

**Reimbursable Advisory Services Agreement on Public Expenditure Review in
Science, Technology and Innovation and Support for Building Evidence-based
Approach for the National Strategic Framework in Education 2030**

**Pillar 1 Bulgaria Public Expenditure Review in Science, Technology and
Innovation (STI)**

Final Report for the Bulgaria Public Expenditure Review
for Science, Technology, and Innovation

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Final Report for the Bulgaria Public Expenditure Review for Science, Technology, and Innovation

This document provides a summary of the key findings and recommendations of the Bulgaria Public Expenditure Review for Science, Technology, and Innovation (PER STI) project. The objective of the project is to provide an analytical background for improving the effectiveness of public investments for STI through reallocation of resources, redesign and rationalization of STI policies and instruments. The project utilizes the PER STI methodology, a results-based framework to logically link inputs, outputs, outcomes, and impacts of public spending on research and innovation.

This work was conducted at the request of and in collaboration with Ministry of Education and Science (MoES) and implemented in close collaboration with the Executive Agency for Operational Programme Science and Education for Smart Growth (EA OPSG) and Ministry of Economy and Industry (MoEI), as well as the National Science Fund (NSF), SME Promotion Agency (SMEPA), and other relevant stakeholders.

The project has three components:

- **Country needs and policy mix assessment:** a comprehensive overview of the flow of funds in the STI system, the budget structure and policy mix, and how well STI support policies and investments respond to the diagnosed country's needs.
- **Functional and governance analysis:** an in-depth assessment of the design, implementation and governance of instruments and institutions, and their position within the policy mix. This component includes a capacity building task aiming at sharing international best practices and equipping policy makers and practitioners with design, implementation, and monitoring tools.
- **Efficiency analysis:** an analysis of outputs and outcomes for selected programs which includes looking at the relationship between inputs and outputs and monitoring the progress of the outcomes of interest.

The findings from these three components inform a set of recommendations that aim to improve Bulgaria's STI support policies and programs. The Government of Bulgaria has prepared its National Recovery and Resilience Plan to facilitate economic and social recovery in the aftermath of the pandemic, which will allocate approximately €1.25 billion in funding for innovation-related activities. At the same time, Bulgaria's preeminent STI implementing bodies are defining the priorities and targets for the new programming period (Bulgaria's third since EU accession), which will include a research and innovation budget of approximately €1.17 billion. The PER STI project provides a thorough review of the implementation and coordination of the current period's policy portfolio and makes recommendations for new policies and reforms to reforms aimed at ensuring that this substantial funding yields productive impacts on the STI system.

Country Needs and Policy Mix Assessment

The Country Needs and Policy Mix Assessment report consists of a comprehensive assessment of the country's research and innovation needs and an analysis of the policies devoted to supporting STI in Bulgaria, including nearly all national-level STI-related policy instruments (118 instruments operational from 2013 to 2019 with €843 million in disbursed funding) from the current programming period. A World

Bank analytical framework was used to compare the coherence of the STI policy mix to the country needs, which generated policy recommendations to reduce misalignment or gaps between policy support and the research and innovation needs of the nation's public and private sectors.

Country needs assessment

Labor productivity has shown dramatic improvement in the last decade, but despite this growth, Bulgaria still exhibits one of the lowest productivity performances in Europe. Aggregate productivity growth has been driven by the ability of existing firms to become more efficient (through technology upgrading, innovation, and other factors), while productivity growth is dragged down by barriers to the reallocation of resources (preventing more productive firms from growing) and to the creative destruction process (firm entry and exit). Further productivity gains to catch up to European peers will require reforms to the business environment that ease firm entry and exit and allow resources to move more efficiently within the market.

Bulgaria exhibits one of the lowest innovation performances in Europe, driven by very low levels of research investment compared to peers. Research outputs (publications, patents, etc.) tend to have little impact internationally and there is little transfer of knowledge and technologies from the public to the private sectors. This poor research and innovation (R&I) performance represents a missed opportunity for additional productivity growth driven by innovation and skilled labor. There is a clear need to modernize the national research system, particularly in the public sector, to improve the performance of public research organizations, with a focus on research excellence, market-oriented research agendas, and technology transfer.

Research institutions a number of challenges related to governance, capacity, linkages to the private sector, and incentives that negatively impact the quality and relevance of public research. Lack of research capacity, low levels of funding for research, and a lack of adequate research facilities are major barriers to improved research outcomes. As a result of the lack of external stakeholder input, research agendas are not oriented toward industry needs, which is a major impediment to public-private collaboration, technology transfer, and research impact. Further, the career development framework for public researchers does not provide adequate or coherent incentives for commercialization.

Technology adoption in firms has improved over the last ten years, helping to drive productivity growth, but Bulgaria still lags behind most peers in technology adoption. Bulgarian firms have among the lowest levels of digitization in firms in Europe, for both basic and advanced digital technologies. The findings from the recent World Bank Business Pulse Survey (BPS) survey in the aftermath of the COVID 19 outbreak show that the industry sectors least affected are those with the highest share of firms that have adopted digital solutions, underlining the need for increased digitization to build business resilience and flexibility. Bulgaria should continue to promote and support technology adoption and digitization through targeted instruments and the removal of constraints on the business environment.

Policy mix analysis:

The policy mix analysis included a mapping of including nearly all national-level STI support instruments (118 instruments operational from 2013 to 2019 with a total allocated budget of €1.6 billion). The instrument policy mix was analyzed in a matrix containing detailed information about each STI support instrument, including a total of 169 variables per instrument describing characteristics such as objectives, implementing body, targeted beneficiaries, mechanism of support, and other key parameters.

STI institutions are disconnected from one another and suffer from weak governance structures, which has resulted in fragmented policies and programs and an uncoordinated national R&I agenda. A new Ministry of Innovation and Growth (MoIG) has been established to address this issue and consolidate implementation, coordination, and monitoring of the STI portfolio currently spread across different government bodies. However, this ministry is newly created and will need to build an organization and capabilities able to carry out this large and important mandate.

Analysis of the coherence of the policy mix with identified country needs shows gaps in support for technology transfer, Industry 4.0 technology adoption, early-stage company support, improvements to the business environment, and development of digital skills. These gaps should be considered when designing the next operational program.

Moreover, severe lags in the allocation and disbursement of funds for STI indicates serious challenges in the implementation of the STI policy mix, which has likely hindered the effectiveness of existing policy instruments.

Functional and Governance Analysis

The Functional and Governance Analysis report provided an assessment of the functionality and quality of governance of key policy instruments that support research and innovation in Bulgaria. This analysis represents the second phase of the World Bank's Public Expenditure Review for Science, Technology, and Innovation (PER STI) project in Bulgaria. The first phase of the PER STI project, the Country Needs and Policy Mix Assessment, provided a comprehensive assessment of the country's research and innovation needs, an overview of the national policies devoted to supporting STI in Bulgaria, and an analysis of the alignment or gaps between policy support and the research and innovation needs of the nation's public and private sectors. This report builds on the first phase of the project by exploring the functionality of a representative set of STI policy instruments through a review of their design, implementation, and governance. The findings from this report inform a set of recommendations to improve the functionality and governance of the portfolio of STI support programs.

The functional analysis identified areas of strength, as well as many areas for improvement across the policy portfolio:

Instrument design

There is a general disconnect between program objectives (what instruments are trying to accomplish) and program activities (what instruments actually do), which is largely due to the lack of use of theories of change in instruments. Many instruments lack a clear justification for intervention – in other words, they lack an explicit description of the market or system failure being addressed by the instrument. This lack of clear identification of the failure being addressed is a large contributing factor to an observed disconnect between program activities and objectives and negatively impacts other areas of instrument design, such as setting program objectives and developing eligibility and selection criteria. Almost no instruments have an explicit theory of change or logic model, which further adds to the disconnect between activities and objectives. The lack of theories of change also contributes to poorly defined and disconnected indicators for inputs, activities, outputs, and outcomes. Outcome indicators, in particular, tend to be poorly defined and weakly connected to program activities. M&E frameworks are largely focused on whether beneficiaries are in compliance with administrative regulations, rather than assessing

program performance. Stakeholder engagement is an area of strength, with almost all instruments utilizing strong formal mechanisms for engagement with non-beneficiary stakeholders

Program implementation

All institutions engaged in implementing STI policies, to varying degrees, suffer from a lack of capacity and resources to fully implement their portfolios, although this challenge is most severe for nationally-funded instruments due to insufficient and unpredictable budgets. This lack of resources has had negative impacts on instrument functionality, limiting implementing bodies' ability to administer calls for proposals, evaluate projects, and has even resulted in program cancellation. Capacity issues are particularly severe in M&E, and almost no evaluations of instruments have been done in the current programming period due to a lack of resources and staff. A majority of instruments in the STI portfolio only issued a single call for solicitations over the life of the program, rather than issuing regular annual or semi-annual calls. This "one-time" instrument design severely limits opportunities for learning, adaptation, and improvement of instruments and has negative impacts on other areas of functionality, such as learning and knowledge management and the development of selection criteria. Almost no impact evaluations of instruments have been done in the current programming period, and few are planned for the future. There are few formal knowledge management systems in place; adjustments to instruments are generally ad hoc and not well documented.

Governance and coordination

STI institutions are disconnected from one another, resulting in fragmented policies and programs and an uncoordinated national STI agenda. While formal coordination mechanisms between STI institutions are largely in place, very little coordination or collaboration occurs that is relevant to individual programs.

Importantly, a cluster analysis of the functional analysis scoring found that many of the differences in instrument functionality across the portfolio can be attributed to the organization that designs and administers the individual instruments. This means that reforms aimed at improving the functionality of instruments should be addressed at the level of the implementing bodies, rather than through portfolio-wide reform efforts.

Efficiency Analysis of STI Programs

This efficiency analysis addresses an identified gap in Bulgaria's STI system: the monitoring and evaluation (M&E) of STI support programs. Previous components of this project found that STI implementors lack capacity and resources for M&E, and few evaluations of STI programs have been done during the current programming period. This report aims to address those gaps by identifying benchmarks for assessing the results of STI support programs in Bulgaria and providing a methodology and tools for carrying out such evaluations in the future.

Key Findings from Analysis of Research Support Programs

Research support programs had very different levels and compositions of administrative costs of implementation, largely due to the different management structures of the programs. Programs implemented by the National Science Fund (NSF) had a relatively high share of costs for external services and low share of costs for personnel, indicating that much of the program implementation is done by external experts rather than full-time NSF staff. By contrast, the sectoral programs of Bulgaria's National Science Programs 2018–22 portfolio have very low administrative costs overall because part of these costs

are borne by beneficiary consortiums, which are responsible for part of the program administration and monitoring.

Research programs generally produced outputs and had outcomes that were in line with the program objectives, but a citation analysis raises concerns about the quality of research being produced.

Publications reported by research respondents generally had lower numbers of year-normalized citations than the average Bulgarian publication indexed in the Web of Science from 2016 to 2020. This low level of citations indicates that the research being funded is not generating significant impact on the scientific community. Publications in peer reviewed journals were the most common outcome for all of the research programs, although publications per project and per unit of cost varied between programs. Capacity building outputs (in the form of seminars, conferences, and workshops; training activities; and hiring new researchers) were the most common outputs of almost every research program.

Respondents from researchers' programs were mostly satisfied with program processes, but some had issues with the transparency of the selection process and with monitoring requirements. Although researchers were generally satisfied with project application and selection, some were dissatisfied with the unavailability of feedback on which projects were selected, which can make selection processes appear opaque. Some respondents were also dissatisfied with program reporting requirements, particularly financial reporting rules, which require beneficiaries to provide certified and translated copies of all eligible expenses, including things like plane tickets.

Key Findings from Analysis of Firm Support Programs

Respondents from firm support programs generally achieved the outputs and outcomes intended by the programs, including developing and upgrading products, services, and processes; and increasing sales and employment. More than 70 percent of firm projects resulted in firms adopting a product or service for the first time. Roughly 65 percent of projects resulted in the introduction of a product or service that was new to the Bulgarian market.

Firm beneficiaries reported dissatisfaction with key areas of program implementation, including the overall application process, the transparency of project selection, and financial monitoring requirements. The *Functional and Governance Analysis* found that application processes for firms are burdensome, particularly the supporting documentation firms must provide to support their applications, which can include financial statements, declarations of clean criminal records, tax liabilities, and offers from third parties for assets. The *Functional and Governance Analysis* also found that reporting processes were easier for beneficiaries of programs funded under EU operational programmes (OPs) than for nationally funded programs because beneficiaries of OP-funded programs report using an online portal with preloaded templates for technical and financial reports. Despite these challenges, more than 70 percent of respondents felt their project results matched their expectations and were generally satisfied with other aspects of their programs, including program rules and regulations and the accessibility of financial and administrative support.

Key Recommendations

The three PER STI components informed a set of recommendations aimed at improving the effectiveness of public investments for STI. These recommendations can be grouped into six themes:

- 1) improving STI coordination;
- 2) improving instrument functionality;

- 3) new policies and programs for supporting research;
- 4) reforms to the research sector;
- 5) new policies and programs for supporting innovation in the private sector; and
- 6) reforms to the private sector.

Improving STI Coordination

Empower the Ministry of Innovation and Growth to monitor and coordinate the STI agenda

Approach

- MoIG should take on the mission of monitoring and coordinating the implementation of the national R&I agenda through
 - (i) mandating the Ministry to collect and manage data on the progress of the implementation of STI programs; and
 - (ii) accumulating the analytical and professional expertise needed to fulfill this mission.
- Technical assistance should be provided to the founding team of the Ministry through knowledge sharing, training, and partnerships to ensure that the design, governance, and operations of the organization build on international good practice.

Priority timeline: Short-term

Responsible stakeholder(s): Council of Ministers, MoIG

Activate existing coordination bodies

Approach

- Improve coordination of the STI agenda by activating existing coordination channels, such as the Council for Smart Growth, Inter-Institutional Working Group, and Regional Partnership Network, to set a commonly agreed upon R&I vision and strategic objectives among national and regional STI actors.

Priority timeline: Short-term

Responsible stakeholder(s): Council of Ministers

Improving Instrument Functionality

Improving instrument design

Approach

- Articulate a theory of change (and related indicators) for each instrument to show the connections between instrument inputs, activities, outputs, and desired outcomes. Each instrument should include a results framework (tied to the theory of change) with a full catalog of input, activity, output, and outcome indicators.

- Improve M&E practices and capacity of STI implementing bodies by developing impact evaluation strategies for instruments that includes clear objectives, theories of change and results frameworks, evaluation plans, supporting systems, and protocols. This will require committing to regular performance and impact evaluations of instruments; and providing resources and incentives for STI implementing bodies to carry out these M&E activities and train their staff and administrators.
- Develop an Innovation Lab (within MoIG or another implementation body) to pilot new STI support interventions and provide advice and services to other STI implementors

Priority timeline: Short-term

Responsible stakeholder(s): MoES, MoIG, MoEI

Building capacity for implementation

Approach

- Increase budget support to functioning and scalable national programs and organizations to bridge the capacity divide with OP-funded programs.
- Improve human resource management and capacity of STI implementors by increasing staffing across the STI system, both for full-time and part-time positions, especially in nationally-funded programs; providing discretionary budgets for consultants, external experts, and other part-time positions; and improving HR management practices related to STI staff incentives and training opportunities.

Priority timeline: Mid-term

Responsible stakeholder(s): Council of Ministers, Ministry of Finance (MoF), MoES, MoIG, MoEI

Policies for Supporting Research

Improve resources and capacity for tech transfer support

Approach

- Address the performance of existing Technology Transfer Offices and other relevant support institutions through sustainable funding for technology transfer and commercialization activities
- For funding to be effective, it must be complimented with capacity building and training on international best practices (invention disclosure, patenting, licensing, market assessment, startup/spin-off formation, etc.), as well as reforms to the research sector to improve the relevance of research outputs
- Provide informational sessions and training on technology transfer policies and resources to public researchers

Priority timeline: Short-term

Responsible stakeholder(s): MoIG, MoES

Consider developing applied research programs targeting the researchers

Approach

- The Policy Mix Assessment showed a gap in applied research funding programs to public research institutions
- Efficiency Analysis findings suggest that some NSF project results could be further developed and potentially commercialized if there were applied research grant schemes that their projects could “graduate” to for additional funding and support.

Priority timeline: Mid-term

Responsible stakeholder(s): MoES, MoIG

Research Sector Reforms

Reform the governance and strategic orientation of public research institutions

Approach

- Ensure that public research institutions have clear missions and objectives, in line with national goals. Align M&E frameworks with institutional objectives and missions.
- Support PROs and HEIs in the articulation of their research and technology transfer strategies for achieving institutional objectives.

Priority timeline: Mid-term

Responsible stakeholder(s): MoES, BAS, HEIs

Strengthen PRO/HEI-Industry linkages to ensure alignment with demands

Approach

- Improve the relevance of public research and education agendas through industry representation in PRO/HEI governing bodies (steering/trust boards) and consultation in the definition of research and knowledge strategies.
- Strengthen public-private linkages by encouraging mobility of researchers between public research institutions and the private sector through secondments, sabbaticals, joint positions, and PhDs in industry.

Priority timeline: Short-term

Responsible stakeholder(s): MoES, BAS, HEIs

Improve the incentive framework for public researchers to engage in high quality research, knowledge transfer, and commercialization activities

Approach

- Include technology transfer and collaborative research activities in career development and salary progression of researchers.

- Strengthen financial incentives through allowing researchers' participation in licensing revenues and provision of equity rights (in startups/spinoffs).

Priority timeline: Short-term

Responsible stakeholder(s): MoES, BAS, HEIs

Policies for Supporting Innovation in Firms

Promote firm digitization and tech adoption

Approach

- Help identify firm technology and digitization needs through diagnosis tools and tech extension services.
- Gather more evidence on firms' managerial capabilities and digital skills – particularly in SMEs – to get a better understanding of whether existing instruments adequately address the needs of Bulgarian firms in this area.

Priority timeline: Short-term

Responsible stakeholder(s): MoIG, SMEPA

Promote innovative entrepreneurship and remove impediments to early venture growth

Approach

- Support early-stage entrepreneurship through ideation, national competitions, and targeted early-stage support (prototyping, PoC), and to create a steady supply of investible knowledge-based companies.
- Develop instruments that support early-stage business intermediaries, such as incubators, investment readiness programs, business advisory services, and technology extensions
- Develop the business angels' market and support the professionalization of angel investors.

Priority timeline: Short-term

Responsible stakeholder(s): MoIG, Fund of Funds (FoF)

Build the supply of digital skills

Approach

- Support and incentivize firms in accessing training and capacity building on data science, analytics, cloud computing, digital marketing and sales, and other digital tools.

Priority timeline: Short-term

Responsible stakeholder(s): MoIG, SMEPA

Private Sector Reforms

Address constraints related to the operating business environment and the mobility of resources

Approach

- Conduct an in-depth assessment of product market regulations to identify and remove competition and market constraints.
- Prioritize regulations aimed at increasing the mobility of production factors across producers, such as facilitating firms' exit and resolving insolvency.
- Facilitate firm entry across the economy to boost aggregate productivity performance.

Priority timeline: Mid-term

Responsible stakeholder(s): MoEI, MoIG

Remove barriers to teleservices and e-commerce

Approach

- Clarify (and, where appropriate, relax) the legal framework surrounding online delivery of professional services and address last mile delivery challenges (logistics and postal delivery service).
- Support businesses in adopting electronic payment options and selling online

Priority timeline: Short-term

Responsible stakeholder(s): MoEI, SMEPA, Ministry of Transport and Communications