasses a complete, concise, and clearly defined list of properties to be part of the framework. The full list of properties that could be part of the monitoring framework for Romanian R&I policies is available in the template structure provided in Appendix 8 (see Box 9). MCID and the World Bank defined the elements of this structure in a consultative and collaborative manner.[37]

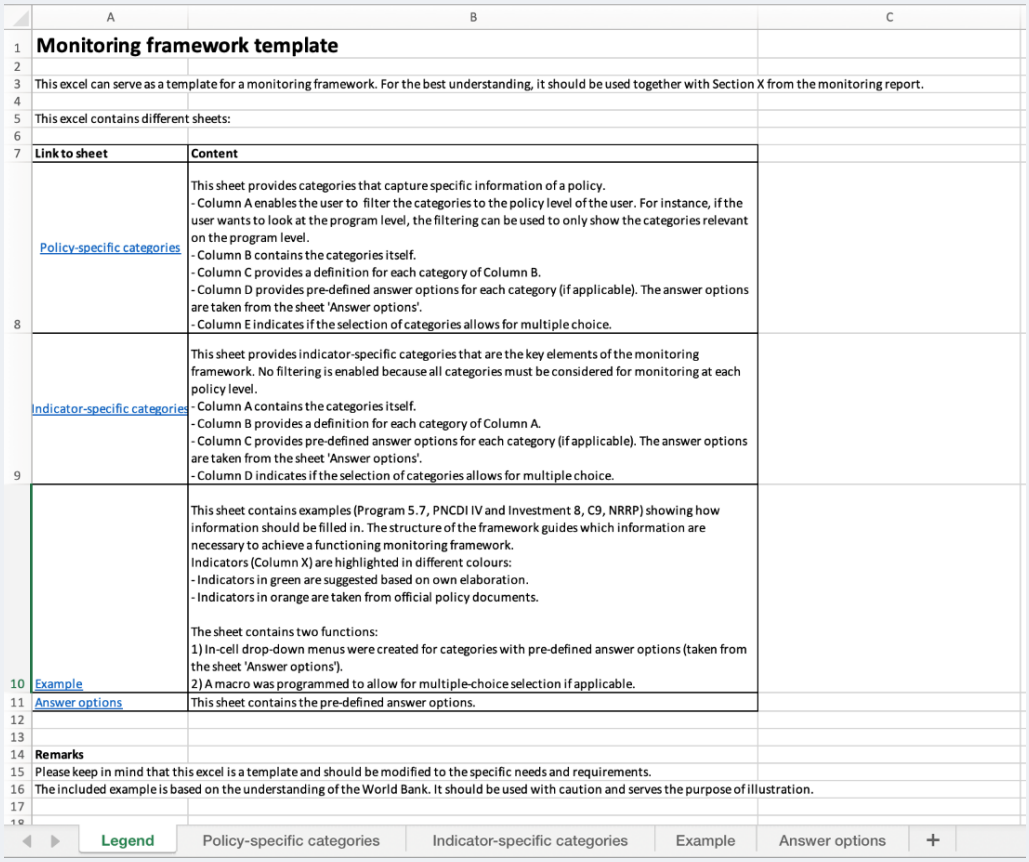
Box 9 Template for the development of the monitoring framework

This report comes with an Excel file as a supplementary appendix. The Excel file is a template to be used for the development of a monitoring framework. The template contains five sheets:

1. Legend: Contains general information about the template file.
2. Policy-specific properties: Provides space for capturing the properties of the policy being monitored.
3. Indicator-specific categories: Provides space for capturing the indicator-specific properties that are the core elements of the monitoring framework.
4. Example: Contains examples (Program 5.7, PNCDI IV and Investment 8, C9, NRRP) on how indicators and other information should be entered into the monitoring framework. Indicators were derived from the ToC developed in Step 3. Whenever possible, the indicators were aligned with the existing indicators reported in the official policy documentation. The entries are fictive examples because data for the indicator-specific properties are unavailable. Data for policy-specific properties are taken from available policy documentation.
5. Answer options: Contains the pre-defined answer options used to partially automate the completion of the monitoring framework.

[37] The draft methodology developed for the centralized monitoring platform of the R&I system developed by DPSCDITT was taken into consideration and provided valuable input. The structure of the monitoring framework should guide the architecture of the centralized monitoring platform.

Figure 8 View of the monitoring framework template, section "Legend"



	A	B	C
1	**Monitoring framework template**		
2			
3	This excel can serve as a template for a monitoring framework. For the best understanding, it should be used together with Section X from the monitoring report.		
4			
5	This excel contains different sheets:		
6			
7	**Link to sheet**	**Content**	
8	Policy-specific categories	This sheet provides categories that capture specific information of a policy. - Column A enables the user to filter the categories to the policy level of the user. For instance, if the user wants to look at the program level, the filtering can be used to only show the categories relevant on the program level. - Column B contains the categories itself. - Column C provides a definition for each category of Column B. - Column D provides pre-defined answer options for each category (if applicable). The answer options are taken from the sheet 'Answer options'. - Column E indicates if the selection of categories allows for multiple choice.	
9	Indicator-specific categories	This sheet provides indicator-specific categories that are the key elements of the monitoring framework. No filtering is enabled because all categories must be considered for monitoring at each policy level. - Column A contains the categories itself. - Column B provides a definition for each category of Column A. - Column C provides pre-defined answer options for each category (if applicable). The answer options are taken from the sheet 'Answer options'. - Column D indicates if the selection of categories allows for multiple choice.	
10	Example	This sheet contains examples (Program 5.7, PNCDI IV and Investment 8, C9, NRRP) showing how information should be filled in. The structure of the framework guides which information are necessary to achieve a functioning monitoring framework. Indicators (Column X) are highlighted in different colours: - Indicators in green are suggested based on own elaboration. - Indicators in orange are taken from official policy documents. The sheet contains two functions: 1) In-cell drop-down menus were created for categories with pre-defined answer options (taken from the sheet 'Answer options'). 2) A macro was programmed to allow for multiple-choice selection if applicable.	
11	Answer options	This sheet contains the pre-defined answer options.	
12			
13			
14	**Remarks**		
15	Please keep in mind that this excel is a template and should be modified to the specific needs and requirements.		
16	The included example is based on the understanding of the World Bank. It should be used with caution and serves the purpose of illustration.		
17			

Source: World Bank.

The sheet 'Example' includes three basic features for facilitating the functioning of the monitoring framework:

1. In-cell drop-down menus for categories with pre-defined answer options (taken from the sheet 'Answer options').
2. A macro to allow for multiple-choice selection when applicable.
3. The relevance of one property (a column) might depend on the value of another property. A cell turns grey if a property is NOT required due to the entry of a previous property. For example, the regions are only relevant if the policy occurs on a regional level.

The automation of the monitoring framework can be further improved.

The proposed structure of the Romanian R&I monitoring framework in Appendix 8 comprises both policy-specific and indicator-specific categories. The complete lists of properties, including a short definition and potential answer options[38] for each property, can be found in the supplementary Excel file in the respective sheets, "Indicator-specific categories" (Figure 9) and "Policy-specific categories" (Figure 10).

[38] The Excel template available in Appendix 8 contains suggestive answer options in the sheet "Answer options" that are also used for in-cell drop-down menus. The answer options are aligned with information from the Portfolio Analysis conducted by the World Bank (World Bank 2023).

Figure 9 Preview of the template monitoring framework, section “Indicator-specific categories”

	A	B	C	D
1	Category	Definiton	Pre-defined answer options for categories	Multiple choice possible?
2	ToC level	ToC level at which the indicator is measured	Inputs/Activities Outputs Short-term outcomes Mid-term outcomes Goals Assumptions	No
3	ToC unique ID	Unique ID for the combination of the ToC level, the goal, the policy, and the indicator.		n/a
4	Indicator unique ID	Unique ID for each indicator.		n/a
5	Indicator name	Name of the indicator		n/a
6	Indicator definition	Clear and concise definition of the indicator		n/a
7	Measurement unit	Unit of measurement for the indicator	Doctoral student Researcher Young researcher Project proposal Application Publication Project LEI Enterprises	No
8	Indicator type	Type of indicator	Share Numeric Dummy Qualitative	No
9	Disaggregation	Level of disaggregation of indicator	By research field By sector By S3 thematic priority area By funding source By region By seniority (doctoral students, postdoctoral researchers) By indicator type By policy status (in implementation, completed)	Yes
10	Baseline value [year]	Baseline value of the indicator. To be set before the policy starts. It is important to also indicate the year of the baseline value.		n/a
11	Intermediary target value [year	Intermediate target value of the indicator. To be set before the policy starts. Also referred to as milestone value. It is important to also indicate the year of the baseline value.		n/a
12	Final target value [year]	Final target value of the indicator. To be set before the policy starts.		n/a
13	Current value	Current indicator value. To be collected during policy implementation.		n/a
			Monthly	

Legend | Policy-specific categories | Indicator-specific categories | Example | Answer options | +

Source: World Bank.

Figure 10 Preview of the template monitoring framework, section "Policy-specific categories"

	A	B	C	D	E
1	Categories filtering	Category	Definiton	Pre-defined answer options for categories	Multiple choice possible?
2		Policy level	Policy level	Project Call Policy instrument Program	Yes
3	All	Policy unique ID	Unique ID for each policy.		n/a
4	All	Policy name	Name of the policy.		n/a
5	All	Start date	Start date of the policy. Please provide in format *MM/YYYY*		n/a
6	All	End date	End date of the policy. Please provide in format *MM/YYYY*		n/a
7	All	Duration of policy (in months)	Duration of the policy in months.		n/a
8	All	Mechanisms of intervention	Mechanisms of intervention, i.e., type of policy.	Tax incentives - R&D, Non-R&D innovation, and entrepreneurial activities Scholarships Subsidies Credit guarantees Grants and matching grants Repayable grants Vouchers Equity finance Loans and credit Public procurement for innovation Pre-commercial procurement (e.g., DARPA, prototyping) Crowdsourcing and open innovation instruments and awards Business advisory and technology extension services Collaborative networks and cluster policy Training and skills upgrading	Yes
9	Project	Coordinator's name	Name of project coordinator		n/a
10	Project	CUI/CIF coordinator	Fiscal identification (CUI or CIF) of the project coordinator		n/a
11	Project	Categories of activities (descriptive)	Description of specific type of actions to be implemented to reach the target. Relevant categories still need to be defined here.		n/a
12	Project	Technology-readiness level	The level of technology-readiness. To be entered on a scale from 1 to 9.		n/a
13	Project	Project results (descriptive)	Description of project results after end of project implementation. Relevant categories still need to be defined here.		n/a
14	All	Authority responsible for preparation (policy design and launch)	Authority reponisble for the preparation of the policy	MCID UEFISCDI Other	Yes
15	All	Authority responsible for selection (project selection)	Authority which is responsible for the implementation of the policy	MCID UEFISCDI Other	Yes
16	Call, Project	Platform for application	The name of application platform, if existing.	Udi Manager Other	Yes
17	All	Policy objective (descriptive)	Objective of the policy in descriptive manner		n/a
				Technology transfer Technology adoption	

Legend | Policy-specific categories | Indicator-specific categories | Example | Answer options | +

Source: World Bank.

Pre-defined answer options for indicator or policy properties can ease the alignment of information across policies and policy levels. This approach assures that entities responsible for monitoring different policies provide the same kind of information. The structure of the monitoring framework is flexible and should evolve to meet additional information needs and incorporate feedback from the framework users.

The policy-specific categories should be tailored to the specific needs of each policy level. Some information might be relevant at the lowest policy level (project level) but not at a higher strategic level. For example, the technology-readiness level is only defined at the project level. Another example is the platform used for project applications which is only a relevant category below the program level. The first column in the Excel sheet called “Policy-specific categories” contains the policy level and can be used for filtering the relevant categories.

Once the structure of the monitoring framework is established by defining all relevant elements, the selected indicators and their properties must be entered into the monitoring framework. The resulting framework can be seen as a table, with each column describing a need for information (the potential properties of an indicator) and each row describing the properties of one indicator. (See the Sheet “Example” of Appendix 8 as an illustration and Figure 11 for a preview).

Figure 11 Preview of the template monitoring framework, section "Example"

						Indicator-specific categories			
Indicator name	Indicator definition	Measurement unit	Indicator type	Disaggregation	Baseline value [yea	Intermediary target value [yea	Final targe	Current value	Periodicity of current value
Number of highly-skilled young researchers	The indicator refers to the number of young researchers (below age 35) supported through the project that acquired new and relevant skills. The indicator takes into account all young researchers who participate in the implementation of the project as researchers. "Highly-skilled" refers to the attendance of workshops/trainings/seminars with some kind of examination.	Young researcher	Number	By gender, By research field	0	15	50		
Number of doctoral students due to project implementation	The indicator refers to the number of doctoral students supported through the project for obtaining a doctorate. The indicator takes into account all doctoral students who participate in the implementation of the project as researchers, regardless of whether they had tuition support or not.	Doctoral student	Number	By gender, By research field	0	10	30		

Source: World Bank’s own elaboration.

The centralized M&E unit of the Romanian R&I sector must prioritize incorporating existing indicators during the transition phase to facilitate a seamless transition to an enhanced monitoring framework. This approach recognizes that indicators are already defined for the current programming period. It is essential to develop ToCs to facilitate the determination of the required information, even if policy implementation has already been initiated, to determine new indicators and potentially refine old ones. Implementing the ToC exercise (see Step 3) for the current programming period will ease the adoption of this approach from the beginning of the next programming period.

Each unit responsible for implementing and monitoring programs should enter indicators and other information into the monitoring framework. Each unit must assign at least one individual to be an M&E focal point and oversee the monitoring framework. (See Step 2 on focal points and roles.) The M&E focal point should possess a solid understanding of monitoring principles, good analytical and communication skills, technological proficiency, and a high degree of adaptability and flexibility.

The information for the elements of the monitoring framework must ideally be determined and entered before policy implementation starts. Realistic final and intermediary target values can only be defined once the baseline value is set as a benchmark.

This benchmark has to be recorded before the policy intervention is in place to capture the current status precisely. Once the policy implementation has ended, comparing the achieved value to the baseline value provides information about the implementation progress of a policy. How to measure an indicator must also be determined before the policy implementation launch. The first measurement of an indicator might take place within a few weeks after the start of the implementation. Since the relevant data collection structures (measurement units and data collection tools) must be ready by then, it is important to start the preparations for the data collection structures early enough (ideally, at the same time as the preparations for the instrument or policy start).

A pilot could be set up to validate the proposed structure and reach agreement on a common monitoring framework for Romanian R&I policies. One way to gather relevant feedback would be to pilot the structure with one program per funding source for a month. Each managing authority could share feedback on the usefulness of the proposed draft structure. In addition to testing the structure of the framework, the pilot can be used to test reporting on the common indicators defined by SNCISI. Each program manager could then share their experiences in filling in this information. The authority responsible for the central framework would coordinate the pilot, collect feedback, and seek agreement on the required changes. Some challenges may be addressed by providing clearer guidelines and organizing onboarding seminars on how to fill in the structure.

CHECKLIST – Step 6: SET UP THE STRUCTURE OF THE MONITORING FRAMEWORK

- ✓ The Excel template provided in Appendix 8 is the starting point for developing the monitoring framework
- ✓ Core indicator-specific categories that are necessary for a functioning monitoring system are included: baseline values, target values, current value, data source, data collection method, ToC level, responsible agents/entities, and indicator definition
- ✓ Supplementary information is identified based on decision-makers' learning objectives
- ✓ The structure of the framework is validated by the programs' managing authorities

STEP VII

STEP VII. Determine how to collect data for the monitoring of the R&I system in Romania and ensure its quality

- Data sources can be classified as primary (collected directly from target respondents) or secondary (utilizing existing data sources), each with its own strengths and limitations for monitoring purposes.
- Surveys, conducted through different methods such as computer-assisted telephone interviewing (CATI), computer-assisted personal interviewing (CAPI), and web surveys, are methods of primary data collection that offer advantages like data integrity, error reduction, efficiency, and easy analysis, enabling in-depth information collection and real-time insights.
- Accessing secondary data is a cost-effective and time-efficient way to collect R&I-related information, although finding relevant data and aligning it with monitoring needs may require significant resources.
- Ensuring high-quality data through a thorough data quality assurance strategy of both primary and secondary data is crucial for informed decision-making and effective program management.

General recommendations

Where should data on the indicators be coming from?

Data falls into two categories: primary and secondary. Primary data refers to information collected directly from the target respondents (for example, an individual, a research organization, or a firm) by the organization itself or by intermediaries contracted by the organization. Secondary data involves using existing data sources, particularly administrative data and data collection efforts by other organizations (either disaggregated or summarized in reports).

Both primary and secondary data have their unique characteristics, strengths, and limitations, which influence their suitability for different monitoring purposes. Although primary data offers the advantage of being recently collected, specifically tailored to the monitoring objectives, and potentially being more accurate and reliable, secondary data provides a low-cost alternative, allowing actors to leverage existing resources and gain insights from large datasets that may not be feasible to collect independently. As a result, before collecting primary data, the monitoring staff should assess what data is already available and how well it can fill the monitoring objectives. When data gaps are identified, the monitoring staff should turn to primary data collection. The review of available secondary data also helps to identify the target population with the highest needs and the need for additional (primary) data. Because the monitoring indicators of the R&I system are predominantly quantitative, the rest of the section focuses on quantitative data sources.

Primary data sources

Surveys are an essential method for collecting primary data to measure the outcomes of R&I instruments and policies. Calls application data and beneficiary reports represent major sources of primary data for the monitoring of R&I instruments and policies. Surveys can complement the information obtained from beneficiaries' reports and are particularly relevant for an accurate record of the instruments and policies' outcomes.[39] Surveys enable gathering information about the needs of potential beneficiaries, learning about challenges in the take-up of an intervention, and understanding mechanisms of change. Surveys offer the opportunity to collect information on a sub-set (sample) of the target population while (if the sample is representative) still being able to generalize conclusions to the entire target population (e.g., a specific instrument's beneficiaries).

Surveys can either be conducted on paper or in electronic form, and the latter can be done in the form of CATI, CAPI, and web surveys. Digital data collection relies on interviewing software on a tablet, smartphone, or laptop. These tools allow the interviewer to maneuver through the interview and record responses. Each method offers distinct advantages, and all are suited to the R&I sector.[40] The right method depends on the purpose and setting of data collection.

- **CATI** involves conducting surveys over the phone using computer software. It is particularly valuable because it can rapidly gather data from respondents from different demographic groups and geographic locations, contributing to more extensive survey coverage. Therefore, it is an effective tool for identifying any issues or gaps in policies in close to real time and assessing the implementation and outcomes of policies over time.
- **CAPI** involves face-to-face interviews conducted using mobile devices or laptops equipped with survey software. Due to the face-to-face interaction of enumerators with respondents, CAPI offers a deeper level of engagement with respondents and facilitates the collection of more detailed information. Its main advantage lies in collecting more nuanced responses and accurate information, thanks to more personal interaction with respondents. Potential disadvantages are related to considerable costs and the possible influence of enumerators on respondents' answers (due, for example, to the desirability bias[41]).
- **Web surveys** involve sending a questionnaire to target respondents via the Internet, inviting them to complete an online survey at a time that suits them best and at their own pace. Web surveys enable monitoring staff to collect data from individuals at lower costs. However, the response bias may be problematic: individuals without access or unfamiliar with the Internet may be left out, while those with less time may be less likely to fill it in.

Electronic survey methods have many advantages over paper-based surveys:

1. Digital data collection enhances data integrity by providing data validation and quality control mechanisms. Mandatory fields, range checks, and logical constraints can be built into digital forms or surveys, ensuring that only valid data is captured.
2. Digital data collection minimizes the risk of human errors that can occur during manual data entry or data transfer from paper to electronic formats. The data collected digitally can be automatically validated, reducing the chances of missing or inconsistent data.
3. Digital data collection methods are typically faster and more efficient than paper-based methods. With digital tools, data can be collected, recorded, and processed in real time, reducing the need for manual data entry and transcription.

[39] Calls applications and beneficiary reports are already widely used in the R&I ecosystem (mandatory for many instruments and policies). For this reason, this section focuses on surveys as additional primary data sources.
[40] Appendix 9 provides an assessment of the comparative advantages of each of these data collection methods.
[41] Social desirability bias occurs when individuals respond to questions in a way they believe is socially acceptable or desirable, rather than providing truthful or accurate answers.

4. Digital data can be easily imported into statistical analysis software or a monitoring platform, facilitating advanced data analysis and the generation of insightful reports. With digital data, it is possible to automatically generate charts, graphs, and visualizations, saving time and effort.

It is important to start with planning primary data collection early enough, ideally in parallel with shaping the instrument or policy details. Preparing for data collection requires significant time and resources. Survey preparation also includes the determination of the sample size. To the extent possible, primary data collection should include several hundred observations. The exact sample size depends on the data collection method, the sampling method, the number of beneficiaries, the budget, and several statistical factors (such as margin of error).

Secondary data sources

Secondary data refers to information previously collected and compiled for purposes other than monitoring R&I instruments and policies. Monitoring staff may use data collected for other purposes (for example, data collected by the statistical office or data collected on policies with similar beneficiaries, topics, or time periods) to monitor R&I instruments and policies. Monitoring staff should use secondary data containing information on aspects, context, or target groups relevant to the monitoring purpose. This information should shed light on an instrument or policy's ToC by allowing for the measurement of monitoring indicators determined in Step 4 or testing critical assumptions of an instrument or policy's intervention logic.

Using secondary data is generally less costly than primary data collection. Because secondary data already exists, the need for resources, time, and funding is usually lower than for primary data collection. However, it takes human and financial resources to identify and access secondary data suitable for specific monitoring purposes. Monitoring staff should thoroughly assess available and suitable secondary data and its related costs before collecting primary data.

Using secondary data brings benefits but also challenges. Secondary data may provide access to longitudinal data, facilitating the assessment of changes and trends over time. Secondary data may also be used to perform comparative analyses across regions, populations, or interventions, aiding benchmarking. Secondary data can serve as a valuable source of historical context and baseline information, supporting comprehensive assessments and informed policy planning. Finally, monitoring staff can use secondary data to triangulate or corroborate findings from primary data collection. Aligning and harmonizing outcomes obtained from primary and secondary data strengthens the validity and reliability of monitoring results. Nevertheless, challenges might arise from the use of multiple sources. Ensuring consistency and comparability of indicators can be difficult. Changes in data collection methodologies, definitions, or classification systems across different periods or sources can limit accurate comparison across indicators and over time.

Secondary data may not always be current or timely for M&E purposes. Delays in data availability, reporting, or publication can affect the relevance and utility of the information, particularly in dynamic or rapidly changing situations where real-time data is crucial. Moreover, some variables or indicators may be missing, incomplete, or not collected regularly. Monitoring staff should consider time and IT infrastructure needed to access very disaggregated data well ahead of time.

Establishing data-sharing agreements with owners of secondary data can secure access to secondary data and its usage for monitoring purposes. Access to secondary data might be challenging and constrained by various factors. For example, fees or payments may be required to acquire the data, the relevant data might not be available to the public, it

might be stored in a format that needs further processing, or it might require obtaining permission, which can take time and effort.

Secondary data needs to be accompanied by clear and complete documentation. Clear documentation is crucial to understand the information obtained from secondary data fully. The documentation should include information on what was collected, from whom (for example, the type of beneficiary), how data was collected (for example, which data collection methods and tools were used, which data quality measures were implemented, what sampling strategy was applied, and how questions were phrased and understood by the respondents), and when data was collected. Whenever possible, the survey manual should be acquired. Detailed documentation on the data collection process helps assess whether the survey was conducted professionally and independently.

Developing a data quality assurance strategy

Data should satisfy five quality standards (accuracy, completeness, timeliness, relevance, and consistency) to form the foundation for informed decision-making and effective program management. High-quality data is meticulously collected, thoroughly validated, and consistently maintained. High-quality data is essential to ensure that monitoring efforts yield accurate insights, enhance program effectiveness, and contribute to achieving desired outcomes. Bad data quality can cause policy makers to draw incorrect conclusions and, thus, take actions that hinder improvement. There are five widely accepted dimensions of data quality:

1. **Accuracy:** Accuracy refers to how well the data reflects the true or intended values or facts it aims to represent. Accurate data is free from errors, biases, or inaccuracies that could lead to incorrect interpretations or decisions.
2. **Completeness:** Completeness refers to the degree to which data contains all the necessary and relevant information for the given purpose. Complete data ensures that no crucial elements or variables are missing.
3. **Timeliness:** Timeliness relates to the currency and relevance of data in relation to the specific time period or context under consideration. Timely data is up-to-date and reflects the most current information available, enabling prompt and informed decision-making.
4. **Relevance:** Relevance pertains to the applicability and significance of data to the specific research question, problem, or decision at hand. Relevant data is directly related and aligned with the objectives, context, and requirements of the analysis, ensuring its usefulness and suitability.
5. **Consistency:** Consistency refers to the uniformity and reliability of data across different sources, time points, or data collection methods. Consistent data is collected, recorded, and measured in a standardized and comparable manner, enabling valid comparisons, trend analysis, and reliable insights.

A data quality assurance strategy is needed for both primary and secondary data sources. Although the procedures for ensuring high-quality data differ across the two types of data, both should secure data quality along the five dimensions mentioned above. In addition, indicators should be cross-validated whenever possible with other available data to assess the accuracy and quality of information. The following sub-sections summarize essential quality assurance procedures for primary and secondary data.

Reducing errors in primary data collection: system-wide quality control procedures

Several errors may occur during primary data collection. Errors may be made during data entry. For example, the person entering the data may make typos or accidentally introduce outliers (numeric values standing out as particularly high or low), for example by adding a zero by mistake. Another source of error results from the questionnaire design, for example implementing wrong filters which results in falsely skipping a question. Errors may also arise due to a different understanding of questions between interviewers and beneficiaries. To avoid these problems, monitoring staff should implementquality control procedures during data collection to minimize errors.

Train personnel responsible for data collection to avoid mistakes during data collection and entry. Training should target interviewers in the case of interviewer-led surveys: training on the specific questionnaire, how to ask questions, how to probe for answers, and where to pay particular attention. In cases without interviewer involvement, project managers should be trained to equip them with the knowledge to answer questions and guide the beneficiaries. It is also recommended to conduct training sessions with beneficiaries on reporting at the beginning of project implementation. The focus should be on how to enter data correctly and the correct understanding of survey questions or answer fields. The project manager should be supported by a data manager who oversees the flow of data and its logistics (e.g., inflow and correction of data), and also attends the training. The information shared in the training sessions should be documented to secure retention of information and smooth internal processes.

Computer-assisted data collection methods allow for programming automated data quality checks during data entry that significantly reduce the likelihood of mistakes. Data entered into the survey are automatically and immediately checked and validated based on the programmed automated data quality checks. In case an error is detected, a message can provide a hint on how to modify the entry. Examples of automated quality include lower- and upper-bound of acceptable values for integer values (for example, profits) or data entry restricted to only numeric values (for example, phone numbers or financial values). Information entered at several different times can be automatically compared.

Another tool used to enhance survey data quality is automatic skip patterns. Hereby, a set of questions is only triggered based on a specific answer to a previous question. For instance, the interviewer only asks questions about labor income and hours of work if the answer to “Are you currently working?” is “yes.” Using such skip patterns improves the logical flow of surveys, reduces survey time, and facilitates data cleaning. These skips need to be well-programmed and very well-tested in advance.

Careful pre-testing and piloting of data collection tools is another way to improve data quality. A pre-test means repeatedly going through a questionnaire to adjust and improve it, often imagining a hypothetical profile of a potential beneficiary. The pre-tests are usually performed in-house, for instance, by colleagues with limited involvement in the development and programming of the survey. Having an “independent” tester ensures an objective assessment of the programmed survey. Piloting should be performed in an environment and with respondents comparable to the planned survey. Pre-tests and pilots are useful for detecting potential programming errors, identifying questions that are difficult to understand, and training interviewers in natural conditions.

Developing and implementing systematic data verification procedures is another vital measure in securing high-quality data. Despite automated data quality checks, inconsistencies and errors usually remain in raw (unprocessed) data. During the verification

process (when data quality is checked), the coherence of one respondent's responses can be compared with the values given by other beneficiaries or within a group of beneficiaries sharing similar characteristics (including information from secondary data). Monitoring units should develop a comprehensive list of data verification tests to identify information that needs verification. After finding errors, there are different options on how to deal with such cases, depending on the error and the data collection method: (i) trying to reconnect with the respondent to correct the answer, (ii) correcting the answer based on other information from the survey, (iii) setting the variable to a missing value, or (iv) not considering the entire interview. Any modification to the raw data needs to be carefully documented to guarantee transparency, replicability of changes made, and the ability to revert to the original raw data.[42] Transparent documentation on the modification of raw data is essential to guarantee data accuracy, one of the key dimensions of data quality.

Ensuring the use of quality secondary data: external quality assurance procedures

The quality of secondary data might differ across external data sources and should be verified before use. Even after the institution that collected them performs initial data quality checks, secondary data sources frequently retain inconsistencies and errors. As such, any secondary source should be handled cautiously by always assessing its quality before using it for monitoring.

The quality assurance process of secondary data should start with studying the available documentation about the secondary data. Fully understanding the source of information is crucial for assessing the data quality along the five critical dimensions of high-quality data. First, whenever possible, secondary data should be compared with other similar available sources. This comparison allows for verifying information across similar time periods, types of beneficiaries, and survey methods. Second, the coverage and completeness of information need to be checked. Ideally, the secondary data should be representative of either the entire population of interest or a specific sub-group of the population of interest. If the sample was not designed to be representative of the target population, the results cannot be generalized outside of this group. Furthermore, the data needs to be complete. If data is missing for specific sub-groups (for example, by age or gender) or time periods, the secondary data may not fully represent the true characteristics of the target population. Moreover, understanding when the secondary data was collected is an important requirement for assessing the purposes for which it can be used. Finally, understanding which data quality measures were applied during the primary data collection can help assess data reliability.

Because the data originates from an external source, it is important to keep in mind the limitations of the data and their implications for the interpretation of results. The data might contain biases challenging its relevance and applicability for monitoring. Potential biases include selection bias (a systematic error in sampling that occurs when certain individuals or groups are more likely to be included or excluded), response bias (a systematic tendency of survey respondents to answer questions inaccurately or misleadingly, often due to social desirability, memory limitations, or other factors), measurement bias (a systematic error in data collection or measurement techniques that consistently skews the results in a particular direction), and reporting bias (a selective inclusion or exclusion of certain research findings or outcomes based on their perceived significance).[43] The limitations of the external sources should be clearly documented in monitoring reports (see Step 9). Monitoring platforms (see

[42] Notably, it is important to label missing values explicitly and avoid replacing them with zeros.
[43] These biases extend to primary data as well, and it is important for the data collection institution to seek to minimize them. Any residual bias should be transparently acknowledged in monitoring reports.

Step 11) displaying information from secondary sources should include links to relevant documentation on these external sources.

Data protection and dissemination

Data storage is a critical aspect of managing information securely and efficiently. Data storage requires data protection through anonymization techniques to ensure the safety and privacy of the collected data. Anonymization involves removing or encrypting personally identifiable information from datasets, safeguarding individual privacy, and complying with data protection regulations, such as the General Data Protection Regulation (GDPR) from the EU. Managing access to data is another measure to safeguard sensitive information: access should only be authorized to users that work with the information frequently. The users should also sign an agreement to adhere to data protection rules. Data should be stored using clear and consistent naming to facilitate identification. For example, it is good practice to always include in the file name the date when the data was stored.

Current practices in Romania

Challenges in data availability impedes a greater use of secondary data in the monitoring of Romanian R&I policies. Relevant secondary data is not always available at the right disaggregation level (for example, the indicator “Projects for R&D activity” from the National Institute of Statistics (INS) is only available at the national level) or is not freely available (for example, data from the National Trade Registry).

Data quality processes focus much more on regulatory compliance than on data relevance to the R&I objectives. Most respondents to the World Bank’s M&E survey (43 percent, N=23) claim that ensuring the accuracy and completeness of M&E data is not part of their responsibility, thus suggesting that data quality processes are not intrinsic to M&E systems. Using standardized data collection methods and tools is reported by 39 percent of respondents as the main data quality tool, while applying regular data quality checks is a systematic practice for less than a third of the participants. This result must still be taken cautiously because respondents may not report data quality checks performed by other departments or external contractors. During stakeholder meetings, it was revealed that regular field visits are a commonly employed measure to verify data accuracy. These field visits enable comparing the information gathered with beneficiary reports, ensuring data quality. Furthermore, to the extent possible, data entry is cross-validated by comparing it with external data sources (for example, with financial reports to confirm that projects adhere to the agreed-upon budgetary allocations.

Although a large part of available resources is invested in complying with existing regulations, the EC audit missions identified several deficiencies in monitoring verifications and data management. For instance, the 2018 EC audit mission had negative findings for Operational Program Competitiveness, highlighting errors in reporting on indicators and storing data in MySMIS. In this respect, it may not be surprising that receiving more training on data collection for M&E purposes (process, quality, sampling) is highly interesting for 56 percent of respondents to the World Bank’s M&E Survey.

Specific recommendations for the R&I system in Romania

Increase the use of secondary data for monitoring of the R&I system in Romania. The wide range of secondary data containing information related to R&D (mostly on a more aggregated policy level) has the potential to make M&E more efficient while reducing costs. Some indicators from secondary data are already used. For example, secondary data is used in the reporting of system-level indicators specified in the SNCISI (such as R&D expenditure from the government sector or European Patent Office (EPO) patent applications). However, Romania has not yet exploited the full potential of available secondary data. Eurostat from the EC operates a large database covering data related to R&D containing indicators such as employed human resources in science and technology or business enterprise expenditure on R&D. On a national level, the relevance of the TEMPO database managed by INS should be considered. For instance, this dataset includes the number of units with research-development activity (available disaggregated by public/private sector and year). An assessment of available secondary data sources for the Romanian R&I sector is provided in Appendix 10.

CHECKLIST – Step 7: DETERMINE HOW TO COLLECT DATA AND ENSURE ITS QUALITY

- ✓ Available secondary data is reviewed to identify the target population with the highest needs and the need for additional (primary) data
- ✓ Relevant modes of primary data collection are selected based on the purpose, target group, and data collection setting
- ✓ Measures are taken to enhance the quality of primary data before its collection, including thorough training of personnel, questionnaire design and programming, and providing guidelines and examples of how surveys or reports should be filled out
- ✓ Automated and systematic data verification procedures are in place during and after the collection of primary and secondary data

STEP VIII

STEP VIII. Specify how monitoring data for the R&I system in Romania will be analyzed and used

- A comprehensive monitoring strategy involves careful planning for data analysis to inform decision-making throughout an instrument and policy cycle.
- Monitoring serves as an early warning system, highlighting deviations or shortcomings in instruments and policy implementation. It can be used to identify drivers and inhibitors of the changes (impacts) intended by instruments and policies by comparing performance across different groups or dimensions.

General recommendations

A comprehensive monitoring strategy involves careful planning for the analysis of monitoring data. An effective monitoring framework goes beyond collecting and providing timely access to relevant data. This data must be used to inform decision-making through careful analysis throughout various stages of the instruments and policy cycle.

Monitoring data can serve as an early warning system, indicating potential deviations or shortcomings in achieving desired goals during instruments and policy implementation. One common application of monitoring data is to summarize information on the indicators of the monitoring framework, assessing whether instruments and policy implementation is on track toward its objectives. This information can be used to flag implementation delays or failures in the instruments and policy intervention logics (for example, unmet short-term outcome targets while output targets were met) early on. Such a system should extend beyond the instrument and programming levels by tracking progress toward strategic objectives. This can be done by carefully aggregating program-level monitoring indicators common to different R&I programs, preventing double counting. However, this approach alone provides little information on how objectives were or were not achieved. Furthermore, it does not uncover new implementation challenges and opportunities, which could inform a better allocation of resources, even when pre-established objectives were met.

Monitoring should be used to identify drivers and inhibitors of the changes intended by R&I instruments and policies. One approach to identifying drivers and inhibitors of change brought by R&I policies consists of comparing the performance of different typologies of beneficiaries (e.g., by firm size). Such a comparison can be accomplished by disaggregating indicators based on specific dimensions of interest (see a list of examples in Table 2). Using data with this kind of structure allows—for example—comparing performance across different types, and within similar types, of policy instruments contributing to the same national specific objectives, both at the program and at the strategic level. These dimensions need to be defined beforehand by establishing common classification systems for monitoring the R&I system, as described in Step 5.

Table 2 Examples of potential levels of disaggregation of monitoring data

Levels of disaggregation
Type of target beneficiaries
Gender of beneficiaries
Region
Country
Research field
Industry
Sector
Smart Specialization priority domain
Strategic Research agenda
Nomenclature for the analysis and comparison of scientific budgets and programs (NABS) themes
Firm size
Project duration
Type of policy instrument
Grant range
Co-funding rates
Type of policy objective

Source: World Bank.

Monitoring data can be analyzed using descriptive statistics and regressions, which are reported as tables and graphs. Descriptive statistics are summaries and presentations of basic characteristics of data, providing a clear and concise overview of its central tendencies, variability, and distribution. Key statistics are sum, mean, variance, mode, minimum and maximum. An example is the distribution of the sum of young researchers (aged 18 to 35) in each region. Econometric methods like multi-linear regressions can be employed to identify associations between projects' performance and key background characteristics (examples listed in Table 2). For example, a linear regression can be used to measure the correlation between the age and gender of beneficiaries with the number of PhD students. Analysts can present descriptive statistics and regressions as tables (for example, regression tables) and graphs (for example, box plots, x-y plots, and histograms). Both visualization types can help detect patterns that might not be immediately apparent when looking at raw data. The quantitative results could be complemented with stakeholder consultations or other qualitative assessments to shed further light on why some characteristics are associated with uneven performance.

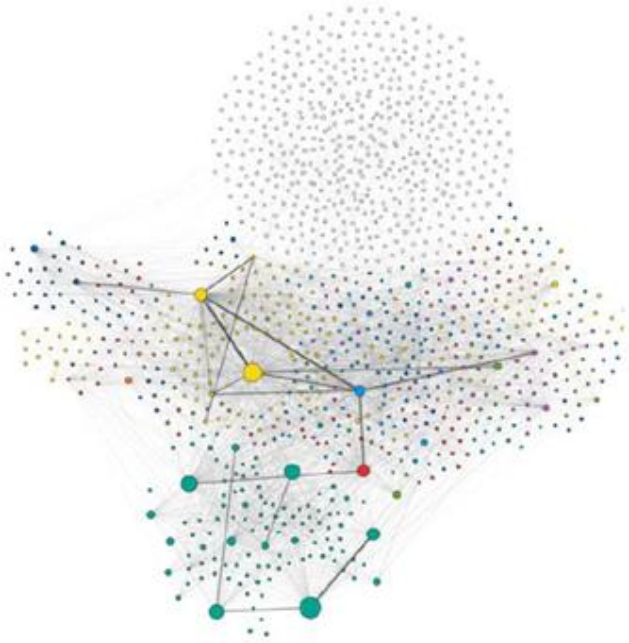
Comparing outcome- and system-level[44] indicator changes over time supports continuous improvement in R&I decision-making. Changes in common indicators with respect to their baseline values will provide some insights on the direct contributions (not to be mistaken for attribution) of R&I public funds. However, the end objective of public policies may be to have an impact beyond their direct beneficiaries. By covering both policy beneficiaries and non-beneficiaries, changes in system-level indicators can provide suggestive (but not causal) evidence on the effects of public funds beyond their direct effects on beneficiaries. Comparison of trends in system-level and outcome indicators can help identify areas where improvements or adjustments might be needed. One should remember that these observed changes are also affected by factors other than R&I policies. The analysis

[44] System-level indicators are used to assess policies' performance across a broader system. In contrast with outcome-level indicators, these indicators are based on policies' direct beneficiaries. Examples of system-level indicators include the number of R&D staff in the country and the annual number of articles indexed in Web of Science.

of changes in outcome- and system-level indicators is best combined with identifying these external factors, or with isolating changes that can be attributed to the R&I policies through impact evaluation methods (see Step 11).

The relevance and effectiveness of instruments and policy interventions are contingent upon the evolution of the R&I ecosystem. Instruments and policy's ToC rely on assumptions about the R&I ecosystem that may prove incorrect.[45] Consequently, the monitoring strategy for the R&I system should include tracking the evolution of R&I capacities and target sectors, including Smart Specialization priority domains and Strategic Research Agendas. A visualization of the network of R&I actors can, for instance, support the identification of patterns of existing and emerging collaborations, providing insights into opportunities for new collaborations. An example taken from the monitoring of Smart Specialization in Catalonia, a region of Spain, is provided in Figure 12.

Figure 12 Example of visualization of collaboration between R&I actors



Note: Snapshot of the platform used to monitor RIS3 in Catalonia, a region of Spain. Each node represents an R&D&I actor with legal headquarters in Catalonia. Different colors are used to distinguish between different types of entities. The size of the node is proportional to the volume of investment made by the actor in R&D&I projects. Lines illustrate collaboration between actors. The thickness of a line is proportional to the number of projects shared within this collaboration.

Source: Government of Catalonia 2021.

Managing authorities and intermediate bodies need to be held accountable for the analysis and use of monitoring data. Within an institution, monitoring staff are responsible for timely reporting on the monitoring results directly to policy makers able to decide on adjustments in instruments and policy implementations. Policy makers from different levels (instrument, program, funding source and strategic) are then responsible for making decisions based on these results. The implementation unit is then responsible for implementing these adjustments. Outside the institution, monitoring results (for example, in the form of dashboards and reports) need to be made public to strengthen policy makers' accountability towards citizens. This cycle of accountability fosters a change in processes toward evidence-based decision-making.

[45] For example, the availability and quality of human capacities, infrastructure for R&D, or other complementary factors such as availability of downstream or upstream providers.

Current practices in Romania

Analytical capacity is crucial for effectively monitoring government programs because it enables accurate data collection, analysis, and interpretation for informed decision-making. As mentioned earlier, managing authorities and implementing bodies face major challenges in attracting and retaining skilled monitoring staff. As a result, most institutional stakeholders of the R&I system lack staff with relevant professional experience and background, limiting the overall institution's analytical capacity. The SNCISI does not include a detailed approach for utilizing data on outcome indicators to adjust existing policy instruments and develop future ones. The lack of a structured approach for data analyses to inform policy decisions can limit the effectiveness of monitoring efforts and impede progress toward achieving policy objectives.

Specific recommendations for the R&I system in Romania

The SNCISI would benefit from a detailed analysis plan for monitoring data at the strategic level. The projection of the analysis of monitoring data on R&I policies at the strategic level can support identifying additional features of the planned centralized monitoring platform (see Step 10). By clearly communicating the value added of analyses at the strategic level, DPSCDITT may gain additional buy-in from R&I implementers, facilitating information sharing and promoting the use of this platform.

R&I decision-makers must commit to rapid and relevant policy action based on monitoring results. Improved monitoring alone is unlikely to lead to larger policy impacts on the R&I system. Monitoring results should be used to inform decision-making at all steps of instruments and policy implementation. Monitoring staff should facilitate the preparation and dissemination of clear and actionable results. As a result, decision-makers should commit to taking quick action based on this information. The rationale for instruments and policy adjustments and instruments and policy design should be documented and clearly grounded on past and present monitoring results.

A detailed analysis and learning plan for monitoring data should be included within the regulatory framework of each R&I policy. R&I managing authorities should further commit to derive lessons from monitoring data and use these results by adding a detailed analysis and learning plan of the monitoring data within programs' regulatory framework.

CHECKLIST – Step 8: PLAN HOW TO ANALYZE AND USE MONITORING DATA

- ✓ A detailed data analysis plan is defined for each relevant policy level (from the instrument to the strategic level), ideally before the start of the instrument and policy implementation
- ✓ Reporting format, including visualization, is determined to communicate progress effectively
- ✓ Monitoring results are shared directly with decision-makers and are made public to be held responsible for taking action based on evidence

STEP IX

STEP IX. Define a relevant management information system

- An online platform can increase the efficiency of the information management necessary for the monitoring framework, thereby saving time and staff resources.
- Smart visualization through interactive dashboards can assist data interpretation and facilitate decision-making by providing clear and organized information on key indicators disaggregated in different ways.
- Establishing and maintaining an online platform should be based on a well-thought strategy. It requires sufficient time and adequate planning of human and financial resources.
- Centralizing information on the R&I ecosystem is a crucial step towards ensuring good governance of the R&I system, facilitating communication and cross-learning across managing authorities and program managers.

General recommendations

The management of information

A monitoring strategy must clearly define the procedures for managing the information necessary for the monitoring framework. A comprehensive monitoring strategy specifies the appropriate technology that will be employed to effectively centralize, store, process, and disseminate to decision-makers the information collected by monitoring R&I policies.

An online platform offers the potential to enhance the efficiency of the management of information, thereby saving time and staff resources. Compared to alternative management information systems, an online monitoring platform offers several key advantages. A platform allows for easier access to information by various stakeholders, with different interfaces that can be tailored to different target users of the platform. This contributes to enhancing the exchange of information while ensuring data security by guaranteeing that sensitive information is safeguarded and only accessible to authorized users.[46]

Key end-user requirements of a potential digital M&E platform

A well-designed platform centralizes information and provides automation to enhance monitoring functions that may not be readily accessible otherwise. A platform can automate data collection, verification, and analyses, thus reducing the time and effort required for manual data processing and related errors. This functionality allows decision-makers to focus on analysis and decision-making. Moreover, a platform can be used to centralize other sources of information beyond what is collected through monitoring, thereby allowing for additional layers of data analyses on the ecosystem.

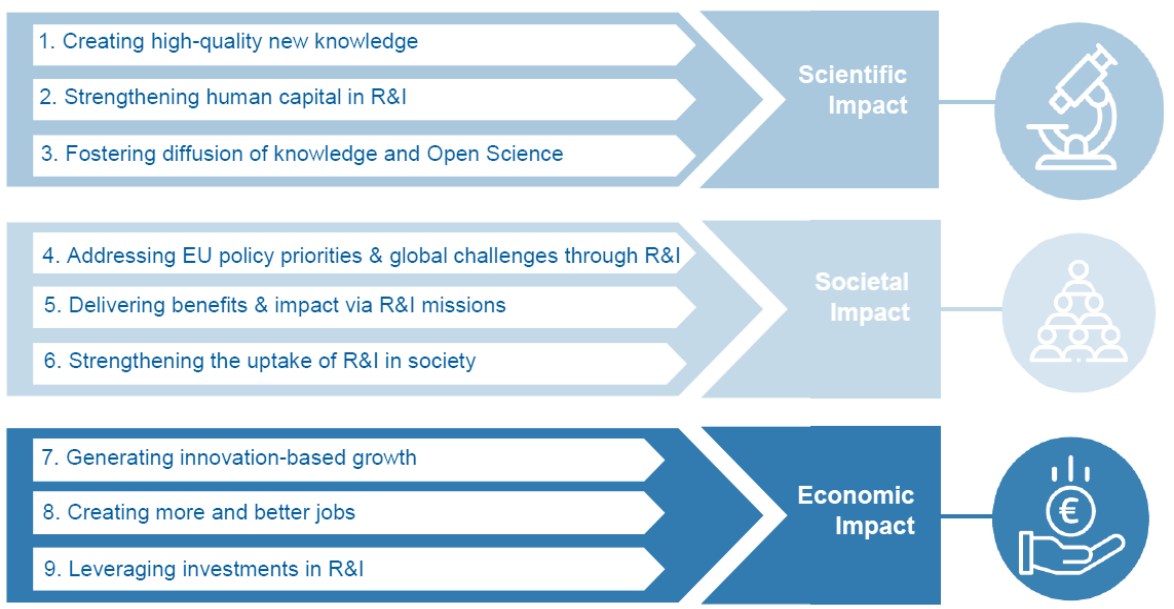
[46] While Excel offers a multitude of advanced functions and tools for monitoring, it is often utilized in a simpler form. Features such as automatic data validation, advanced analysis, and visualization are seldom employed. Furthermore, Excel files are commonly shared via email, which poses a threat to both data security and timely access to information by relevant stakeholders.

Visualization can be used to enhance informed decision-making by presenting complex data in more easily comprehensible formats. Using a monitoring platform offers a good opportunity to set up an interactive dashboard addressing various data and analysis needs of the platform users. The dashboard should allow for aggregating and disaggregating the data on different variables (for example, at different policy levels, by program, by Smart Specialization domain and Strategic Research Agenda, or by type of policy instruments). The type of visualization may also be tailored to pre-defined type of users, to ease access to and use of information. One approach Horizon Europe followed is displaying information on common indicators by general objective and the indicators' time-sensitivity (see Box 10).

Box 10 Example of an interactive dashboard from Horizon Europe

Horizon Europe promotes a new approach to capture and communicate a program's impacts: the Key Impact Pathway framework. The end goals of Horizon Europe are defined in three impact categories: scientific, societal, and economic impacts. Each impact category is then tracked along three Key Impact Pathways. As illustrated by Figure 13, each pathway (on the left) captures a key channel through which the projects will contribute to the program's end goals (on the right). The framework further defines three time-sensitive indicators per pathway, capturing three key pillars of the ToC: short-term, medium-term, and longer-term outcomes. For instance, indicators for the Key Impact Pathway 1 include publications (number of peer-reviewed scientific publications resulting from the program), citations (citation index of peer-reviewed publications resulting from the program), and world-class science (number and share of peer-reviewed publications resulting from the projects funded by the program that are core contributions to scientific fields). Each indicator is accompanied by detailed guidance on how it should be measured. Thanks to this common framework, projects with similar Key Impact Pathways can then be compared at different stages of their implementation.

Figure 13 Relating indicators to common policy objectives: a good example from Horizon Europe



Source: EC 2022c.

The dashboard of Horizon Europe offers a comprehensive overview of the program's common indicators by general objective and time period. Within each general objective, several default dashboards can be consulted depending on the stage of the policy's intervention logic (short-term, medium-term, or longer-term). As illustrated below (Figure

14), the dashboard recalls the Key Impact Pathways contributing to this general objective and its respective common indicator. The dashboard displays not only summary information on this indicator but also relevant disaggregations specific to this indicator.

Figure 14 Preview of the Horizon Europe dashboard

Source: EC 2022d.

Key factors determining the design of a dashboard are audience, purpose, and clarity of displayed information. The interest, needs, and capabilities of the audience should guide the development of the dashboard. Information should be clearly organized, parsimonious, and displayed with appropriate scales to prevent misinterpretation of the results that may eventually mislead decision-making. Box 11 provides guidance on how to design a good dashboard.

Box 11 How to design a good dashboard

Key elements to consider when designing a dashboard:

- Audience and purpose
  - Identifying target audience
  - Consider what the goal of the dashboard is and what story it should tell
  - Only display information most relevant to the target audience
  - Pilot the dashboard repeatedly with the target audience. Feedback should be incorporated.
- Display of information
  - Information provided should be easy to understand when just quickly looking at it (i.e., within 5 seconds)
  - The content should fit fully on one screen without the need for scrolling
  - Consider how the dashboard is viewed (e.g., computer, tablet, smartphone) and possibly allowing automatic adjustment of layout

- More aggregate information should be provided first and be followed by more detail in the direction that the audience is used to read
- The information on the dashboard should tell a story – related information should be provided close to each other
- Consider how exceptions or actions required based on the data displayed can be highlighted visually
- Use icons only if familiar to the target audience
- Consider load time of dashboards

- Numbers
  - Use degrees of change or put single value numbers into context
  - Limit the numbers before and after the decimal point where not relevant, e.g., 65 million Euro instead of 65.000.000,00 Euro.
  - Avoid detailed tables
- Graphs
  - Graphs need to be large enough to be readable
  - Graphs need to contain a legend and axis labels and should not be overloaded with value labels
  - The scale of the axes should be consistent with other information provided on this matter visible in the same dashboard view
  - The scale should not distort the results
  - Avoid using circular shapes as they are more difficult to interpret for the human brain
  - Do not use different type of graphs just to have variety
- Colors
  - Colors concerning the same categories (e.g., men versus women) need to be consistent across graphs
  - Consider whether different colors have meanings associated to the information displayed or can be used for signaling
  - Colors should be distinguishable for colorblind people
- Information sources
  - Information provided should contain a date when it was last updated
  - Information provided should contain the information source if the dashboard presents information originating from various sources

Sources:
https://powerbi.microsoft.com/en-gb/blog/the-art-and-science-of-effective-dashboard-design/
https://help.tableau.com/current/pro/desktop/en-us/dashboards_best_practices.htm
https://www.linkedin.com/pulse/dashboard-design-principles-best-practices-gustavo-cortez-msba?trk=public_profile_article_view
https://thenewstack.io/5-dashboard-design-best-practices/

Establishing and maintaining an online monitoring platform demands significant time and resources. The design of a monitoring platform should be based on a well-thought-through strategy and needs to be accompanied by adequate resource planning. Box 12 lists

nine assessment domains of a quality checklist to aid in evaluating the clarity, completeness, and feasibility of a monitoring platform's design. The full quality checklist is provided in Appendix 11. The actionability of the design of a monitoring platform strongly relies on setting realistic goals that align with the institution's needs and budget. Based on the experiences of other countries, Box 13 highlights selected lessons learned in implementing a new monitoring platform. Overall, one should be aware that implementing a new management information tool induces organizational change that requires time for adoption. Therefore, a significant amount of time should be factored in between the platform's design and its full roll-out to ensure a smooth transition.

Box 12 Assessment domains of a monitoring platform's design

Nine assessment domains of a monitoring platform's design:

1. **Coverage**: Explicit list of responsible authorities and persons, programs, data sources, and indicators. Indicators should allow tracing policies' intervention logic.
2. **Actionability of primary data collection plans:** Interoperability with existing platforms, provision of clear guidelines for data entry, alignment with existing reporting format and users.
3. **Actionability of secondary data collection plans:** Legal arrangements and automatic data extraction with target secondary sources.
4. **Role of the platform in planning and decision-making:** Harmonization of indicators definition and measurement, clear plans for automatic data analysis and visualization, automatic reporting and data export.
5. **Credibility:** Transparency of data collection methods and data manipulation, automatic data quality procedures.
6. **Responsibility:** Clear roles for contribution to and use of the platform by different entities, clear data protection regulations.
7. **Commitment:** Clear action plan and allocation of sufficient financial and human resources to ensure the completeness and timeliness of information available on the platform, platform management, and maintenance.
8. **Adaptability:** Clear action plan for frequent updates to match the evolving needs of platform users.
9. **Monitoring of the platform implementation:** Monitoring strategy of the platform and features testing.

Source: World Bank's own elaboration.

Box 13 Key lessons learned in implementing a new monitoring platform

Six lessons learned in implementing a new monitoring platform:

1. **Good interface design:** A user-friendly interface and a relevant selection of visualization are key success factors.
2. **Prioritization:** Prioritize the low-hanging fruits or the most critical elements of the platform's scope to facilitate the initial setup.
3. **Good planning:** The time and budget required for the platform roll-out should not be underestimated. The planning phase should anticipate multiple adjustments and being extended over several years from the start.
4. **Clear instructions for contractors:** Instructions for contractors need to be very clear and specific to hold them responsible for the quality of their output.

5. **Stakeholders' engagement:** The monitoring platform's success depends on various stakeholders' support. However, it is essential to have realistic expectations of other stakeholders and data providers and not set the bar higher than what the leading agency could itself deliver.
6. **Common standards of data quality:** Common data standards should be applied to ensure consistency across different data sources. Using similar unique identifiers allows for matching individuals, firms, projects, and sectors across different sources, ensuring consistency and accuracy in data integration.

Sources: EC 2021a; USAID 2013.
https://oecd-opsi.org/innovations/rd-platform-for-investment-and-evaluation-rd-pie/
https://alper.datav.is/assets/publications/dashboards/dashboards-preprint.pdf

Depending on the scale and timeframe of the monitoring framework, developing a new platform is not always cost-effective. Managing authorities should explore the possibility of expanding the scope of existing platforms by adding additional features or making them interoperable with other platforms in place, which is a more efficient and economical solution. These decisions and their implementation should be supported by consultation with IT experts familiar with both data management systems and monitoring.

The added value of a central platform

Centralizing information on the R&I ecosystem is a crucial step toward ensuring good governance of the R&I system. A centralized monitoring platform that sources information from fund- and program-specific monitoring systems is an effective solution for strategic-level monitoring. This platform promotes cross-learning across programs and policy instruments by extending access to all managing authorities and program managers. Box 14 provides an example from South Korea, where a central platform facilitated collaboration across ministries and R&I actors, resulting in improved forecasting capabilities for the sector.

Box 14 Example from South Korea –R&D Platform for Investment and Evaluation

The South Korean government has seen steady growth in R&D funding. However, it has also been concerned that the funding is fragmented across ministries and agencies, leading to duplication of work and short-term projects. As a response, the Ministry of Science and ICT implemented a new R&D Platform for Investment and Evaluation that uses big data analytics and machine learning techniques to identify overlaps, gaps, and missing links in R&D, and to bring all actors (universities, research institutes, companies, ministries, investors) together to stimulate collaboration and connect different R&D projects with relevant policies and human resource planning. The platform was first introduced for eight priority areas, and the government is considering expanding the platform's coverage beyond R&D for government budgeting, thanks to the rapid acceptance by the different stakeholders.

However, the implementation of the new platform has not been without challenges. Introducing the new system involved a highly labor-intensive transition, requiring more attention and time than anticipated. During this phase, the support at the ministerial level and the willingness of government officials and program managers—initially following the old and new processes in parallel—have been seen as key success factors. Nonetheless, the platform's analytical power brought together different stakeholders addressing the same topic and helped settle differences in opinion through the evidence-based policy-making process it enabled.

Source: https://oecd-opsi.org/innovations/rd-platform-for-investment-and-evaluation-rd-pie/

Current practices in Romania

Centralizing data within a comprehensive R&I platform could support the information exchange needs of multiple line ministries and program managers in Romania. Currently, the lack of interoperability among existing IT platforms and inconsistencies in monitoring procedures pose significant challenges to achieving better information exchange across R&I decision-makers and implementers. Addressing these challenges will require close collaboration among stakeholders and a concerted effort to develop standardized monitoring procedures and interoperable IT systems. Recent efforts by MCID to establish a centralized monitoring framework that integrates data from all R&I programs are a promising start in this respect. The World Bank team actively supports and encourages MCID's plans to this end, and the present report is meant to add value to these efforts.

MCID, through DPSCDITT, has taken initial steps in the design and implementation of a central monitoring platform (hereafter referred to as 'DPSCDITT platform') covering the whole R&I system. The DPSCDITT platform aims to harmonize data on R&I from multiple database management systems for national, EU, and regional funding that are operating in Romania (for example, MySMIS, EVoC), with each system being adapted to different levels of data volume and intended use of the information. According to the draft methodology of the DPSCDITT platform, currently under development, the platform's purpose goes beyond monitoring the progress of R&I policies, leaving the door open for additional data that will support R&I planning and decision-making. Data will be automatically extracted from existing sources to the extent possible based on the interconnection and interoperability with primary information systems. This initiative aims to improve the uptake of the DPSCDITT platform among program managers and RIS3 coordinators and to foster transparency regarding the progress of R&I interventions.

Lessons on the implementation of a new monitoring platform can be learned from past experiences, including in Romania. UEFISCDI's current administrative and IT systems stand out as being well-organized and collecting relevant information directly from beneficiaries. But UEFISCDI's platforms include comprehensive evidence only for projects funded through the Agency, while other national R&I programs use different platforms (i.e., Nucleu) or other data collection formats. The EU programs benefit from a single management information system (MySMIS). The system, however, received criticism in the previous programming period, especially due to the high reporting burden placed on beneficiaries. The recent implementation of the Status PNRR platform as part of monitoring NRRP interventions in Romania provides an example of transitioning from an Excel-based tool to an online platform. This platform primarily functions as a tool for management and structured communication between key stakeholders of NRRP implementation.[47] The platform fosters collaboration between these different actors and facilitates information exchange. The platform's development and implementation required a clear action plan and benefited from a strong political commitment from the responsible Ministry. The latter was reinforced by the critical services provided by the platform, alleviating the previous administrative burdens.[48] The provision of clear guidelines and repeated onboarding workshops were other key elements for the uptake of this new tool.

[47] This includes the organizations and structures responsible for the achievement of milestones and targets, reform and investment coordinators, NRRP National Coordinator and the Inter-ministerial Committee for NRRP Coordination.
[48] Several tasks are now automated within the platform, including the monitoring of activities deadlines and informing users when a delay occur, generating and submitting standard emails when different tasks are completed by users, generating standard online and offline reports.

Specific recommendations for the R&I system in Romania

The proposed template for the monitoring framework of the Romanian R&I sector (Appendix 8) serves as a foundation for the architecture of the DPSCDITT platform. The template builds on the draft methodology of the DPSCDITT platform. The proposal in this report complements this initiative by providing a comprehensive list of crucial information that should accompany the monitoring indicators of the R&I system and putting these elements in an actionable structure.

A transparent and concrete operational plan should accompany the methodology of the DPSCDITT platform. The actual implementation of the DPSCDITT platform would benefit from more explicit governance (see Step 2), a clear political commitment of each involved ministry and RDA, and a more concrete and structured way forward. The plan for the DPSCDITT platform could take the form of an operational manual providing answers to all questions listed in Appendix 11. This manual should seek two objectives: (i) clarify the concrete steps of the platform implementation and maintenance; and (ii) promote the harmonization of monitoring procedures of the R&I system. The latter can be achieved by providing clear guidance on indicators measurement, data collection, and data management. The provision of such a manual is now part of the current draft methodology. In the future, the DPSCDITT platform may feed information into the platform for the Institutional Strategic Plans under GSG. The platform will also provide data to an R&I Observatory that will be developed with the support of the World Bank. The R&I Observatory's objective is to provide analysis of the R&I system covering the economic context, main actors, funding trends, human resources, as well as policies to address R&I challenges in national and regional strategies.

MCID should promote using digital tools to monitor R&I national funds to reduce time-intensive manual tasks and the likelihood of errors. Although MySMIS and Status PNRR are used to monitor European funds, EvoC or the DPSCDITT platform could be enlarged to encompass the monitoring of funds that do not yet rely on a monitoring platform. This would also contribute to the government's efforts to promote digitalization.

The DPSCDITT platform, and later on the R&I Observatory, should be used to promote and facilitate information exchange on the performance of R&I instruments and policies across and within managing authorities and implementing bodies. Information exchange may be facilitated by the Committee for Science, Technology, and Innovation, provided clear monitoring roles and responsibilities are assigned, and by the future DPSCDITT platform and R&I Observatory. As such, their realization is key to attaining this objective. The DPSCDITT platform could be expanded to a communication and management tool to facilitate information exchange within and beyond MCID.

The finalization and maintenance of the DPSCDITT platform require adequate financial and human resources. To ensure the operationality of the DPSCDITT platform, a minimum of four additional internal full-time positions should be created within MCID (see Step 2): an outreach specialist, dedicated to the promotion of the platform; an IT expert for platform development, maintenance, and user support; a data manager to oversee data; and an M&E specialist, responsible for data analysis and reporting at the strategic level.

CHECKLIST – Step 9: DEFINE A RELEVANT MANAGEMENT INFORMATION SYSTEM

- ✓ Management information systems are set-up and, when relevant, interoperable
- ✓ Monitoring data is centralized at the strategic level and accessible to all relevant stakeholders

STEP X

STEP X. Identify suitable evaluation strategies for R&I instruments and policies

- When uncertainties about the best way to implement impactful programs exist, a learning-oriented monitoring strategy should be complemented with evaluations.
- Rigorous impact evaluations are crucial for assessing the causal effects of interventions, determining their effectiveness and cost-efficiency, and generating valuable lessons for future learning.
- Although impact evaluations are valuable, they may not be applicable to or needed for all instruments and policies, and different evaluation approaches should be considered.

General recommendations

A learning-oriented monitoring strategy needs to be complemented with evaluations. This report intentionally focuses on the monitoring side of M&E. However, both elements—monitoring and evaluation—are complementary, and learning from policy making would be incomplete without evaluations. A key limitation of monitoring is the inability to differentiate changes caused by the instrument or policy from changes caused by external factors. For completeness, this section presents a brief overview of key evaluation approaches. Hereafter, a distinction is made between methods allowing for a clear quantitative attribution of an instrument or a policy's impacts, referred to as impact evaluations, from other approaches.

Impact evaluations

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 future learning. 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?" Essential resources on each of the methods presented here are listed in Box 15.

Box 15 Key reading recommendations on impact evaluation methods

- ✓ Gertler, P. J., Martinez, S., Premand, P., Rawlings, L. B., & Vermeersch, C. M. 2016. Impact evaluation in practice. World Bank Publications.
- ✓ Link to resources from DIME analytics (World Bank)
- ✓ Link to research resources from J-PAL
- ✓ Link J-PAL evaluations
- ✓ Link to the American Economic Association's registry for RCT

The most rigorous way to measure the causal effects of instruments and policies is using randomized controlled trials (RCTs). 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 treatment 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 control 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, 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** 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 treatment.

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 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.[49]

Other evaluation approaches

Despite the rigor of impact evaluations, not all instruments and policies can or should be evaluated using one of the five approaches presented before. Rigorous impact evaluations require resources (i.e., personnel and for data collections) and most importantly commitment to share relevant information and be open to change. These types of evaluations cannot be applied for instruments and programs in which the logic of what should be tested and why are not finalized yet (i.e., setting up a coherent, logical and realistic ToC is a first step). They may not be applicable when instruments or programs have a low number of targeted beneficiaries, which limits the application of statistical methods. They should be applied ideally for lower-level program questions allowing to capture variation in implementation (i.e., high-level changes in national legislation are hard to evaluate).[50] In situations where rigorous impact evaluations are not feasible, several other evaluation methods are available. They differ in their learning purpose and pre-conditions. Some of them are presented in the points listed below.[51] (More information on each of these methods can be found in the reading recommendations provided in Box 16.).

- **Process or implementation evaluations** assess the quality of policy delivery by examining how well the instrument or policy has been implemented and what could have been improved.
- **Economic or efficiency analyses** consist of estimating the economic returns of an instrument or apolicy's monetary investments. Two key approaches are cost-benefit analyses and cost-effectiveness analyses. *Cost-benefit analyses* use the monetary costs (direct and indirect) and benefits (monetary and non-monetary) associated with an instrument or a policy in terms of net present value to assess whether an instrument or a policy is economically justified. In contrast, a *cost-effectiveness analysis* is used to identify the most efficient instrument or policy that achieves a desired outcome at the lowest cost.
- **Case studies** look more in-depth into the contextual matters and underlying mechanisms of an instrument or policy intervention for a few beneficiaries**.**
- **Simulation models** imitate and replicate the behavior of real-world systems. These models are designed to analyze complex systems and predict their performance, behavior, or outcomes under different conditions or scenarios.
- **Process tracing** specifically evaluates the mechanisms of different aspects of the instrument or policy intervention based on hypotheses about the policy's impact**.**

[49] To increase the credibility and accountability of evaluation results (including those of an impact evaluation), an evaluation should be conducted by independent evaluators.
[50] Please find a more detailed discussion, why rigorous impact evaluations might not be applicable, here: https://ssir.org/articles/entry/ten_reasons_not_to_measure_impact_and_what_to_do_instead.
[51] This report focuses on monitoring and does not aim at providing an list of evaluation approaches. Interested readers are invited to consult the reading recommendations provided in Box 16.

- **Qualitative comparative analyses** seek to identify the conditions (for example, a context or a specific intervention) that lead to the instrument or policy's outcomes across a set of cases.
- **System mapping and dynamics** methodologies visualize the interconnected, multi-layered elements of complex instrument or policy interventions, assessing the context in terms of cultural, social, economic, and institutional features.
- **Outcome mapping and outcome harvesting** are participatory evaluation methods, collecting outcomes identified by different stakeholders directly exposed to the policy.
- **Social network analyses** evaluate the extent to which different actors, such as individuals or other entities, are connected, what characterizes these linkages, and what impact they have on the overall network.
- **Life cycle assessments** analyze the implications of a policy throughout its lifecycle, aiming to identify the long-term sustainability of the observed outcomes.
- **Expert opinion** involves seeking and considering assessments, insights, or judgments from knowledgeable and experienced individuals to inform the evaluation process.
- **Trend analysis** identifies and analyzes patterns or changes in data over time to discern underlying trends and make predictions about future developments.

Box 16 Key reading recommendations on other evaluation approaches

- ✓ European Commission. 2021. 'Better Regulation' toolbox 2021 – November 2021 edition.
- ✓ OECD. 2020. Chapter 1. Towards a systemic approach to policy evaluation. In Improving Governance with Policy Evaluation: Lessons From Country Experiences.
- ✓ Vaessen, J., Lemire, S., & Befani, B. (2020). Evaluation of International Development Interventions: An Overview of Approaches and Methods. Independent Evaluation Group. World Bank.

Current practices in Romania

Evaluation culture in Romania is still in its infancy, and there are large differences in evaluation practices between the national and the EU-funded programs. The PSF report points to the absence of rigorous evaluations of individual research organizations, R&I programs, and instruments (EC 2022b). This conclusion is corroborated by the World Bank's functional analysis, which shows that almost no evaluations of individual R&I instruments were done in the previous programming period. Furthermore, the functional analysis reveals that evaluation results are rarely used to learn and improve R&I policy instruments (World Bank 2023). Because of their regulatory requirements, EU-funded programs are more commonly evaluated. Nevertheless, there is scope for improving evaluation practices on both the supply and the demand side, and improving their rigor, to bring evaluation closer to decision-making (World Bank 2021b). To our knowledge, no rigorous impact evaluation of R&I policies has been conducted in Romania.

Specific recommendations for the R&I system in Romania

Uncertainties about how to improve ongoing instruments and programs or how to address changing environments should guide the willingness to learn about what works, for whom, and at what costs. These questions can be answered through rigorous impact evaluations. To illustrate the learning benefits of impact evaluations, two rigorous impact evaluations of R&I policies will be conducted by 2026 as part of the joint World Bank and MCID project. The impact evaluations will aim at assessing the impact and mechanisms of interventions of programs selected based on their importance for the R&I ecosystem or novelty and potential for scale-up. At the time of writing, identifying implementing partners and policies for these impact evaluations is ongoing.

Many existing policies at different policy levels are suitable for impact evaluation. The necessary condition for an impact evaluation—finding and establishing a comparison group that does not receive the policy—is often fulfilled naturally: the number of beneficiaries is limited by the available funds. Furthermore, programs are phased in over time and not rolled out at once, allowing analysts to compare early and late beneficiaries. Moreover, a certain score frequently serves as a cut-off for receiving funding; such cutoff scores can be exploited for identifying comparison groups.

The assessment of whether an instrument or a policy is suitable for an impact evaluation should be made during an instrument and policy planning stage. To increase the integration of impact evaluations into the policy cycle, each instrument and policy should be checked for its suitability for an impact evaluation. The assessment should be guided by uncertainties about how to improve ongoing policies or how to adapt to changing environments. The willingness to improve instruments and policies and to learn about what is effective, for whom, and at what costs is crucial. The assessment should occur during the instrument and policy design stage (that is, before the implementation starts).

CHECKLIST – Step 10: IDENTIFY SUITABLE EVALUATION STRATEGIES

- ✓ Opportunities for impact evaluation of specific interventions, instruments and programs are assessed and impact evaluation strategies are developed before instruments and policy implementation
- ✓ When an impact evaluation is not appropriate, different evaluation approaches are identified

STEP XI

STEP XI. Determine reporting and dissemination procedures of monitoring results

- Effective evidence-based policy making requires sharing findings and recommendations with relevant stakeholders, especially policy makers and the research sector.
- A monitoring strategy should establish a clear plan for periodic and continuous reporting and disseminating monitoring results.
- Reporting, which includes providing accessible report summaries to the general public, serves as a means of making managing authorities and program managers accountable for acting on monitoring results.

General recommendations

Sharing of findings and recommendations with relevant stakeholders is key for effective evidence-based policymaking. M&E reports can be broadly categorized into two main groups. Reports intended for internal audiences primarily serve the purpose of aiding **instruments** or program management. On the other hand, external reports are created for stakeholders not directly involved in the **instruments** or program implementation teams (e.g., policy makers (including EU institutions), higher education institutes, public research institutes, other public and private research institutions, researchers, private sector, as well as the general public). The external reports primarily serve the purposes of showcasing accountability, or fostering broader knowledge dissemination.

A monitoring strategy involves a clear definition of how monitoring results will be reported and disseminated to stakeholders of interest (how often, with which focus and content, as well as in which format). Generally, two main forms of communication can be distinguished: periodic and continuous progress reporting. The messages should be tailored to the specific stakeholder of the report.

Periodic reporting refers to assessments conducted at regular intervals, such as monthly, quarterly, biannually or annually. Periodic reporting is frequently done in the form of monitoring reports that provide a snapshot of progress and performance over a specific period, allowing for monitoring key indicators, targets, and outcomes. They are often used for tracking instruments and policy implementation, identifying trends, and informing decision-making. The most important parts of a monitoring report are:

- A comprehensive update on the progress made during the reporting period, including achievements, challenges, and any deviations from the planned activities or targets.
- A detailed analysis of the monitored data (including selected KPIs such as SNCISI common indicators), identifying trends, patterns, and significant observations. This section may also include comparisons with previous reporting periods, benchmarks, and targets. It may include visual representations such as graphs or charts to aid in understanding the data.
- A discussion about the lessons learned from the monitoring process, highlighting successful practices, challenges faced, and recommendations for improvement. This

section focuses on actionable insights that can inform future decision-making and program adjustments.

- Specific recommendations, based on the findings and analysis, suggesting actions or strategies to address identified gaps, improve performance, and enhance instruments and policy effectiveness.

Continuous reporting involves reporting in real-time or near real-time. Continuous reporting provides a more dynamic and up-to-date understanding of instruments and policy performance, enabling timely interventions and adjustments. Continuous reporting relies on the use of automated data systems and real-time feedback mechanisms to capture data and provide regular updates on key metrics. Continuous reporting primarily serves to outline and compare activities and financial performance against the set plans and budgets. The focus should lie on indicators that can quickly inform stakeholders about the policy status. They can be presented in graphs or tables and disaggregated for different groups (for example, gender and age) to facilitate a quick and comprehensive overview. Monitoring platforms can be used for continuous reporting (see Step 9.).

Current practices in Romania

There is little comprehensive information about the evolution of the Romanian R&I system because reporting on the monitoring of R&I policies at the strategic level has not yet been implemented. Despite various commitments made in strategic documents, regular reports on the implementation of SNCISI are still missing. Consequently, evidence of progress toward the strategic goals or oversight of RIS3 targets is scarce and incomplete.

There are large variations in reporting practices between program implementors. UEFISCDI, for instance, publishes detailed annual reports on the state of implementation of PNCDI. The reports give thorough evidence of the number of projects funded (per scientific domains, RIS3 priorities, counties, types of institutions etc.), disbursed funds, projects' evaluation processes, R&I outputs, and best practices, among other indicators. However, given UEFISCDI's role in the ecosystem, their reports cover exclusively the instruments managed by the Agency and not the whole R&I ecosystem. An overarching view of the implementation of PNCDI is missing because not all program managers release public reports. MCID has recently started to issue public activity reports, but these focus more on inputs and processes than on R&I outputs and results obtained. The Romanian Academy and the branch academies publish annual reports that summarize the activity of their scientific sections and their financial activity. MEDU releases annual reports about the state of higher education in Romania, while the National Council for Financing of Higher Education (CNFIS) publishes annual reports about the state of higher education financing. In their turn, all managers of ESIF-funded programs release periodical reports informing on physical and financial progress. There is still space for harmonizing and adjusting the reporting requirements to the needs of the overall M&E system.

Specific recommendations for the R&I system in Romania

Reporting on the monitoring of R&I policies at the strategic level and for dissemination should follow best practices. Creating a functional centralized monitoring system requires harmonizing existing monitoring systems at the program level and clarifying reporting flows at the SNCISI level. At the strategic level, the Research Law stipulates that the newly created Inter-ministerial Committee for Science, Technology, and Innovation should issue and make

public an annual report with conclusions and recommendations for the R&I system (Research Law, Art. 40.2.f). It should also include proposals for the update of the strategic objectives of the R&I field and for the revision of the National Strategy (Art. 40.4.2). To achieve greater coherence in reporting and monitoring, the annual report prepared by the Inter-ministerial Committee should be corroborated with the periodic reports on SNCISI implementation. The annual report could also provide evidence of progress toward achieving country-specific recommendations, supporting Romania's reporting on R&I in the context of the European Semester. Broad dissemination of the annual report is strongly encouraged to inform and empower decision-making at all levels and inform the research sector. To communicate the content of the annual report to citizens, it is essential to create and distribute a summary tailored specifically for the general audience. The R&I Observatory (to be developed with support from the World Bank) could decisively improve the policy intelligence function and shed light on Romania's R&I strengths and areas of excellence.

CHECKLIST – Step 11: DETERMINE REPORTING AND DISSEMINATION PROCEDURES

- ✓ Ideally, the frequency, outline, and reporting formats are defined before instruments and policy implementation
- ✓ The reporting and dissemination plan includes both periodic and continuous reporting of monitoring results, from the instrument to the strategic level

STEP XII

STEP XII. Update previous steps as necessary

- The design of the monitoring framework of the R&I system may not always follow a linear process, with a potential for some of the steps to occur simultaneously, calling for an update of previous steps.
- Financial and human resources requirements especially need to be reassessed during implementation to respond to potential challenges.

General recommendations

Designing an effective monitoring strategy at the strategic or lower levels is dynamic and iterative, seldom following a straight path. Throughout developing the monitoring system, decisions are carefully aligned with the predefined objectives and made in consideration of available resources, both defined in the initial steps. However, as technical requirements are clarified, additional needs may be identified. The design of the monitoring system involves aligning indicators and plans with changes in actual instruments and policy implementation and instruments and policy implementation plans, ensuring precision and adaptability. Upon completing all elements of the monitoring strategy (Steps 1 to 11), with a potential for some of the steps to occur simultaneously, a crucial step is to evaluate whether the initially identified budget and human resources are sufficient to implement these plans effectively. Adjustments, if needed, should be made promptly to optimize the strategy's implementation.

The whole cycle, Steps 1 to 12, should be repeated at least twice a year at each policy level (from the instrument to the strategic level) to assess the needs for any updates. Setting a specific target ensures consistent and frequent assessment of the monitoring system. It allows for promptly identifying any emerging issues or trends and addressing them quickly. The regular repetition of the cycle enhances organizational learning and continuous improvement, as feedback and lessons learned from previous cycles can be integrated into subsequent iterations. Changes in the monitoring strategy, and their rationale, should be carefully recorded for future reference.

CHECKLIST – Step 12: UPDATE PREVIOUS STEPS AS NECESSARY

- ✓ At each policy level (from the instrument to the strategic level), previous steps of the design of the monitoring strategy are updated when new decisions, circumstances, or information affect the initial plans
- ✓ Financial and human resources are updated to match the needs of the monitoring strategy
- ✓ A regular update schedule is set in advance
- ✓ Updates of the monitoring strategy are documented for future reference

SUMMARY OF KEY RECOMMENDATIONS AND PLANNED NEXT STEPS

Summary of key recommendations and planned next steps

Key Recommendations

Based on the analysis done in the report, we have formulated a list of critical recommendations for the design and implementation of a centralized monitoring framework of the R&I system in Romania. These recommendations, provided throughout this report, are summarized in Table 3 and discussed further below. The summary recommendations are organized around four main themes:

1. Governance of the monitoring of R&I policies
2. Comparability of indicators and of the performance of R&I policies
3. Learning-oriented monitoring
4. Adequate resources for monitoring

Table 3 Summary of recommendations

	Recommendation	Related Step(s)	Responsible entity(s)	Priority timeline
Governance	Assign clear monitoring roles and responsibilities to the Committee for Science, Technology and Innovation and its secretariat, and in the future, to the R&I Observatory	Step 2	Prime Minister	High priority Short term
	Determine the monitoring responsibilities at the MCID, create a centralized M&E unit with necessary staff (M&E, Outreach, IT and Data Specialists), create an inter-departmental M&E group, and assigned focal points for M&E in other units	Step 2, Step 5, Step 6, Step 7, Step 9	MCID	Medium priority Short term
	Provide DPSCDITT with clear authority on leading the implementation of a centralized monitoring framework at the strategic level, and possibly later to the R&I Observatory	Step 2, Step 5, Step 9	Prime Minister	High priority Short term
	Promote and facilitate information exchange on the performance of R&I policies across and within managing authorities and implementing bodies	Step 2, Step 5, Step 9	MCID, MIPE, MEDU, Romanian Academy, RDAs, UEFISCDI, other R&I implementers	Medium priority Short term
	Make policy makers accountable to rapid and relevant policy action based on monitoring results	Step 8	Committee for Science, Technology and Innovation MCID, MIPE, MEDU, Romanian Academy, RDAs, other R&I managing authorities	High priority Short term

Comparability	Reach agreement on a common monitoring framework for R&I policies	Step 6	MCID, MIPE, MEDU, Romanian Academy, RDAs, UEFISCDI, other R&I implementers	High priority Short term
	Accompany the SNCISI common indicators with clear definitions and guidance on how to measure them	Step 5	MCID	High priority Short term
	Assess current differences in indicators measurement and information gaps using the proposed structure for a common monitoring framework, and promote harmonization rules of R&I indicators and measurement	Step 5, Step 6	MCID, with information provided by all R&I implementers	High priority Short term
	Promote the coherence of monitoring procedures and management information systems of funds managed by MCID	Step 6, Step 9, Step 11	MCID	Medium priority Medium term
	Promote a clear and harmonized documentation of monitoring processes across R&I policies	All steps	MCID	Medium priority Medium term
Learning	Articulate a ToC at each policy level to assess the relevance and completeness of existing indicators	Step 3, Step 4	MCID, MIPE, MEDU, Romanian Academy, RDAs, UEFISCDI, other R&I implementers	High priority Short term
	Clearly align program and instrument indicators with the SNCISI-specific objectives	Step 3, Step 4	MCID, MIPE, MEDU, Romanian Academy, RDAs, UEFISCDI, other R&I implementers	High priority Short term
	Clarify the analysis plan of monitoring data at the strategic level	Step 1, Step 8	MCID	Medium priority Short term
	Use these ToCs to identify risks to policies' effectiveness as well as synergies and complementarities of existing instruments	Step 3	MCID, MIPE, MEDU, Romanian Academy, RDAs, UEFISCDI, other R&I implementers	Medium priority Medium term
	Include a detailed analysis and learning (action) plan of the monitoring data within the regulatory framework of each R&I policy	Step 8	MCID, MIPE, MEDU, Romanian Academy, RDAs, other R&I managing authorities	Medium priority Medium term
Res ourc	Secure sufficient human and financial resources for further development and maintenance of the central monitoring platform, including budgets	Step 2, Step 9	MCID	High priority Short term

	for full time experienced M&E Specialist, IT Expert, Outreach Specialist, and Data Manager			
	Provide regular relevant M&E training to staff from M&E units, and focal M&E points	Step 2	MCID	Medium priority Short term
	Allocate relevant human and financial resources to implement improved monitoring practices	All steps	MCID, MIPE, MEDU, Romanian Academy, RDAs, UEFISCDI, other R&I implementers	Medium priority Medium term

Governance: Strengthen the coordination of all managing authorities and implementing bodies of R&I policies on monitoring

The implementation of an improved and centralized monitoring framework of the R&I system requires the strong and close coordination of all R&I implementers. In the short-term, this includes a clarification of roles and responsibilities of monitoring at the strategic level for the Inter-ministerial Committee, MCID departments and all R&I implementers.

- **Assign clear monitoring roles and responsibilities to the Committee for Science, Technology and Innovation and its secretariat, and in the future to the R&I Observatory**

The approved Committee for Science, Technology and Innovation represents a key opportunity for greater coordination and exchange of information between R&I implementers. Overall, the operationality of this Committee could benefit from a clarification of its expected outputs in terms of updating the monitoring of the R&I system at the strategic level and in terms of using monitoring results in decision-making. The Committee can support setting up mechanisms of enforcement for data generation, dissemination and aggregation to ease the implementation of the centralized monitoring platform, thereby clarifying information gaps and remaining inconsistencies at the strategic level. The proposed structure for the monitoring framework of R&I policies provided in Appendix 8 can facilitate this process of information centralization and gaps assessment. The Committee can serve as a platform of consultation for collecting feedback on the needs of additional information of R&I implementers, the clarity and ease of reporting to the strategic level, and of accessing and interacting with monitoring data that will be provided in the central monitoring platform. Currently, the DPSCDITT under MCID leads responsibilities over the design, implementation, and update of monitoring at the strategic level. However, plans to promote further harmonization of monitoring processes beyond the common indicators of the SNCISI remain uncertain. The Committee could endorse this role. The Committee should be responsible for reviewing the monitoring results at the strategic level and taking concerted action accordingly. This entity will also play a key role in guiding the development of an R&I Observatory, with support from the World Bank. Once in place, the analytical reports of the R&I Observatory will be used as inputs for decision-making by the Committee and other decision-makers within the national R&I system.

- **Determine the monitoring responsibilities at the MCID, create a centralized M&E unit with necessary staff (M&E, outreach, IT, and data specialists), create an inter-departmental M&E group, and assign focal points for M&E in other units.**

The recent reorganization of MCID is an opportunity for greater inter-departmental coordination within the Ministry. However, it also requires clarifying the attribution of previous and potentially new responsibilities for monitoring the R&I system, in line with the ambition of the SNCISI. At the strategic level, the centralized M&E unit needs to be supported by the necessary staff. They include, at the very minimum, four key roles: M&E specialists, an IT expert, an outreach specialist, and a data manager (whereas institutions implementing R&I programs should employ, at the very least, an M&E specialist and a data manager). Moreover, program departments should assign an M&E focal point. These focal points act as liaisons between the central unit and specific departments or teams, facilitating the collection and dissemination of relevant data. Furthermore, establishing an interdepartmental M&E coordination group that convenes regularly can significantly enhance the effectiveness of M&E efforts. This group brings together focal points and the M&E unit, ensuring harmonization, fostering collaboration, encouraging sharing of insights, and ensuring alignment with overall objectives.

- **Provide DPSCDITT with clear authority on leading the implementation of a centralized monitoring framework at the strategic level and possibly later to the R&I Observatory**

To be effectively fulfilled, the roles and responsibilities described in the first summary recommendation can benefit from a stronger endorsement by higher political levels. Transitioning towards a centralized monitoring framework requires additional time and sharing of information from all R&I implementers to reduce future reporting burdens. The reporting responsibilities of all R&I implementers at the strategic level need to be clear and time-bound during this transition period. The division's work would be facilitated by identifying focal points at each policy level responsible for information sharing using the proposed structure for the monitoring framework of R&I policies provided in Appendix 8. In the future, the R&I Observatory may take over this role. The R&I Observatory is expected to play a central role in centralizing information between all R&I monitoring units to ensure complementarity and strengthen the functionality and effectiveness of intermediary institutions.

- **Promote and facilitate information exchange on the performance of R&I policies across and within managing authorities and implementing bodies**

Information exchange may be facilitated by the Committee for Science, Technology and Innovation, provided there are clear monitoring roles and responsibilities, as well as by the future centralized monitoring platform and R&I Observatory. As such, the effective implementation of the DPSCDITT platform is key to attaining this objective. Information exchange across the divisions of MCID should be promoted through structured and regular consultations on monitoring R&I policies and the ecosystem. The scope of the centralized monitoring platform could be expanded to a communication and management tool within the Ministry.

- **Make policy makers accountable for rapid and relevant policy action based on monitoring results**

Improved monitoring alone cannot lead to larger policy impacts for the R&I system. Monitoring results should be used at all relevant policy levels to inform decision-making at all steps of instruments and policy implementation. Monitoring staff should facilitate preparing and disseminating clear and actionable results, highlighting their policy implications. As a result, decision-makers should commit to taking quick action based on this information. The rationale for instruments and policy adjustments and instruments and policy design should be documented—and clearly grounded in past and present monitoring results—to be shared with the public. A cycle of accountability needs to be set up from the instrument to the strategic level, from producing rigorous and actionable monitoring results to policy design and implementation changes, with clear implications for deviating from these roles and

responsibilities. Within an institution, monitoring staff is responsible for timely reporting on the monitoring results directly to policy makers. Policy makers are then responsible for making decisions based on these results. The implementation unit is then responsible for implementing these adjustments. Outside the institution, monitoring results (for example, dashboards and reports) must be made public to strengthen policy makers' accountability towards citizens. Granting public access to the future centralized monitoring platform or public sharing of information through the future R&I Observatory is crucial to improve transparency.

Comparability: Accelerate and deepen the process of harmonization of the monitoring of the R&I system

Monitoring at the strategic level requires consistent indicators collected across programs and projects. Although several steps have been taken in this direction, there is room to accelerate the existing initiatives and expand their scope.

- **Reach agreement on a common monitoring framework for R&I policies**

The proposed structure for a centralized monitoring framework provided in Appendix 8 guides reporting at the strategic level. In the future, a similar structure may be adopted to monitor every R&I policy. Meanwhile, feedback on the structure's clarity, completeness, and relevance should be collected to agree on the need for information. One approach would be to pilot the structure with one program manager per funding source for a limited period.

- **Accompany the SNCISI common indicators with clear definitions and guidance on how to measure them**

To ensure a consistent measurement of the common indicators, each indicator needs to be accompanied by an indicator reference sheet (Table 1 provides an example) and a clear list of definitions of terms. To be comparable, monitoring staff from different R&I programs should follow similar data collection procedures (including, when relevant, selecting respondents), verification, and aggregation to produce the SNCISI common indicators. The DPSCDITT (and later the R&I Observatory) should contribute to setting standards by developing guidelines to be adhered to by all program managers from the lowest level of implementation. This information needs to be centralized in an operational manual describing in detail all monitoring processes of the SNCISI.

- **Assess current differences in indicators measurement and information gaps using the proposed structure for a common monitoring framework, and promote harmonization rules of R&I indicators and measurements**

The monitoring of the R&I system would benefit from harmonizing its indicators beyond a unified measurement of the common monitoring indicators for Romanian R&I programs of the SNCISI. The structure of the centralized monitoring framework, elaborated by the DPSCDITT and to which this report made additions (see Appendix 8), can assist this process. To ease the transition from the existing to an improved framework, the proposed structure can first be filled from pre-existing documentation by the DPSCDITT, which can reach out to the respective responsible agents to fill information gaps. Along this process, DPSCDITT can assess the current extent of comparability of indicators definition and measurement within groups of indicators with a similar intent. Proposing harmonization rules of R&I indicators and their measurement should be a natural extension of assessing the comparability of existing indicators. Propositions should acknowledge external constraints by seeking alignment with

indicators required by the EC whenever relevant. This exercise can guide the definition of common output indicators (based on the ToCs leading to and overall ToC), which are currently missing from the SNCISI.

- **Promote the coherence of monitoring procedures and management information systems of funds managed by MCID**

In promoting greater coherence on the monitoring of R&I policies, MCID should seek opportunities to promote the harmonization of monitoring procedures and management information systems of PNCDI IV programs. For instance, MCID may seek to expand the scope of EVoC or the planned centralized platform to encompass a larger share (if not all) of these programs.

- **Promote a clear and harmonized documentation of monitoring processes across R&I policies**

Clear documentation of planned and actual monitoring processes of every R&I policy would contribute to greater transparency of policy monitoring and implementation. This documentation should include common elements, covering the key aspects highlighted in this report. This includes a policy's ToC, a list of indicators together with accompanying information—for instance, in the form of indicator reference sheets, a monitoring framework listing key needs of information (adopting a common format upon its agreement), information on responsibilities and roles (governance), on the management of information, on data sources and collection, data quality, data analysis and use, plans for evaluation, reporting, and dissemination as well as for learning and take rapid action on monitoring results. This documentation should include clear procedures to make monitoring staff, decision-makers, and implementation units accountable for fulfilling these roles and responsibilities. The checklists provided in this report for steps 1 to 12 should be used to assess the completeness of this documentation. Various tools are presented throughout this report to support implementing those steps, including a list of questions that monitoring should seek to answer (Step 1), the job descriptions of central monitoring staff (Step 2), examples of ToCs applied to two R&I policies (Step 3), a template for an indicator reference sheet (Step 4), a template for the structure of the monitoring framework with pre-defined options and examples (Appendix 8, Steps 5 and 6), an assessment of various modes of primary data collection (Appendix 8, Step 7), an assessment of key secondary data that could be used for monitoring (Appendix 9, Step 7), examples of indicator disaggregation for data analysis (Step 8), a comprehensive quality check-list for designing and implementing a new monitoring platform (Appendix 11, Step 9), and a list of crucial reading references on monitoring (Section III) and evaluation, including rigorous impact evaluations (Step 10). A common structure and format could be adopted across funding sources and programs to ease the comparison and localization of relevant information.

Learning: Enhance the use of monitoring data in R&I policy decision-making

Improving R&I policy effectiveness can only be achieved with improved monitoring and a commitment to use this information at every stage of policy implementation. There is a need for a culture change in which there are clear and explicit links between a policy's indicators and the different steps of its intervention logic (ToC) and how these indicators contribute to higher-level objectives (from the policy instrument to the program level, from the program level to the funding source, and from the funding source to the SNCISI).

- **Articulate a ToC at each policy level to assess the relevance and completeness of existing indicators**

A ToC should be the starting point of every monitoring framework. By eliciting strategic steps and assumptions in a policy's intervention logic, a ToC helps to identify a concise set of indicators relevant to track a policy's progress and to understand its performance. In the present monitoring of R&I policies, indicators were not derived from a ToC. Nevertheless, a ToC is a powerful tool to verify whether the selected indicators effectively capture the key steps of the policy's intervention. To the extent possible, indicators weakly linked to a policy's intervention should be foregone, whereas indicators should be added on key steps and assumptions that are not currently captured. Furthermore, creating a ToC allows policy makers to identify potential gaps or areas of improvement. Examples of ToCs applied to Romanian R&I policies are provided in Step 3. Program teams should meet at least twice a year to review their ToCs (also based on monitoring data), validate assumptions, and adjust policies where needed.

- **Clearly align program and instrument indicators with the SNCISI-specific objectives**

The above exercise would help clarify the different steps through which every policy instrument contributes to Vision 2030, resulting in the elaboration of a ToC of R&I policies at the strategic level. Linking existing indicators to the SNCISI-specific objectives would support understanding how these objectives were or were not achieved.[52]

- **Clarify the analysis plan for monitoring data at the strategic level**

The SNCISI would benefit from a detailed analysis plan for monitoring data at the strategic level. The projection of this work can support the identification of additional features of the centralized monitoring platform. By clearly communicating the value added of analyses at the strategic level, DPSCDITT may gain additional buy-in from R&I implementers, facilitating information sharing and promoting platform use.

- **Use these ToCs to identify risks to policies' effectiveness, as well as synergies and complementarities between existing instruments**

By bringing together the ToCs of lower policy levels, the SNCISI's ToC would provide a clear and coherent overview of the expected respective contribution of each R&I instrument and policy to the government's end goals. This overview will unravel existing threats to instruments and policies' effectiveness by eliciting the key assumptions behind policies' intervention logic. Monitoring the realization of these risks will enable decision-makers to adjust the planned activities in a timely manner. ToCs will also ease the identification of synergies and complementary between the R&I instruments. This process should inform the monitoring of R&I policies at the strategic level by assessing the extent to which these synergies and complementarities have been realized. Complementary instruments should be closely monitored together because challenges in one of these instruments' implementation will directly affect the ability of other instruments to achieve their objectives.

- **Include a detailed analysis and learning (action) plan of the monitoring data within the regulatory framework of each R&I policy**

In the medium term, R&I managing authorities should further commit to learning and taking action on the results from monitoring by adding a detailed analysis and learning (action) plan of the monitoring data within the programs' regulatory framework. The learning plan should include the above-mentioned procedures to make monitoring staff, decision-makers, and implementation units accountable for fulfilling these roles and responsibilities. The analysis and learning plans should clearly reflect how monitoring data will be used to meet the monitoring's key learning objectives, answering the key guiding questions provided in Step 1.

[52] This does not prevent R&I implementers from defining additional monitoring indicators to ensure good quality monitoring at lower policy levels.

Resources: Allocate sufficient human and financial resources for transitioning to an integrating monitoring framework

Implementing the SNCISI's envisioned monitoring plans and the best practices promoted by the present report calls for adequate investment in human and financial resources.

- **Secure sufficient human and financial resources for further development and maintenance of the central monitoring platform, including budgets for full-time, experienced M&E specialists, IT experts, outreach specialists, and data managers.**

Sufficient resources should be secured to guarantee the further development and maintenance of the platform after the end of the project through which the MCID is developing the platform. This includes the consideration of a minimum of four additional internal full-time positions: an outreach specialist, dedicated to the promotion of the platform; an IT expert, for platform development, maintenance and user support; a data manager to oversee data; and an M&E specialist, responsible for data analysis and reporting at the strategic level. This may also involve resources to guarantee the provision of high quality data to the strategic level from lower levels. Step 2 includes a job description of these key monitoring roles.

- **Provide regular, relevant M&E training to staff from M&E units and focal M&E points.**

Monitoring staff should receive relevant training opportunities to improve their knowledge of best practices. Four key training areas were identified: (i) developing an instrument's or a policy's ToC and using this tool to define monitoring indicators; (ii) the use of representative surveys in monitoring and their implementation; (iii) data analysis; and (iv) effective communication on lessons learned to foster evidence uptake in decision-making. Training documentation and recordings could be stored and shared with new staff for better knowledge retention. This report links the recording and material of workshops held by the World Bank to Romanian R&I decision-makers and monitoring staff (see Introduction).

- **Allocate relevant human and financial resources to implement improved monitoring practices**

Policy design needs to be accompanied by adequate planning of the human and financial resources needed to monitor its progress. The use of digital tools should be promoted to reduce time-intensive manual tasks and the likelihood of errors. One approach would be to expand the coverage of the existing monitoring platforms or the centralized monitoring platform to cover monitoring functions not yet available to some R&I implementers.

Next steps

Although the 12 Steps proposed in this report provide structured guidance to set up effective monitoring systems, it is merely the starting point. Developing a thorough monitoring system requires ongoing commitment and active implementation of the framework. It involves timely data collection, regular analyses, interpretation of results, and timely adjustments on the way. Under the technical assistance provided to MCID, the World Bank will continue to provide advice to the client in its implementation of a monitoring framework and other activities on monitoring and evaluation, potentially including:

- **Support the establishment of an R&I Observatory**: considering the Romanian context, the Bank will provide recommendations based on international good practices to inform Romania's establishment of an R&I Observatory, including aspects related to design, operations, and evaluation, estimated resources, and key service lines or analytical product lines. A report outlining the options for an R&I Observatory is expected to be ready in summer 2024.
- **Support the creation of ToCs for R&I policies:** the World Bank can support the establishment of comprehensive roadmaps outlining the intended outcomes, activities, and underlying assumptions of selected R&I programs and policy instruments. We can also train partners in applying and running ToC workshops to develop roadmaps in the future.
- **Support the establishment of monitoring frameworks based on ToCs for selected programs:** this can include, for example, support to defining learning needs, defining indicators, establishing data flow, and creating templates for reports. The selected programs could be used to pilot the structure of the monitoring framework proposed in this report.
- **Conduct two impact evaluations of R&I investments:** the WB will conduct rigorous impact evaluation of two MCID programs, as well as support the set up of other impact evaluations through capacity building and advise. The results are expected to be available in 2026.
- **Virtual capacity building sessions for the M&E community of practice**: these sessions will focus on monitoring and evaluation methodologies and techniques and are intended for M&E practitioners from Romania. The workshops will feature expert speakers from the World Bank and invited guests. The first workshop, held in June 2023, delved into the topic of *Integrated data systems*. The upcoming workshops will cover a range of valuable subjects (for example, the experiences of setting up monitoring frameworks in other EU countries, insights into the pivotal role R&I Observatories can play in ecosystems, effective use of surveys to collect primary data, and real-life examples of rigorous impact evaluations of innovation support programs). We will also run a short survey to understand practitioners' learning needs to adjust the series' content.
- **Online M&E walk-in clinic:** every month, a dedicated 1.5-hour slot will be available for line ministries, RIS3 coordinators and program managers to seek guidance and support from The Bank's team of seasoned M&E experts. This walk-in clinic will provide an opportunity for providing guidance on real-time problem-solving, data interpretation, and capacity building.

References

Bjärkefur, K., de Andrade, L. C., Daniels, B., & Jones, M. R. 2021. Development research in practice: The DIME analytics data handbook. World Bank.

Blažek, J., & Vozáb, J. 2006. Ex-ante evaluation in the new member states: The case of the Czech Republic.". *Regional Studies*, *40*(02), 237-248.

de Jong, S. P., &Muhonen, R. 2020. Who benefits from ex ante societal impact evaluation in the European funding arena ? A cross-country comparison of societal impact capacity in the social sciences and humanities. *Research Evaluation*, *29*(01), 22-33.

EC (European Commission). 2021a. *Open Data Best Practices in Europe : Estonia, Slovenia & Ukraine—Three countries showing high growth in maturity score according to the Open Data Maturity assessment 2021.*

EC (European Commission). 2021b. 'Better Regulation' toolbox 2021 – November 2021 edition.

EC (European Commission). 2022a. *European Innovation Scoreboard 2022—Romania Country Profile*. Luxembourg: Publications Office of the European Union. https://ec.europa.eu/assets/rtd/eis/2022/ec_rtd_eis-country-profile-ro.pdf.

EC (European Commission). 2022b. *Country review of the Romanian research and innovation system: Final report : PSF country.* Publications Office. https://data.europa.eu/doi/10.2777/28266

EC (European Commission). Directorate General for Research and Innovation. 2022c. *Study to support the monitoring and evaluation of the framework programme for research and innovation along key impact pathways : Indicator methodology and metadata handbook.*

EC (European Commission). Directorate General for Research and Innovation. 2022d. *Study to support the monitoring and evaluation of the Framework Programme for research and innovation along Key Impact Pathways. Operationalisation plan for IT systems.*

Gertler, P. J., Martinez, S., Premand, P., Rawlings, L. B., & Vermeersch, C. M. 2016. Impact evaluation in practice. World Bank Publications.

Goergens, M., & Kusek, J. Z. 2009. Making Monitoring and Evaluation Systems Work: A Capacity Development Tool Kit. World Bank.

Gugerty, M. K., & Karlan, D. 2018. *The Goldilocks challenge : Right-fit evidence for the social sector*. Oxford University Press.

Han, X., Parker, C., Rogger, D., & Schuster, C. 2021. *The Impacts of Survey Mode in Public Administration: Evidence from a Randomized Control Trial*.

Innovations for Poverty Action. 2016. *Guiding Your Program to Build a Theory of Change*.

Kusek, J. Z., & Rist, R. C. 2004. Ten steps to a results-based monitoring and evaluation system: A handbook for development practitioners. World Bank.

OECD. 2020. Chapter 1. Towards a systemic approach to policy evaluation. In Improving Governance with Policy Evaluation : Lessons From Country Experiences.

REFERENCES

USAID. 2016. *Performance Indicator Reference Sheet (PIRS) Guidance & Template*. https://usaidlearninglab.org/resources/recommended-performance-indicator-reference-sheet

USAID. 2013. Monitoring and Evaluation Platforms Considerations for Design and Implementation Based on a Survey of Current Practices. Discussion Note

Vaessen, J., Lemire, S., & Befani, B. 2020. Evaluation of International Development Interventions : An Overview of Approaches and Methods. Independent Evaluation Group. World Bank.

World Bank. 2018. *Component D: Strategy Unit Monitoring Guide*.

World Bank. 2021a. *A complementary M&E Framework for EU Smart Specialisation Strategies. Case studies in Poland Pomorskie and Romania North-East.*

World Bank. 2021b. *Advisory Services Agreement on Improving Monitoring and Evaluation Capacity in the Context of EU-funded Programs in Romania (2021–2027). Report on institutional, procedural, and legislative assessment, Output 1b.*

World Bank. 2022. “Consultations: Romania Systematic Country Diagnostic Update 2023.” Brief. World Bank. December 9, 2022. https://www.worldbank.org/en/country/romania/brief/consultations-romania-systematic-country-diagnostic-update-2023.

World Bank. 2023. *Romanian Research and Innovation Policy Effectiveness Review*.

Appendix 1. SNCISI 2022–2027 funding sources

Funding sources (2022–27)	Managing Authority	Implementor(s) / Intermediate Body	Planned allocations (Euro)
NATIONAL R&D FUNDS			
PNCDI IV	MCID	MCID 's implementation units	12,000 million
		UEFISCDI	
		Institute of Atomic Physics	
		Romanian Space Agency	
R&D Programs of the Romanian Academy	Romanian Academy	Romanian Academy	400 million
R&D Programs of the Academy of Romanian Scientists	Academy of Romanian Scientists	Academy of Romanian Scientists	12 million
Budgetary lines for R&D in universities	MEDU	MEDU & UEFISCDI	120 million
R&D Plans of other ministries	MARD	MARD & Academy of Agricultural and Forestry Sciences	
	MH	MH & Academy of Medical Sciences	
	Other ministries with sectoral R&D Plans		
EUROPEAN STRUCTURAL AND INVESTMENT FUNDS			
PCIDIF	MIPE	MCID—Intermediate Body for PCIDIF, Priority 1 (RDI), Priority 2 (RDI in the ICT sector)	1,000 million
Health Program		MCID—Intermediate Body for PS, Priority 5 (Medical Research)	386 million
Education and Employment Program		MEDU—Intermediate Body for PEO, Priority 7 (Education and Training)	40 million
Just Transition Program		RDAs in selected regions, Priority 1-6 (Entrepreneurship support)	200 million
Regional OPs	RDAs	RDAs—Priority 1 (Competitive regions through innovation, digitalization and dynamic enterprises)	2,200 million
NATIONAL RECOVERY AND RESILIENCE PLAN			
Component 9: Support for the private sector and RDI	MIPE	MCID—PSF unit and RRP Direction	259 million
TOTAL			16,617 million

Source: World Bank compilation, based on Annex 2 of SNCISI.

Appendix 2. Key documentation on the regulatory framework for monitoring R&I funds

Strategic level	Gov Ordinance 57/2002 on scientific research and technological development (Research Law) Gov Decision 933/2022 for the approval of the National Strategy for Research, Innovation and Smart Specialization 2022–2027 Gov Decision 379/2022 for the approval of the methodology for design, implementation, monitoring, evaluation and updating of government strategies Gov Decision 427/2022 for the approval of the methodology for design, monitoring, reporting, and revision of Institutional Strategic Plans, including the methodology of the institutional strategic plans Min Order 458/2019 for the establishment of the Committee for Coordination of Smart Specialization (modified by Min Order 648/2018)
PNCDI IV (including Nucleu)	Gov Decision no 1265/2004 for the approval of methodological norms regarding the evaluation, contracting, financing and monitoring of programs, RDI projects and actions included in the National RDI Plan Gov Decision 1188/2022 for the approval of the National Plan for Research, Development and Innovation 2022–2027 Gov Decision no. 1405/2022 for the approval of methodological norms regarding the evaluation, contracting, financing and monitoring of Nucleu research-development programs Procedure for reporting and monitoring of projects financed through the National RDI Plan (UEFISCDI)
R&D Programs of the Romanian Academy and of branch academies	Law 752/2001 on the organization of the Romanian Academy; status of the Romanian Academy; regulation on the organization and functioning of the Romanian Academy Law 45/2009 on the organization and functioning of the Academy of Agricultural and Forestry Sciences; status of the Academy of Agricultural and Forestry Sciences Law 264/2004 on the organization and functioning of the Academy of Medical Sciences Law 31/2007 on the reorganization and functioning of the Academy of Romanian Scientists
Budgetary lines for R&D in universities	Min Order no. 3721/ 2023 for the approval of the methodology regarding the financing of university scientific research within state higher education institutions in 2023
R&D Plans of other ministries	Gov Decision no 1265/2004—Methodological norms regarding the evaluation, contracting, financing and monitoring of programs, RDI projects and actions included in sectoral RDI Plans
PCIDIF	Regulation (EU) 2021/1060—Common provisions for ESIF Regulation (EU) 2021/1058—ERDF and Cohesion Fund Regulation Regulation (EU) 2021/1057—European Social Fund Plus Regulation
Health Program	
Education and Employment Program	

APPENDIX 2

Just Transition Program	Partnership Agreement on European funds for the 2021–27 programming period between Romania and the European Commission (Operational) Programs with RDI components PCIDIF Health Program Education and Employment Program Just Transition Program Regional OPs
Regional OPs	
Component 9: Support for the private sector and RDI	Gov Ordinance 124/2021 for the establishment of the institutional and financial framework for the management of European funds allocated to Romania through the Recovery and Resilience Mechanism

Appendix 3. List of institutions met for bilateral stakeholders consultations

Institution	Unit
RDA North East	M&E Unit
RDA South East	Evaluation Unit
UEFISCDI	IT Department
MCID	NRRP Monitoring Unit
MCID	Direction RDI Policies and Strategy, Innovation and Technological Transfer

Appendix 4. List of institutions that attended World Bank M&E workshops

Institution	Unit
Workshop on Monitoring and Evaluation to Support Evidence-Based Decision-Making (March 6–7, 2023)	
Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI)	Policy center service for higher education, science, innovation and entrepreneurship
Ministry of European Investments and Projects (MIPE)	Evaluation Unit
Ministry of Education (MEDU)	Department of Public Policies
Ministry of Education (MEDU)	Directorate General for International Relations and European Affairs
Ministry of Education (MEDU)	The Minister's Cabinet
Ministry of Finance (MoF)	General Directorate Budget Programming
Ministry of Finance (MoF)	Spending Review Unit
Ministry of Research, Innovation and Digitalization (MCID)	Directorate of Policies and Strategies for RDI and Technological Transfer
Ministry of Research, Innovation and Digitalization (MCID)	Directorate for International & European Relations
Ministry of Research, Innovation and Digitalization (MCID)	Directorate-General for Management and Coordination of the NRRP (DGGCPNRR)—Monitoring Unit
Ministry of Research, Innovation and Digitalization (MCID)	Policy Support Facility Implementation Unit (PSF unit)
Ministry of Research, Innovation and Digitalization (MCID)	Financial Management Service
National Centre for Policy and Evaluation in Education CNPEE	Unit of Research in Education
Prime Minister's Chancellery	Department for Social Responsibility and Vulnerable Groups
Regional Development Agency Center	Regional Operational Program 2014–2020, Monitoring and Help Desk Service
Regional Development Agency Center	Program Management Department
Regional Development Agency North-East	Programming, Monitoring and Evaluation Unit
Regional Development Agency North-East	Regional Programming Unit
Regional Development Agency South-East	Regional Planning, Programming and Monitoring Office
Regional Development Agency South-West Oltenia	Regional Operational Program, Monitoring Department
Workshop on Recommendations for the Monitoring of the Research and Innovation System (May 11, 2023)	
Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI)	Policy Center Service for Higher Education, Science, Innovation and Entrepreneurship

APPENDIX 4

Alexandru Ioan Cuza University of Iași	Faculty of Physics
Ministry of Education (MEDU)	General Direction of Early Education, Primary Education (DGETIPG)
Ministry of European Investments and Projects (MIPE)	Evaluation Unit
Ministry of Research, Innovation and Digitalization (MCID)	Directorate of Policies and Strategies for RDI and Technological Transfer (DPSCDITT)
Ministry of Research, Innovation and Digitalization (MCID)	Directorate for International & European Relations
Ministry of Research, Innovation and Digitalization (MCID)	Policy Support Facility Implementation Unit (PSF unit)
Ministry of Research, Innovation and Digitalization (MCID)	Directorate-General for Management and Coordination of the NRRP (DGGCPNRR)
Ministry of Research, Innovation and Digitalization (MCID)	Department of European Programs, International Relations and Protocol
Regional Development Agency Bucharest-Ilfov	Programming, Planning, Monitoring and Portfolio Department
Regional Development Agency Center	Regional Operational Program 2014–2020, Monitoring and Help Desk Service
Regional Development Agency Center	Regional Policy Department—Strategy Planning and Development Service
Regional Development Agency North-East	Programming, Monitoring and Evaluation Unit
Regional Development Agency North-East	Regional Programming Unit
Regional Development Agency North-East	RIS3 Management Office
Regional Development Agency South-East	Regional Planning, Programming and Monitoring Office
Regional Development Agency South-West Oltenia	Regional Operational Program, Monitoring Department
The Romanian Academy	Institute of Philosophy and Psychology
The Romanian Academy	Institute of Biology
The Romanian Academy	Ştefan S. Nicolau Institute of Virology
The Romanian Academy	Institute of Cellular Biology and Pathology N. Simionescu
The Romanian Academy	Institute for Biochemistry
The Romanian Academy	Institute of Art History “G. Oprescu”
The Romanian Academy	Institute of Romanian Philology—Lași Branch
The Romanian Academy	Section of Mathematical Sciences
The Romanian Academy	Department of Historical Sciences and Archaeology
The Romanian Academy	Petru Poni Institute of Macromolecular Chemistry
The Romanian Academy	Research and Doctoral Projects Office

Appendix 5. World Bank M&E survey questionnaire

World Bank Romania M&E Survey

We would like to ask to shortly share your experiences with and knowledge of monitoring and evaluation. This survey is conducted on behalf of the World Bank Romania. You are invited to participate in the survey if you design, overview the implementation, and/or need to account for the results of policy implementation in Romania. The results of the survey will be used to develop tailored monitoring and evaluation support and material by the World Bank. All information and opinions you provide will be anonymized. Participation is voluntary. You can stop the participation at any time. If you have any questions or concerns regarding this survey, please contact Łukasz Marć (Senior Economist and Team Task Leader), at lmarc@worldbank.org. The whole survey takes 5-7 minutes of your time.

Do you consent to participate in the survey?

◯ Yes

◯ No

1. We would like to start with few questions about your background. Which best describes your experience? [Please, select ONE answer that applies]

◯ I design governmental programs

◯ I report on the progress of program implementation

◯ I need to identify bottle-necks in program implementation and address them

◯ I need to report on the impacts of programs

◯ None of the above

2. Please indicate whether the following sentence is true or false: I have received specific training on how to design good monitoring and evaluation systems

◯ True

◯ False

3. How many years of experience with monitoring and evaluation of governmental programs do you have?

4. In your experience, did you ever systematically compare the results of a program you implemented to a comparison (control) group? By systematically we mean that you acquired survey responses or administrative information on a control group to benchmark the impacts of your program.

◯ Yes

◯ No

5. In your experience, did you ever collect data on the baseline values (i.e., desired outcomes prior to the program implementation) of key indicators to track the progress of a program?

◯ Yes

◯ No

6. In your experience, have results from monitoring or evaluation ever informed policymaking such that it led to the re-design of a program design and/or an implementation approach?

◯ Yes

◯ No

◯ I don't know

7. In your experience, what has been the primary purpose of monitoring a government program? [Please, select ONE answer that applies]

◯ To track progress of program implementation

◯ To identify problems and make changes

◯ To report to regional, national, or EU bodies

◯ Other (please specify)

8. In your view, what is the difference between program outputs and outcomes?

◯ Outputs refer to activities, outcomes refer to results

◯ Outputs refer to results, outcomes refer to activities

◯ Outputs and outcomes are the same thing

9. In your work, what is the main role of data in monitoring and evaluating government programs? [Please, select ONE answer that applies]

◯ To inform decision-making and program improvements

◯ To demonstrate accountability (reporting) to stakeholders

◯ To allocate future funding for the program

◯ It is required

◯ Other (please specify)

10. Why is it important to be transparent in reporting the results of government program monitoring and evaluations? [Please, select ALL answers that apply]

☐ To build trust with stakeholders

☐ To identify areas for improvement and make changes

☐ To demonstrate accountability (reporting) for the use of public resources

☐ Other (please specify)

11. How familiar are you with developing a logical framework or a theory of change of a program?

◯ Very familiar

◯ Somewhat familiar

◯ Not very familiar

◯ Not at all familiar

12. How familiar are you with setting up monitoring systems for your programs?

◯ Very familiar

◯ Somewhat familiar

◯ Not very familiar

◯ Not at all familiar

13. What methods do you use to monitor the implementation of your programs? [Please, select ALL answers that apply]

☐ Surveys and data collection

☐ Site visits and observations with program staff

☐ Site visits and observations with beneficiaries

☐ Reports and feedback from stakeholders

☐ External sources

☐ Other (please specify)

14. In your work, when do you start designing the program evaluation? [Please, select ONE answer that best applies]

◯ Before the program is rolled out

◯ When the program is being implemented

◯ After the program has been implemented

15. How often do you review the data collected from monitoring systems of ongoing governmental programs? [Please, select ONE answer that best applies]

◯ Monthly

◯ Quarterly

◯ Annually

◯ Rarely

16. How do you usually review the monitoring information of ongoing programs? [Please, select ALL answers that apply]

☐ In excel/csv sheets

☐ Via a dashboard

☐ I receive a report with key information

☐ I don't / This is not my role

☐ Other (please specify)

17. How do you ensure that your monitoring systems are collecting accurate and complete data? [Please, select ALL answers that apply]

☐ Through regular data quality checks

☐ By involving stakeholders in the data collection process

☐ By using standardized data collection methods and tools

☐ I don't / This is not part of my responsibilities

☐ Other (please specify)

18. What methods do you use to finally assess the success of your implemented program? [Please,select ALL answers that apply]

☐ Surveys and data collection

☐ Site visits and observations with program staff

☐ Site visits and observations with beneficiaries

☐ Reports and feedback from stakeholders

☐ Comparison of outcomes to a control group that did not receive the program

☐ Other (please specify)

19. How do you know that your program is targeting the target group that has the highest needs? [Please, select ALL answers that apply]

☐ I conduct a baseline/ eligibility assessment or use administrative data to identify the individuals in need

☐ I follow the instructions of the legal framework for the program

☐ I consult key stakeholders

☐ This is not part of my responsibilities

☐ I am not sure

☐ Other (please specify)

20. How do you ensure that results of your program evaluations are credible, rigorous, and reliable? [Please, select ALL answers that apply]

☐ By involving stakeholders in the evaluation process

☐ By using well-established evaluation methods

☐ By having independent evaluators conduct the evaluation

☐ I don't / This is not part of my responsibilities

☐ Other (please specify)

21. In your experience, how effective are current monitoring systems in tracking the progress of your programs?

◯ Very effective

◯ Somewhat effective

◯ Not very effective

◯ Not at all effective

22. In your experience, how credible are results of impact evaluations assessing the impact of programs at your agency?

◯ Very credible

◯ Somewhat credible

◯ Not very credible

◯ Not at all credible

23. Which of the following are key challenges that you face in your monitoring and evaluation-related work? [Please, select ALL answers that apply]

☐ Unclear links between the program activities and the monitoring and evaluation indicators

☐ Indicators are vaguely defined or incomplete

☐ Too many indicators to report on

☐ Lack of indicators for the program's goals

☐ Lack of relevant and timely data to assess progress of implementation Lack of knowledge on how to monitor programs

☐ Lack of knowledge on how to evaluate programs

☐ Lack of knowledge on how to visualize and process data from monitoring

☐ Other (please specify)

24. Among the following topics, which are the ones on which you would like to receive more training on? [Please, select ALL answers that apply]

☐ Set up of logical framework or theory of change

☐ Development and choice of relevant indicators

☐ Set up of monitoring information systems

☐ Set up of impact evaluations (credibly assessing the impacts of programs)

☐ Data collection for monitoring and evaluation purposes (process, quality controls, sampling)

☐ Data visualization and processing

☐ Data interpretation

☐ Strategies to use monitoring and evaluation data in decision-making Identification of relevant global evidence

☐ Other (please specify)

25. Please feel free to shortly describe your further needs. To better illustrate your needs, you can mention specific reforms these needs most urgently apply to.

Appendix 6. Functional analysis questions

The functional analysis is an in-depth assessment of the design, implementation, and governance of specific policy instruments. It is a component of the Public Expenditure Review for Science, Technology, and Innovation (PER STI) methodology, a results-based framework to logically link inputs, outputs, outcomes, and impacts of public spending on research and innovation.

The objective of the functional analysis is to assess the quality of the design, implementation, and governance (coordination among instruments) through semi-structured interviews with program managers to collect data on the instrument design, implementation, and inter-institutional integration. The questions covered during the interviews can be found in the table below.

I.	**Program Design** *(Note: we can get some of this information from the publicly available program documentation, and simply reconfirm quickly during the interview.)*
1.	Program Origin: Describe the origin of the program. (For example, who were the main supporters? When did it start? Is it based on previous programs?)
2.	Program Justification: What is the explicit justification and main reason to invest resources and offer this program?
3.	Relation of the program with other similar instruments in the pool of firm support programs
4.	Program objectives: What are the explicit objectives of the program?
5.	Logic Framework: Is a logical framework stated in the program?
6.	Inputs: What are the program inputs? Examples include financial and human resources, previous planning or diagnoses that laid out its rationale, and so on.
7.	Activities: What activities are explicitly mentioned? Examples include promotion, solicitations, training, and so on.
8.	Products: Describe the expected products mentioned in the previous section. Examples include lists of participants, approved projects, grant awards, sets of contacts of interested parties gleaned from the activities mentioned before, reports on activities, solicitation materials, and other such things produced by the activities mentioned above that do not constitute a result or outcome of the program.
9.	Audiences and main beneficiaries: Describe the audience, beneficiaries and other stakeholders considered in the design of the program
10.	Expected outputs and impact: What are the explicit expected outputs that are mentioned in the program documents?
11.	Monitoring and Evaluation: What monitoring and evaluation mechanisms were included as part of the program design?
I.	**Implementation**
Implementation experience: What have been the most recurrent issues during the program implementation? What has been done well? What are the main challenges? Has the learning experience been documented for future adoption?	
A.	*Program Implementation Mechanisms*
1.	Program call: If the program uses announcements and public calls, how are they launched (open to all public, periodic cycles, advertisement and promotion tools, and so on)?
2.	Program eligibility and selection process: Does the selection work well? What have been the main challenges and corrections of the process?
3.	Program application process: Could you describe the application process, requirements, and level of difficulty for the applicants?
4.	Instrument used: Has it been effective for the achievement of the program objectives? Were other instruments or adjustments considered to respond better to detected needs?

	5. Program management data and information: What mechanisms of data and information management are used?
	6. Finalizing program participation: What requirements do the participants have to complete to finalize their participation?
	7. Are there any conditions to end the program?
B.	*Effective Resources and Management Quality*
	8. Budget and financial resources: What is the total amount of the program, and what is the average budget per participant? Have these been sufficient to achieve the objectives?
	9. Program management quality: What have been the main challenges to maintain or improve the quality of program management? What is the management structure? Is there a management policy or manual that establishes things like management monitoring, management performance reviews and indicators, existence of process information systems, and so on?
	10. Program manager's autonomy: Do program managers have the autonomy to adjust aspects of program design and implementation?
	11. Staff, training, incentives: What aspects of human resource management have had the greatest effect on the implementation of the program? Is staff compensation adequate, and are there performance incentives?
C.	*Monitoring, Evaluation and Learning:* What monitoring and evaluation processes are in place? What has been learned through these processes? Have any impact evaluations been conducted?
I.	**Program and governance relationships**
	1. Relationships between programs: Does this program have explicit or implicit relationships with other programs in the same agency? If, yes, is there a coordination mechanism?
	2. Relationships between institutions: Does a formal relationship with other institutions exist? Does this relationship have any effect in this program? Are there any coordination mechanisms?'
	3. Relationships among different jurisdictions: Are there general regulations or other non-specific areas of science, technology, and innovation that affect the operation of the program (for example, audit, tax, environment)?

Appendix 7. Case study. Country-region cooperation on monitoring and evaluation processes: monitoring of Smart Specializations in Poland

Background

The aim of this annex is to translate Poland's longstanding experience in cooperation between regional and the central authorities following decentralization, as well as its nearly ten years of experience with the implementation of Smart Specializations, into practical recommendations that can be utilized by the Romanian monitoring system. Having been operational for an extended period, the monitoring of National Smart Specializations in Poland has undergone numerous evaluations, yielding a wealth of best practices that still await implementation. These evaluations include desk research analysis, qualitative field research analysis, an applied behavioural science approach, participatory evaluation, and benchmarking selected solutions and best practices applied in all Polish regions and in selected EU countries—Portugal, Italy, Hungary, Netherlands, and Sweden. The annex compiles key recommendations and identifies significant challenges related to country-region cooperation for effective monitoring processes in Poland.

The decentralization of Poland, resulting in its division into 16 Voivodeships, was a pivotal component of the administrative reforms implemented in 1999, conferring substantial autonomy upon the regions but also presenting significant challenges in terms of policy coordination.[1] Driven by the EU's principle of "subsidiarity," which advocates for decisions to be taken as closely as possible to citizens, the reform was initiated to foster regional development, enhance administrative efficiency, and improve government responsiveness to local needs. The decision also reflected Poland's ambition to join the EU and its understanding that creating larger administrative entities would enable more effective use of financial resources and greater competitiveness with other EU regions. Decentralization also provided a structural framework for implementing the EU's Cohesion Policy, which required strong regional autonomy in managing EU funds. However, a significant challenge arose in coordinating the central and regional levels, requiring the national authorities to take on a leading role.

The experience of 20 years of regional autonomy has been valuable for successfully implementing Smart Specializations, an EU strategic concept to focus public investments on RDI in areas with the greatest innovative and competitive potential. Smart Specialization, a part of the EU's reformed Cohesion Policy, requires regions to develop a RIS3 to receive funding from the European Regional Development Fund. Moreover, on the national level, Poland must demonstrate the fulfilment of the enabling condition of *good governance of national and regional smart specialization strategy* for Policy Objective 1: *Smarter Europe* by supporting innovative and smart economic transformation in the 2021–27 financial perspective. The condition includes (1) an up-to-date analysis of challenges for innovation diffusion and digitalization, (2) the existence of a competent regional/national institution or body responsible for the management of the Smart Specialization strategy, (3) monitoring and evaluation tools to measure performance towards the objectives of the strategy, (4) functioning of stakeholder co-operation (Entrepreneurial Discovery Process), (5) actions necessary to improve national or regional research and innovation systems, (6) actions

to support industrial transition, and (7) measures for enhancing cooperation with partners outside a given Member State in priority areas supported by the Smart Specialization strategy. The leveraging of Poland's two-decade-long regional autonomy and experienced governance structure thus becomes essential in meeting these conditions, ensuring the effective implementation of Smart Specializations and the subsequent realization of its innovative and economic potential.

Poland commenced Smart Specializations during the 2014–20 EU programming period, and they continue through the current phase. This extensive period allows for the development of robust coordination processes between the country and its regions, which are integral to Poland's broader economic growth and development strategy. Smart Specializations' management involves a multi-level governance structure, with key roles played by several bodies. Given its mandate to design and implement innovation policy, the Ministry of Economic Development and Technology has a coordinating role. The Marshal's Offices in each of the 16 Voivodeships are responsible for identifying regional specializations and developing and implementing the RIS3. This process involves extensive collaboration with stakeholders from academia, businesses, and other societal sectors, following the principle of the Entrepreneurial Discovery Process. On the national level, the Ministry of Economic Development and Technology collaborates with the Ministry of Education and Science and the Ministry of Development Funds and Regional Policy to form a Steering Committee. This committee manages the implementation process, oversees the achievement of expected results and objectives, and decides on potential changes to the list and descriptions of National Smart Specializations. The national and regional authorities form the Consultative Group. This group ensures consistency in public administrations' work at national and regional levels and provides recommendations for implementing and monitoring National Smart Specializations. With strategies subject to regular M&E, implementing the Smart Specializations concept in Poland is a dynamic and interactive process, and the rules of operation are subject to constant updating.

The recommendations drawn from the evaluations of the monitoring of National Smart Specialization in Poland primarily pertain to the central authorities due to their leading role in the process. Monitoring and evaluating a project as complex and with so many multi-level stakeholders as Smart Specializations necessitates continual learning and adjustments. Strikingly, international benchmarking reveals that no surveyed country or region—including Sweden, the Netherlands, Italy, Portugal, and Hungary—has yet succeeded in fully developing monitoring methods that satisfy information requirements for Smart Specialization strategies (Polish Agency for Enterprise Development 2021a). Most regions are consistently refining their monitoring approaches, drawing on the experiences of the 2014–20 programming period. Interestingly, in many of the countries, the regional level exhibits significant autonomy in conducting Smart Specialization monitoring, with the central government acting more as a supportive partner than a supervisor. Some countries, like the Netherlands, have developed cross-regional monitoring strategies where regions partially engage in collaborative monitoring activities.

References

1. Report from the study "Ex-ante evaluation of the project 'Monitoring of National Smart Specialisation'" conducted by IBC Central Europe Holding S.A. and Fundacja Rozwoju Badań Społecznych in 2017 on behalf of the Polish Agency for Enterprise Development, Warsaw, 2017.
2. Report from the study "Mid-term evaluation of 'Monitoring of National Smart Specialisation' 2014-2020'" conducted by Fundacja Rozwoju Badań Społecznych in 2021 on behalf of the Polish Agency for Enterprise Development, Warsaw, 2019.

3. Report from the study “Benchmarking of monitoring systems for Smart Specialisations and the EDP. Benchmarking at the international level” conducted by Fundacja Rozwoju Badań Społecznych in 2021 on behalf of the Polish Agency for Enterprise Development, Warsaw, 2021.
4. Report from the study “Benchmarking of monitoring systems for Smart Specialisations and the EDP. Benchmarking at the regional level” conducted by Fundacja Rozwoju Badań Społecznych in 2021 on behalf of the Polish Agency for Enterprise Development, Warsaw, 2021.
5. Annex nr 2 to “Strategia Produktywności 2030”, National Smart Specialisations – update 202, Ministry of Economic Development and Technology, Warsaw, 2022.

Appendix 8. Template for the monitoring framework of R&I policies in Romania

This template is provided as a separate Excel file, which was delivered in its standalone format.

Appendix 9. Comparison of different data collection modes

	CAPI	CATI	Web surveys
Outreach	Although CAPI could be realized almost everywhere, transportation to remote areas and across a large area is challenging and expensive. Usually, face-to-face interviews are limited to a defined area (such as a region or village). Thus, the sample's representativeness might be limited. Individuals that are usually difficult to reach are those temporarily away (for example, for work or school).	Data can be collected from a diverse range of respondents, including individuals from different demographic groups and geographic locations. This method is particularly valuable when reaching populations without Internet access or in regions where face-to-face interviews are challenging. Usually, the interview is conducted with people staying at home during the day.	Web surveys have a wide outreach: potentially each individual with Internet access can fill out a web survey. However, it is difficult to predict who is going to take the survey and who will not. Reaching older people is usually challenging.
Response rate	The response rate ranges from 80 percent to 90 percent and is the highest among CAPI, CATI and web surveys.[53]	The response rate ranges from 15 percent to 45 percent and is usually higher than web surveys and lower than CAPI.	The response rate ranges from 5 percent to 30 percent and is the lowest among CAPI, CATI and web surveys.[54] To increase response rates, web surveys are frequently accompanied by monetary incentives (for example, cash, checks, or gift cards).
Survey length	The number of interviews that can be conducted per day per interviewer depend on the transportation time between interviews. Generally, given an average survey length between 30 and 60 minutes, 5 to 10 interviews per day are realistic. Long interviews should be avoided to limit respondents' fatigue.	Respondents' attention is shorter on the phone than in person. As such, phone interviews should not exceed 20 minutes. Because this method does not involve physical travel, many interviews can be conducted during a day.	A web survey should not exceed 10 minutes. A web survey longer than that will most likely result in low response rates. The short survey length and direct access by respondents reduce the time required for data collection.
Interviewer	Employing reliable, competent and experienced interviewers is essential for face-to-face interviews. They are	Interviewers should have a certain level of experience given the difficulty of receiving good responses from respondents over the phone.	No interviewers are involved in web surveys. Consequently, it is more difficult to engage people in

[53] Han et al. 2021) find a response rate of 86.2 percent in face-to-face mode across different organizations in Romanian public administration.
[54] Han et al. (2021) find a response rate of 53.8 percent in online mode across different organizations in Romanian public administration. Response rates, depending much on the context and setting, fluctuate a lot, particularly in web surveys.

	vital for gathering in-depth information about the experiences, perceptions, and outcomes related to policy instruments. The physical presence of an interviewer enables researchers to probe further and capture nuanced responses, providing valuable insights into the effectiveness and impact of these instruments.	Interviewers can work from home or from a centralized location (call center). The latter enables closer cooperation and organization among interviewers.	participating and making sure questions are well understood.
Costs	CAPI is a more costly method for gathering data given the costs such as transportation, interviewers, and accommodation.	At an equal number of interviews, the required costs are typically lower than those of a CAPI data collection and higher than a web-survey.	Web surveys are a cheaper option for collecting data because no interviewers need to be hired. Increasing the outreach of web surveys might come with additional costs.
Number and type of questions	CAPI offers the opportunity to ask detailed and more sensitive questions. An experienced interviewer has the ability to establish a trusting atmosphere that puts the respondent at ease.	The number of questions to be asked is limited because keeping respondents engaged on the phone is challenging. Given the setting of phone interviews and the difficult of probing for answers, the phrasing of questions needs to be clear and concise.	Questions need to be clear and concisely formulated. No interviewer is available to re-explain unclear questions or probe for answers. The number of questions is limited given the interview length.
Data quality	Different methods to check and improve data quality are available such as automated high-frequency checks, back checks, and spot checks.	Different methods to check and improve data quality are available such as automated high-frequency checks, audio audits, and call recording.	Web surveys are prone to data entry errors because data is entered directly by the respondent and not by the enumerator. To reduce data entry errors, validation checks, logic checks, and skip patterns can be programmed.

Appendix 10. Secondary data sources

Data source	Data accessibility	Data usage	Disaggregation levels	Examples of indicators found in the datasets	Relevance
TEMPO (NIS)	Not all data is publicly available.	Will be used for system-level indicators in the SNCISI.	Some key indicators cannot be disaggregated below the national or regional level.	Indicators already in use.	Microdata is available only to researchers and research institutions following a rather bureaucratic protocol. Time lag of one to two years Datasets excludes micro-firms
Eurostat (Directorate General Eurostat)	Not all data is publicly available.	Will be used for system-level indicators in the SNCISI.	Complete regional disaggregation may not always be achievable. Some indicators cannot be disaggregated below the regional level.	Indicators already in use.	The pace of updates can be slow due to the dependence on national institutions and the requirement for standardization. A time lag needs to be considered.
Web of Science + Derwent (Clarivate Analytics)	Not all data is publicly available.	Will be used for system-level indicators in the SNCISI.	In order to achieve disaggregation, it is necessary to establish data correlation that allows for the alignment of scientific results with specific regional levels.	Indicators already in use.	Depends on protocols established between the ministry and Clarivate Analytics. The Ministry of Education already has an agreement to provide Romanian researchers with free access to certain (not all) scientific publications (E-NFORMATION Platform).
Academic Ranking of World Universities (ARWU) - Shanghai Ranking	Publicly available data.	Will be used for system-level indicators in the SNCISI.	Data disaggregation is possible since unit level data is collected.	Indicators already in use.	Full access for selected indicator: University number in the Academic Ranking of World Universities (ARWU) 1000
Scimago Journal & Country Rank	Publicly available data.	Will be used for system-level indicators in the SNCISI.	Data disaggregation is possible since unit level data is collected.	Indicators already in use.	Full access for selected indicator: Number of organizations in Top Scimago 500
Regional General Directorates for Public Finance	Not all data is publicly available. It provides financial data at the firm level, specifically collecting information at the county level.	Can be used to provide context for SNCISI (data source is not presented in the strategy)	Data disaggregation is possible since unit level data is collected.	Specific indicators are not available to the public, but time series and unit data provides info on several dimensions (for example, NACE code, turnover, profit, debt).	The data is not accessible to the public and obtaining it through data requests can be a bureaucratic process, unless there is an established long-term partnership in place.
Regional Directorates of Statistics under NIS	Public availability of data is limited, because not all data is accessible	Can be used to provide context for SNCISI (data source is not presented in the strategy)	Data disaggregation is possible because unit-level data is collected.	The available indicators provide information on macro dynamics: No. of research staff employed in research.	Microdata is not readily available and necessitates special accounts for policy makers and researchers. The timeline for publishing the data relies on the nature and intricacy of the indicators being considered.

APPENDIX 10

	to the general public.			Financing spending with research and innovation	
Trade registries at county courthouses	Not all data is readily accessible to the public in a user-friendly format.	Can be used to provide context for SNCISI (data source is not presented in the strategy)	Data disaggregation is possible because unit-level data is collected.	The datasets contain information on all legal entities in Romania (private companies, self-employed persons, and so on). Under the Ministry of Justice, the trade registries keep track of all changes performed by these entities (firms' dissolution, closure and liquidations, changes in NACE code, and so on)	Data requests typically require payment to access the desired information, often resulting in a paywall. Furthermore, interinstitutional data requests can be time-consuming, often causing delays in obtaining the requested data.
National Trade Registry (Oficiul National al Registrului Comertului (ONRC)	Not all data is publicly available in a user-friendly format.	Can be used to provide context for SNCISI (data source is not presented in the strategy)	Data disaggregation is possible since unit level data is collected.		Data requests are usually paywalled. The ONRC gathers financial and legal information pertaining to local businesses. There is an extensive collection of time series data spanning over 20 years. The internal database contains financial data that can be partially linked to R&I activities. Certain data is made available to the public through the data.gov.ro portal.
National Agency of Fiscal Administration	The data is not accessible to the public in a straightforward manner.	Can be used to provide context for SNCISI (data source is not presented in the strategy)	Data disaggregation is possible because unit-level data is collected.	Specific indicators are not available to the public, but time series and unit data provides info on several dimensions (for example, NACE code, turnover, profit, debt, number of employees)	Acquiring the data through requests can be a cumbersome process, typically requiring bureaucratic procedures unless there exists a well-established partnership. The data is not easily usable for users because it may contain errors and necessitate additional cleaning procedures. Furthermore, only the primary NACE activity code is provided. The financial data lacks specific details pertaining to R&I and other related factors.
Ministry of Finance (MoF)		Can be used to provide context for SNCISI (data source is not presented in the strategy)	Data disaggregation is possible because unit-level data is collected.		
European Innovation Scoreboard (European Commission)	Not all data is publicly available.	Can be used to provide context for SNCISI (data source is not presented in the strategy)	Complete regional disaggregation may not always be achievable, but data is internationally comparable.	The datasets provide info on: • Public-private co-publications (regional) • Innovative SMEs collaborating with others (regional) • Employed ICT specials (national) • SMEs introduction product innovation (regional).	The data is refreshed every two years, resulting in updates at regular intervals. The sources heavily depend on nationally collected data, leading to potential delays in publication due to the time required for data collection. Over-reliance on the Community Innovation Survey excludes micro firms and incorporates past years' data when the updated data is unavailable.
European Index of Digital Entrepreneurship Systems (EIDES) (European Commission)	Not all data is publicly available. Only national data is available. Data is internationally comparable.	Can be used to provide context for SNCISI (data source is not presented in the strategy)	Data disaggregation is not possible. Only national data is available.	Index data performed on various components (based on different and not publicly available indicators): • Stand-up human capital • Culture, information institutions • Start-up finance • Market conditions • Scale-up human Capital The indices are computed using output measures (focus on entrepreneurial activity Usually 'clean' measures), attitude measures (survey data), framework measures (provide a	Data requests are necessary.

				nuanced reflection of the context of entrepreneurial action, usually wide coverage and relevant indicators at the national level), weighted measures (capture the quality of the entrepreneurial dynamic), ecosystem measures (focus on contexts of entrepreneurial action).	
Digital Economy and Society Index (DESI) (European Commission)	Not all data is publicly available. Only national data is available. Data is internationally comparable.	Can be used to provide context for SNCISI (data source is not presented in the strategy)	Data disaggregation is not possible. Only national data is available.	The indicators provide info, for instance, on: • Level of the digital skills • ICT specialists Enterprises providing ICT training. • ICT graduate • Other digital connectivity measures	Data requests are necessary.

Appendix 11. Quality checklist of the design and implementation strategy of a monitoring platform

Foreword: This checklist should be considered as an evolving tool that should be adapted to the purposes and audience of the assessment. Questions are here tailored to a centralized monitoring platform for the Romanian R&I system. These questions can be easily adapted to other types of monitoring platforms.

1. **Assessment domain: Coverage**
   a. Is there a list of all relevant institutions and agencies managing and implementing programs related to R&I covered by the current methodology, and is this list complete?
   b. Are all programs related to R&I covered by the current methodology?
   c. Does the proposed list of indicators cover inputs, outputs, short-term, medium-term and long-term outcomes of R&I interventions?
   d. Is there a list of all data sources that will feed the platform?
   e. Does that list consider all relevant external sources that are not directly linked to any program (for example, Statistics Romania, Ministry of Finance, any European or world sources publicly available)?
   f. Are data sources clearly linked to the list of indicators?
2. **Assessment domain: Actionability of data collection plans from program managers**
   a. To what extent is data collection from the reporting agencies automatic (through API)? When not, are there explicit plans to move in this direction?
   b. When not automatic, are the processes to access the platform and enter data clearly laid out in the methodology?
   c. When not automatic, are reporting guidelines clear and easy to use, including the definitions of indicators?
   d. When not automatic, are reporting requirements and frequency manageable by the reporting agencies (that is, do they impose a limited burden)?
   e. When not automatic, to what extent does the data entry format align with the current reporting formats of the respective agencies?
   f. To what extent do indicators' definitions match with the definitions commonly used by the reporting agencies?
   g. To what extent is the information required by the platform already gathered by the reporting agencies (assessment of the additional reporting burden)?
   h. When data transfer is not automatic, are there plans to pilot the platform features with a few reporting agencies and intended users?
3. **Assessment domain: Actionability of data collection plans from secondary sources**
   a. Are plans to extract data from secondary sources (including data access) clearly laid out?
4. **Assessment domain: Role of the platform in planning and decision-making**
   a. Does the information gathered by the platform allow for meaningful aggregation?
   b. To what extent are the indicators harmonized across reporting agencies?
   c. Is the extent of access to data by different agencies clearly laid out (content and format)?
   d. Are the data analysis and visualization plans clearly laid out?
   e. Are the plans for using data from the platform at all stages of planning and decision-making (from DCDISITT and by the reporting agencies) clearly laid out (including content, format, frequency, target audience, and both legally required and pro-active dissemination activities)?
   f. To what extent are the data analysis and visualization plans aligned with the intended use of this information?

g. How fast and easy is it to interact with the platform for consulting data?
h. To what extent are default visualizations (if any) relevant for decision-making and easy to interpret?
i. To what extent can the dashboard be customized by needs by the Policy Strategy Division?
j. To what extent can the dashboard be customized by needs by the reporting agencies?
k. Can the dashboard immediately display results and allow for download of data in different data formats by the Policy Strategy Division and by the reporting agencies?
l. To what extent can the platform be used for reporting by the Policy Strategy Division and by the reporting agency?

5. Assessment domain: Credibility

a. Do the reporting guidelines contain guidelines on best practices for sampling and data collection?
b. Can information on actual sampling and data collection practices of the reporting agencies be accessed?
c. To what extent is the data representative of the target beneficiaries, target fields and target geographic areas?
d. Can the raw data gathered by the reporting agencies be accessed and verified?
e. Are processes/ procedures for data quality (including verifications that common definitions are effectively used) clearly laid out?
f. Are there plans to systematically document data verification and cleaning procedures?

6. Assessment domain: Responsibility

a. Are the roles within MCID clearly defined and assigned (to specific departments and positions) around: (i) the development of the platform; (ii) consultation with stakeholders to collect feedback and gather lessons for improving the platform; (iii) the maintenance of the platform; (iv) oversight of data inputted in the platform (timeliness, completeness, veracity); (v) to consult dashboards for planning and decision-making; (vi) to consult stakeholders for planning and decision-making based on this information; (vii) to disseminate success, challenges and learnings to a wider audience?
b. Are the roles within reporting agencies clearly defined and assigned, as a result of the negotiations between DCDISITT and other departments and reporting agencies?
c. To what extent will data on the platform be protected?
d. To what extent are the reporting agencies and program beneficiaries informed about how the data will be stored and used on the platform?
e. Are there mechanisms in place to easily delete information in case a reporting agency of direct beneficiaries withdraw their consent in displaying and using their data?

7. Assessment domain: Commitment

a. Are the incentives of the agencies required to report on the platform clearly identified and laid out (e.g., legal requirements or intrinsic motivations)?
b. Are rules defined if the agencies fail to report information on time?
c. Are rules defined to consult and use data from the platform for strategic planning?
d. Is there a clear and sufficient budget allocated to the platform development and management?
e. Are the enough and sufficiently skilled human resources to fulfill the roles and responsibilities identified for the platform development, management, data quality supervision and data use?

8. Assessment domain: Adaptability

a. Are there plans for systematic assessments of data needs (from the Policy Strategy Division and from the reporting agencies)?
b. Are there communication channels and procedures in place for requests of new indicators from the reporting agencies?
c. How easily can the platform be modified to accommodate for new indicators?

9. Assessment domain: Monitoring of and learning from platform implementation

a. Is the plan to monitor the implementation of the platform clearly laid out (including, among others, clear responsibilities, indicators, milestones and timeline)?

b. Are there plans to collect users' feedback to evaluate and improve the platform?
c. Are there plans to test and evaluate (A/B testing) different features of the platform to promote take-up?

Finanțat de
Uniunea Europeană
NextGenerationEU

Planul Național
de Redresare și Reziliență

„NRRP. Funded by the European Union – NextGenerationEU”

https://mfe.gov.ro/pnrr/
https://www.facebook.com/PNRROficial/