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RIO COUNTRY REPORT 2015: Bulgaria

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Abstract

The 2015 series of RIO Country Reports analyse and assess the policy and the national research and innovation system developments in relation to national policy priorities and the EU policy agenda with special focus on ERA and Innovation Union. The executive summaries of these reports put forward the main challenges of the research and innovation systems.

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Foreword

The report offers an analysis of the R&I system in Bulgaria for 2015, including relevant policies and funding, with particular focus on topics critical for EU policies. The report identifies the main challenges of the Bulgarian research and innovation system and assesses the policy response. It was prepared according to a set of guidelines for collecting and analysing a range of materials, including policy documents, statistics, evaluation reports, websites, etc. The quantitative data are, whenever possible, comparable across all EU Member State reports. Unless specifically referenced, all data used in this report are based on Eurostat statistics available in February 2016.

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Executive summary

The report offers an analysis of the R&I system in Bulgaria for 2015, including relevant policies and funding, taking into account the priorities of the European Research Area and the Innovation Union. The report was prepared according to a set of guidelines for collecting and analysing a range of materials including policy documents, statistics, evaluation reports, websites, etc. The quantitative and qualitative data is, whenever possible, comparable across all EU Member State reports.

Context

Bulgaria is characterized by an industrialized, free market economy, moderately developed private sector and a relatively small domestic market. Since 1997, the economic development of Bulgaria has been framed by a Currency Board Arrangement (binding the national currency to the euro).

The Gross Domestic Product (GDP) at market prices for Bulgaria is €5,900 per inhabitant for 2014, (Eurostat, December 2015). In 2014 its GDP per capita in purchasing power standard (PPS) is at 47% of the EU-28 average, showing a slow upward trend compared to 46% in 2012 and 2013. Unfortunately, due to the global financial and economic crisis, the initial economic 'catch-up' effect around entry into the EU in 2007 has been ceased. Due to the small and further contracting internal market (e.g. 15% contraction for 2013), the economic growth of Bulgaria is strongly dependent on exports. Although Bulgarian exports are diverse and include manufacturing goods, services, agriculture products and metals, Bulgaria's competitive advantage so far has actually been in relatively low value-added products. The internationalisation of the Bulgarian companies is weak and the volume of foreign direct investment (FDI) is limited, which is an impediment to accelerated growth.

The negative effects of the crisis were to a certain degree mitigated in Bulgaria compared to other EU member states due to the country's favourable sound fiscal policies and small debt burden. However, Bulgaria's competitiveness remains based on low corporate and personal taxes (10%) and the low cost of relatively skilled labour rather than on quality-related factors such as innovation and knowledge base. Poverty and social exclusion raise a particular concern for Bulgaria, underpinned by high levels of income inequality. The depressing growth effect of the world crisis calls for smart means of fiscal consolidation¹ in terms of the structure, timing and choice of individual measures. There is some evidence that the post-crisis fiscal adjustment process in Bulgaria has come to the expense of the public support to R&D. Public R&D intensity (the lowest in the EU) decreased from 0.31% in 2009 to 0.21% in 2013, as the government reduced the national funding for research and innovation. Although not fully utilised, European Structural and Cohesion Funds (ESF) became the main and largest source of investment for R&D in Bulgaria. In 2014 the gross domestic expenditure on R&D (GERD) per capita in Bulgaria equals €46.3, while the EU28 average reaches €558.4 (Eurostat, December 2015).

Key developments of the Bulgarian national R&I system in 2015 included:

- peer-review of the Bulgarian R&I system within the framework of the Horizon 2020 Policy Support Facility;
- adoption of Action Plan 2015-2017 of the National Development Programme: Bulgaria 2020;
- adoption of the Strategy for the Development of Higher Education;

¹ Fiscal consolidation is a policy aimed at reducing government deficits and debt accumulation. Smart fiscal consolidation is understood as fiscal consolidation which spares or increases public expenditures in R&I.

Regulation for Monitoring and Evaluation of Research Activities Carried out by Higher Education Institutions and Science Organizations, as well as the Activities of the Scientific Research Fund;

- launch of the National Open Data Portal;
- update for 2015 of Europa 2020: National Reform Programme;
- finalising the Innovation Strategy for Smart Specialisation.

The identified challenges for Bulgaria's R&I system are:

- (1) Overcoming the underfunding of the R&I system and reinforcing the science base
- (2) Improving the R&I governance
- (3) Fostering innovation and science-business cooperation

R&I Challenges

Challenge 1: **Overcoming the underfunding of the R&I system and reinforcing the science base**

Description

The Bulgarian research and innovation system has been characterized by a significant underfunding over a long period of time: in fact since the transition from a centrally planned economy to a free market economy. In June 2010, the Bulgarian government adopted a national R&D investment target of 1.5 % of GDP by 2020, but having in mind that such a target would require dramatic increase of the R&D expenditure over the next five years, the Horizon 2020 PSF panel² (hereafter H2020 PSF 2015) discusses in its "Peer review of the Bulgarian research and innovation system 2015"³ the possibility of setting a more realistic target of at least 1% of GDP. The declining trend in the overall, but primarily public funding of research in Bulgaria stabilized in the mid-nineties as it did in most other "transition" countries. However, in the Bulgarian case, unlike that of other countries, it remained at the low level of R&D intensity of 0.5% of GDP in 2012 rising only slightly over the last couple of years. In 2013 it stood at 0.65% with a public funding contribution of 0.24% of GDP, less than a quarter of a percentage (H2020 PSF 2015). The recent trends in the R&I structural development are characterized by growing private R&D expenditure and in particular by increasing foreign R&D investments. As a result of the implemented EU operational programmes and instruments, the R&D performed by the business sector (as percentage of GERD) increased from 30% in 2009, to 50% in 2010, followed by 61% in 2013 (close to the EU28 average of 64%) (RIO Country Report 2014: Bulgaria⁴). However, the growth in BERD concentrated practically solely in R&D services (H2020 PSF 2015).

Bulgaria ranks among the poorer research performers in the EU, demonstrated by indicators such as the percentage of the top 10% most highly cited publications for the period 2000-2013 (5.71% compared to 7.83% of Hungary) and the total number of patent applications by the Patent Cooperation Treaty in 2012 (48 compared to 264 of Hungary).

Bulgaria's performance in the Framework Programmes has also been inadequate, especially in relation to other "new" Member States of similar size. The total income since the beginning of Horizon 2020 has been €8.6m. In comparison, countries with smaller populations have been capable of attracting more H2020 funding: Croatia (€9m), Slovakia (€9m), Latvia (€9m). Participation in ERA-net joint calls is also lower than in comparable countries (e.g. Romania), and there is a general view that Bulgaria has been pulling out of co-operations (e.g. an ERIC infrastructure) rather than engaging in new European scale co-operations, due to a lack of national funding priority (H2020 PSF 2015).

Simply increasing investment in size, however, cannot be expected to lead to competitive results, unless more focus is placed on incentives for excellence and internationalisation, in particular through a substantial increase in the part of public funding which is allocated competitively, transparently and based on merit.

² [The Directorate-General for Research & Innovation of the European Commission set up a 'Policy Support Facility' \(PSF\) under the European Framework Programme for Research & Innovation 'Horizon 2020' to support Member States in reforming their national science, technology and innovation systems. The first activity requested from the PSF is a Peer Review to support wide-ranging reforms in Bulgaria.](#)

³ <https://rio.jrc.ec.europa.eu/en/library/horizon-2020-policy-support-facility-peer-review-bulgarian-research-and-innovation-system> or <http://horizon2020.mon.bg>

⁴ <https://rio.jrc.ec.europa.eu/en/library/rio-country-report-bulgaria-2014>

According to the World Bank Report "Input for Bulgaria's Research and Innovation Strategies for Smart Specialization" (February 2013)⁵, 'the current funding environment does not encourage sufficiently researchers and research organisations to increase the quality and impact of their research'. According to the PSF panel, a framework of restrictive public means contributes to an atmosphere of mistrust between stakeholders. The lesser the resources, the more there is likely to be discussion, dispute and criticism against those who have received some of those limited resources, the more so when there are no clear and transparent rules for allocation (H2020 PSF 2015).

Policy response

The low level of public funding of research and innovation is the most striking feature of the Bulgarian R&I system, and one which warrants immediate attention, but the quality and efficiency of such public funding is also of central concern. The first priority area, as detailed in the request from the Bulgarian authorities in their appeal to the EC for using the Policy Support Facility was for: "advice on the "Assessment of R&I funding and performing bodies and instruments". In short, the request was for assisting in improving the quality and efficiency of the public research organisations and tailoring the normative base for effective monitoring of R&I programmes and project results (H2020 PSF 2015).

The RIS3 approach tries to encompass the two system failures – weakness and fragmentation. It defines four thematic areas (two strongly technological and two technological with focus on employment), which allow for 1.) strategic focus of funding; and 2.) incentives for all participants to cooperate in these areas. The objective is to foster simultaneously consolidation and excellence, two mutually reinforcing mechanisms to develop the Bulgarian R&I system.

Assessment

It is essential for the Bulgarian public funding in research and innovation to become more in line with what countries of the level of development of Bulgaria spend on R&I. The current very low level of public funding for research in Bulgaria is not sustainable for the necessary economic development and the social welfare of the country. Bulgaria has a historic opportunity to strengthen its economic potential by making a renewed, realistic, long term commitment to a clear increase in its R&D intensity to at least 1% of GDP by 2020 from the current level of 0.65% of GDP in 2013. Public funding should play a decisive role in achieving this target, well beyond the current public R&D intensity level of 0.24% of GDP (H2020 PSF 2015).

The challenge for reinforcing the science base is not just publishing more, but expanding the scope and increasing the impact of the research and development output. Fostering performance-based research funding through focus on RIS3 areas (market-orientation) and impact metrics could guarantee the proper functioning of the R&I system and could provide the missing set of incentives for driving the necessary reforms in the research and higher education institutions. Fast investments (only into the limited number of institutions that produce research results and participate in international research projects) to ensure the building or reconstruction of a modern infrastructure is needed in supporting excellence and attracting talented researchers (S2E 2015)⁶.

Challenge 2: Improving the R&I governance

Description

The Bulgarian R&I system is characterized by uncoordinated priorities and on-going concerns with regard to alleged malpractice. There is no obvious horizontal coordination in the system.

⁵ <http://www.mi.government.bg/>

⁶ Stairway to Excellence Project Country Report for Bulgaria 2015 (S2E 2015) <http://s3platform.jrc.ec.europa.eu/country-region-information/>

The governance is divided between the Ministry of Education and Science (MES) responsible for the public research performing organisations and the Ministry of the Economy whose intention is to promote innovation within SMEs, to create at least one high-tech park (such as Sofia Tech Park) and to attract the research activities of foreign firms.

The R&I system is fragmented mainly due to the overall funding system, which stimulates whole institutions to compete against each other for institutional budgets, instead of competing within themes to support excellence and quality research results on a project basis. The current system of competitive allocation of resources is relatively recent and funding for research and innovation remains fragmented and unpredictable. Two funds were created in 2004, one for science and another for innovation. The Scientific Research Fund (SRF) sponsors basic and applied research activity and training of the public sector. The National Innovation Fund (NIF) finances applied research, development and innovation activities, including technology transfer. The two funds have relatively limited resources, varying annually and per session. Yet, they are managed independently and have autonomous objectives and targets, without any mechanism in place for coordination. The resources (e.g. approximately €15m planned budget for both in 2015) are dispersed for a large number of projects without clear focus and guarantees related to the impact for economy and society. The characteristics of the two funds in terms of their management models are diverse. While the NIF is a programme under BSMEPA (Bulgarian SME Promotion Agency), the SRF has a complex structure, almost similar to a funding agency, but without the capacity, procedures and competences of that type of organisations, typical for other Member States.

The SRF functions on an irregular basis, with unpredictable budgets per session and irregular calls for proposals. Hence, researchers are not able to plan and coordinate their research activities, especially with international partners. Reimbursements and payment mechanisms are similarly irregular with long time lags occurring between approval to expenditure and reimbursement. There is no multi-annual planning capacity. In addition, accusations of malpractice against the Fund and the lack of transparency have seriously damaged trust in both the national and international communities⁷. The NIF on the other hand appears only as a financial dimension within the SME Promotion Agency, which seems to have a clearer picture of its scope of action. But the NIF has also had sustained gaps in funding calls making funding very hard to predict for SMEs and it also lacks a multi-annual planning capacity. In addition, the Bulgarian funding schemes neither complement nor prepare for the effective participation of Bulgarian scientists and innovation entrepreneurs in EU research and innovation programmes or in activities funded through the European Structural and Investment Funds (ESIF).

Policy response

The Research and Innovation Strategy for Smart Specialisation (hereafter RIS3) process allows for three levels of governance and coordination, non-existent before. At the macro-level, Council for Smart Growth was established⁸ with reputable representatives from the science and the business communities under the chairmanship of the Prime Minister. The intention is to ensure high-level political commitment. At mezzo-level two networks function as integrative facilities for innovation policies: 1) inter-ministerial structure under the Council of Ministers (administrative network), mirroring the Smart Growth Council; 2) a regional network for a place-based implementation of RIS3. In addition, an independent agency with a professional multi-level funding competence, namely, a Promotion Agency for Research and Innovation (PARI), is proposed to be established.

⁷ e.g. <https://rio.jrc.ec.europa.eu>, News Section, 07 September 2015

⁸ by Council of Ministers Decree No 116/12.05.2015

At micro-level, the two operational programmes in the programming period 2014-2020 with priorities within the scope of thematic objective 1 "Strengthening research, technological development and innovation" of the Common Strategic Framework (OPIC and OPSEIG) synchronize their efforts within a Coordination Group (S2E 2015).

An interdepartmental working group with representatives of the scientific community was established in 2014 with the aim to develop regulations for monitoring and evaluation of research carried out by universities and research organizations, as well as the activities of the Scientific Research Fund⁹.

A Law on Amendments and Supplements on the Law on Promotion of Scientific Research in Bulgaria is under preparation. The amendments aim at: improving the functionality of the Research Activity Register and introducing regulations for monitoring and evaluation of the Scientific Research Fund activities and of research carried out by universities and research organizations, implementing a policy of open access to scientific results, improving the organisation, management, and result oriented funding of research; establishing a Research Promotion Agency as a tool for integrated policy in the national science and innovation system and for consolidation of science and innovation funding management¹⁰.

Assessment

There is an urgent need to enhance the coordination mechanisms and implementation capacity in Bulgarian research and innovation policy. The recent establishment of the Council for Smart Growth (CSG) and the planned Promotion Agency for Research and Innovations are important steps to address these challenges. The CSG initiative offers a new opportunity for the Bulgarian authorities to revitalize research and innovation policies as well as to reorganize the fragmented landscape of R&I and related sectoral policies – such as higher education and industrial policies including ICT. The implementation of the smart specialisation strategy and of the national funding programmes should ensure synergies and alignment of priorities (H2020 PSF 2015).

The PSF panel recommends that Bulgaria strengthens its EU funding capacities by establishing a Sciences/ EU Funding Liaison Office in Brussels and a full-time professional National Contact Point (NCP) Network. Both actions will contribute to reinforcing the capacities of national researchers and teams to successfully take part in EU funding programmes.

Challenge 3: Fostering innovation and science – business cooperation

Description

According to the Innovation Union Scoreboard 2015¹¹ Bulgaria belongs to the group of modest innovators (together with Latvia and Romania), whose level of innovation performance is less than 50% of the EU average. The Global Competitiveness Report 2014-2015 of the World Economic Forum¹² ranks Bulgaria 113th out of 144 countries after assessing the university-industry collaboration in R&D and 108th based upon capacity for innovation. According to the same report, the country is at the 48th place in Patent Cooperation Treaty (PCT) patents (applications/million population). The respective figures from the Global Competitiveness Report 2015-2016¹³ are 112th out of 140 (university-industry collaboration in R&D), 79th with respect to capacity for innovation and 45th in terms of PCT patent applications. In practice 'islands' of excellence exist, but the system lacks sufficient capacity and key linkages.

⁹ Europe 2020: National Reform Programme 2015 of Bulgaria

¹⁰ Ibid.

¹¹ http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/files/ius-2015_en.pdf/

¹² <https://www.weforum.org/reports/global-competitiveness-report-2014-2015/>

¹³ <http://reports.weforum.org/global-competitiveness-report-2015-2016/>

The Bulgarian National Research Innovation System (NRIS) is characterized by a separation of the publically funded research and development segment on one hand, and the private sector innovation segment on the other. The lack of complementarity between the activities of the beneficiaries and stakeholders of the two segments is one of the main challenges of the innovation system. According to the World Bank Report "Input for Bulgaria's Research and Innovation Strategies for Smart Specialization" (February 2013)¹⁴, "Science policy and funding instruments in Bulgaria have been designed with the idea of the "supply-push" model, in which scientists are at the origin of the project, the main barrier is selling the new idea on the market and the technological sophistication and risks tend to be high to medium. In this context, the priority is to give scientists the resources to develop their projects until the applications are clear, under the assumption that a private partner can be attracted later on." The low level of R&D spending, in particular in the enterprise sector, along with the quality gaps and almost non-existent linkages between research and the needs of the productive sector are key reasons for Bulgaria's comparatively poor record of innovation. The private sector is dominated by SMEs (the largest share of which in trade), and they are at difficulty to allocate funds to R&D, do not have their own technologies and capabilities to develop innovations, which are crucial for individual industries or group of industries.

Bulgaria faces a series of obstacles in increasing entrepreneurial activity in the Public Research Organisations (PROs) with regard to legal ambiguity and apparent contradiction in the status and activities of its research organisations. PROs such as the Bulgarian Academy of Sciences (BAS) and the public universities are by definition 'non-profit organisations'. As they are increasingly encouraged to embrace a model of entrepreneurship and become partners in the Open Innovation system, PROs find themselves acting more as commercial entities – licensing their research results to the private sector for money bearing royalties, starting and taking an ownership stake in commercial spin-off companies, negotiating and signing contract agreement to provide research services.

Failure to set-up institutional level legislation to protect and transfer research results has a negative effect on the commercialisation of research in Bulgaria. The most obvious omission is speed to implement the "Commission Recommendation on the management of intellectual property in knowledge transfer activities and Code of Practice for universities and other public research organisations"¹⁵. This recommendation is designed to help the identification, protection and efficient transfer of intellectual property of all types, created in PROs, to the private sector. Only the Bulgarian Academy of Sciences (BAS) appears to have set up and implemented an institutional IP Policy. Without this institutional framework entrepreneurial researchers will continue to commercialise research privately. This informal approach not only fails to benefit the PRO, it also tends to keep commercialisation activity artificially low, as Bulgarian researchers do not want to draw attention to their 'grey' activities and also lack the necessary support to realise the full potential of their inventions (H2020 PSF 2015).

Policy response

In order to rectify the trends of low innovation and to improve the competitiveness of the country, an Innovation Strategy for Smart Specialisation of the Republic of Bulgaria 2014-2020 (RIS3) was adopted. Its objective is by 2020 Bulgaria to move from the group of "modest innovators" to the group of "moderate innovators". The strategy provides for annual monitoring, and twice during the period – evaluation by independent experts of the effectiveness of measures aimed at achieving the objectives formulated in the Strategy¹⁶.

¹⁴ <http://www.mi.government.bg/>

¹⁵ http://ec.europa.eu/invest-in-research/pdf/download_en/ip_recommendation.pdf/

¹⁶ According to Europe 2020: National Reform Programme 2015 of Bulgaria

During the period 2015-2017, €5.11m will be directed each year through the National Innovation Fund to support the innovation environment. In November-December 2014, 80 projects in two successive sessions of the Fund were approved. The subsidy disbursed amounts to €3.42m¹⁷.

Support for increasing the innovation activities of undertakings is also envisaged under Operational Programme "Innovations and Competitiveness" 2014-2020 (OPIC). Within OPIC, a procedure with a budget of €40m for promoting innovation activities of undertakings and a procedure with a budget of €150m for enhancing the production capacity of undertakings are planned for 2015. In parallel, the implementation of projects to improve the innovation infrastructure (setting up and development of technology transfer offices, technology centres, development of "Sofia Tech Park") and increasing innovation activities in companies under Operational Programme "Development of the Competitiveness of the Bulgarian Economy" 2007-2013" (OPDCBE 2007-2013) continues¹⁸.

Assessment

It is necessary to stimulate both the supply and demand sides in the innovation system and to create professional support services that encourage their interaction. A refocus away from 'supply driven' innovation towards 'demand driven' innovation is needed. This is likely to mean a strong refocus of policy support instruments and in particular introducing more measures that will stimulate a need for knowledge generation and transfer from PROs to companies. This should include flexible schemes to transfer knowledge through employment of skilled individuals. For those research groups who's science does out-strip the existing absorption capacity of domestic companies there is a need to focus on entering global supply chains and, if appropriate, to encourage the formation of spin-off companies. The present focus on stimulating business R&D through tax incentives should be widened to include 'proof of concept' funds, innovation vouchers that can be 'spent' with a public sector R&D partner, matching grant schemes for companies tailored to the needs of different target groups, e.g. sector, age and growth potential, and schemes to transfer knowledge through flexible human resource capital deployment, e.g. Innovation Assistants and Knowledge Transfer Partnerships (H2020 PSF 2015).

¹⁷ Ibid.

¹⁸ Ibid.

1. Overview of the R&I system

1.1 Introduction

Bulgaria is a medium-sized member state of the EU, 16th in terms of territory, with a population of 7.2 million, or 1.4% of the EU-28 population (Eurostat, July 2015). The adverse demographic development (Table 1) is due to both low birth rate (high mortality rate) and high emigration levels. According to the EC 2015 Ageing Report: Economic and budgetary projections for the 28 EU Member States (2013-2060)¹⁹, the population of the country is expected to decrease as low as 5.5 million in 2060.

Table 1: Total population (Bulgaria and EU)²⁰

	Population 1.1.2014 (in 1 000)	Population 1.1.2015 (in 1 000)	Change 2015/2014 (per 1 000 persons)	Share in EU population, 1995	Share in EU population, 2015
EU	506 857.5	508 191.1	2.2	100%	100%
Bulgaria	7 245.7	7 202.2	-6.0	1.7%	1.4%

Source: Eurostat, July 2015

The Gross Domestic Product (GDP) at market prices for Bulgaria is for 2014 €5,900 per inhabitant (Eurostat, December 2015). In 2014 its GDP per capita in purchasing power standard is at 47% of the EU-28 average.

Table 2: GDP per capita in PPS (Bulgaria and EU; Index EU28=100)

	2007	2008	2009	2010	2011	2012	2013	2014
EU	100	100	100	100	100	100	100	100
Bulgaria	41	44	45	45	45	46	46	47

Source: Eurostat, December 2015

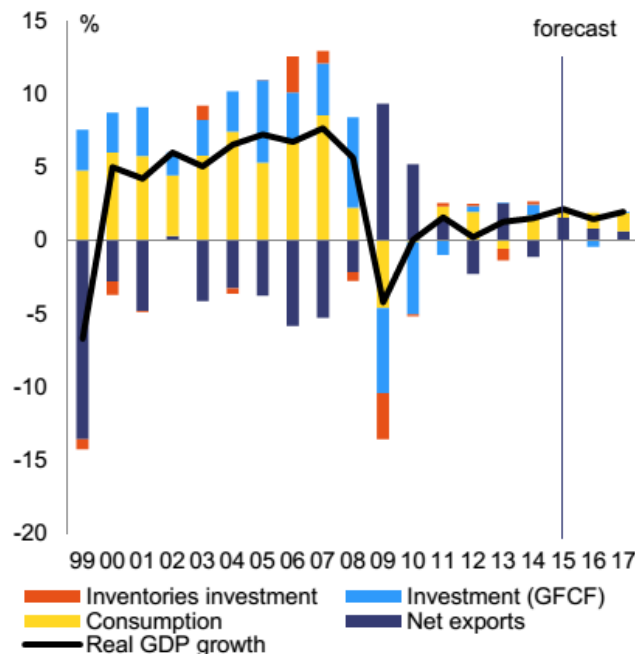
The GDP growth in 2009 has been negatively affected predominantly by the global financial and economic crisis. Bulgaria's economic performance has also remained subdued during the post-crisis period. After the sharp decline in economic activity in 2009, growth has been fluctuating around 1% per year, and is forecast to remain so in the short term (Figure 1). Prices stagnated, followed by deflation expected to extend throughout the whole 2013-2015 period.

¹⁹ EUROPEAN ECONOMY 3|2015 Economic and Financial Affairs ISSN 1725-3217 (online) ISSN 0379-0991 (print)

²⁰ Eurostat, Statistics Explained article "Population and population change statistics", available on the Eurostat website: http://ec.europa.eu/eurostat/statistics-explained/index.php/Population_and_population_change_statistics/

Potential growth estimates indicate limited convergence towards EU average productivity and income levels in the short term. Ageing, emigration and inactivity are becoming a long-term drag on employment and growth. Continued uncertainty, caused by domestic and external factors, is likely to cause companies to focus on productivity gains rather than job creation in 2015-16, in line with the situation in place since 2008.

Figure 1 Real GDP growth by demand components (Bulgaria)



Source: European Commission

http://ec.europa.eu/europe2020/pdf/csr2016/cr2016_bulgaria_en.pdf

The negative effects of the crisis were to a certain degree mitigated in Bulgaria compared to other EU member states due to the country's favourable sound fiscal policies and small debt burden (*Table 3*). However, Bulgaria's competitiveness remains based on low corporate and personal taxes (10%) and the low cost of relatively skilled labour rather than on quality-related factors such as innovation and knowledge base. Shadow economy is estimated²¹ to reach 30.6% of GDP, which remains highest in the EU. Poverty and social exclusion raise a particular concern for Bulgaria, underpinned by high levels of income inequality.

²¹ Friedrich Schneider, January 2015, Size of the Shadow Economy, available on: <http://www.econ.jku.at/members/Schneider/files/publications/2015/ShadEcEurope31.pdf/>

Table 3: Main features of the country forecast (Bulgaria)

	BGN*	2014	Annual Percentage Change					
			2012	2013	2014	2015	2016	2017
	Current prices	% GDP						
GDP	83.6	100.0	0.2	1.3	1.5	1.7	1.5	2.0
Private consumption	52.6	63.0	3.3	-1.4	2.7	0.7	1.4	1.7
Public consumption	13.8	16.5	-0.5	2.2	0.1	0.1	1.2	1.3
Gross Fixed Capital Formation	17.7	21.1	1.8	0.3	3.4	0.2	-2.4	1.7
of which equipment	7.4	8.8	-5.5	1.2	13.9	0.1	2.0	3.0
Exports	54.4	65.1	0.8	9.2	-0.1	5.9	4.3	4.6
Imports	55.2	66.0	4.5	4.9	1.5	4.0	3.0	4.1
Contribution to GDP Growth	Domestic demand		2.4	-0.5	2.5	0.5	0.6	1.6
	Inventories		0.2	-0.8	0.2	0.0	0.0	0.0
	Net exports		-2.3	2.6	-1.1	1.2	0.9	0.4
Employment			-2.5	-0.4	0.4	0.3	0.3	0.5
Unemployment (a)			12.3	13.0	11.4	10.1	9.4	8.8
General Government Balance (b)			-0.6	-0.8	-5.8	-2.8	-2.7	-2.7
Cyclically-Adjusted Budget Balance (c)			-0.5	-0.8	-5.7	-2.6	-2.4	-2.4
Structural Budget Balance (c)			-0.5	-0.8	-2.5	-2.6	-2.4	-2.4
General Government Gross Debt (b)			17.6	18.0	27.0	31.8	32.8	33.6

a) as % of total labour force; (b) as a % of GDP; (c) as a % of potential GDP

Note: Contributions to GDP growth may not add up due to statistical discrepancies.

Source: European Economic Forecast, Autumn 2015 (*1 EUR=1.95583 BGN)

According to the Country Report Bulgaria 2015²² the crisis' negative effect on employment has not been confined to traditionally vulnerable labour market groups. Unemployment is mostly long-term, underlining its largely structural nature, in the absence of well-targeted and sufficient activation policies for the most vulnerable. School-to-job transition is still problematic. The gaps in the education and training systems and the need for a stronger link to the labour market hamper the supply of a suitably-skilled labour force to the economy.

Unsurprisingly, investment in the economy remains low and gross fixed capital formation has stayed broadly flat in real terms since 2009. Private sector investment has been declining since 2008 and is only expected to stabilise in 2016, when uncertainty is expected to decrease, both domestically and abroad. While public investment growth was the main driver of gross fixed capital formation in 2013 and 2014, mainly linked to increased use of available EU structural funds, its contribution to growth is projected to turn slightly negative in 2015, as the 2007-2013 programming period is coming to an end while the government is implementing consolidation measures. Public investment is expected to weaken further in 2016, as EU co-financed projects under the new operational programmes take time to be implemented. Weak investment activity (both internally and from abroad) remains one of the key impediments to growth.

The Commission's Annual Growth Survey²³ recommends three main pillars for the EU's economic and social policy in 2015: investment, structural reforms and fiscal responsibility. The Investment Plan for Europe²⁴ additionally explores ways to maximise the impact of public resources and unlock private investment. The Country-Specific Recommendations (hereafter CSR) for Bulgaria in 2014²⁵ concerned public finances, the pension system, labour market, education, business environment and the energy sector. The CSR in 2015²⁶ also underline the importance of the banking sector, social security, exclusion and reform of the insolvency sector.

Political instability and banking sector turbulence had a negative impact on confidence in 2014. Government finances also deteriorated considerably in 2014. The general government deficit has increased from 0.9% of GDP in 2013 to 2.8% of GDP in 2014, as a result of some expenditure over-runs and weaker-than-expected revenues. There is a risk to the final headline deficit concerning the statistical recording of the financial sector support measures. The government deficit is estimated at 2.9% of GDP in 2015, mostly due to weaker indirect tax revenue, and to stay at 2.9% in 2016, based on a no-policy-change assumption. Bulgaria's structural deficit is projected at around 2½% over 2014-16, reflecting the negative output gap. General government gross debt increased from 18.3% at end 2013 to 27.6% of GDP in 2014 and 29.8 in 2015, reflecting the support to the financial sector as well as the increased budget deficit. By the end of 2016, government debt is expected to reach 31.2% of GDP.

²² http://ec.europa.eu/europe2020/pdf/csr2015/cr2015_bulgaria_en.pdf/

²³ http://ec.europa.eu/europe2020/pdf/2015/ags2015_en.pdf/

²⁴ http://ec.europa.eu/priorities/jobs-growth-investment/plan/index_en.htm

²⁵ http://ec.europa.eu/europe2020/making-it-happen/country-specific-recommendations/2014/index_en.htm

²⁶ http://ec.europa.eu/europe2020/making-it-happen/country-specific-recommendations/2015/index_en.htm

In 2014 the Commission concluded²⁷ that Bulgaria was experiencing macroeconomic imbalances, which require monitoring and policy action. The Economic Surveillance Process continues with the Macroeconomic Imbalance Procedure (MIP) review for Bulgaria²⁸, which includes an In-Depth Review — as per Article 5 of Regulation 1176/2011, as well as analyses of key macroeconomic issues. The main findings concern:

- the key risks for fiscal sustainability in the medium and long run (pensions and healthcare, SOEs in the energy and transport sector, tax collection);
- the gaps in key growth enablers, ranging from complex regulation and weak administrative capacity, over high compliance costs for businesses, to high energy intensity coupled with low energy efficiency and the poor quality of rail and road transport infrastructure;
- the independent, high-quality and efficient judicial system as a building block for an investor-friendly business environment.

The European Economic Forecast²⁹ expects that Bulgarian exports grow faster than imports over 2015 and 2016, as international demand increases and leads to a positive contribution of net exports to economic growth. Exporting industries in Bulgaria are also expected to benefit from the depreciation of the euro, to which the national currency (Bulgarian lev, BGN) is pegged, especially given that a sizeable portion of Bulgarian exports goes to non-euro area countries. Imports growth is expected to remain modest, in line with weakening domestic demand. Concerning exports, the 2015 MIP review³⁰ confirms that Bulgaria appears well-positioned to increase its exports. A detailed look at the geographical and product specialisation of the country shows that for the 2008-2014 period it has managed to expand its share both in the products it exports and in the share of imports of its trading partners. Moreover, the main trading partners exhibit positive market dynamism (their markets are growing faster than the world average) and Bulgaria is able to increase its share of this growing market.

With respect to the GDP from the output side, data³¹ (Eurostat, May 2015) demonstrates the relative importance of 10 activities in terms of their contribution to gross value added. Between 2003 and 2013, Bulgarian industry's share of value added enlarged to 25.2% (unlike EU28), remaining ahead of distributive trades, transport, accommodation and food services (19.5%). The next largest activities in 2013 were public administration, defence, education, human health and social work activities (14.4%), followed by real estate activities (9.7%). Negative trends can be observed for agriculture (incl. hunting, forestry and fishing) (down to 4.9% from 10.4%), distributive trades, transport, accommodation and food services (19.5% from 22.2%) and real estate activities (9.7% from 11.5%), while ICT (up from 4.2% to 5.4%), financial and insurance activities (4.2% to 7.2%), professional, scientific, technical, administrative and support services (3.9% to 5.6%), as well as arts, entertainment and recreation (1.2% to 2.4%) tend to increase. Despite the growth of the share of professional, scientific, technical, administrative and support services in Bulgaria, it still represents nearly half the EU28 share (10.4%).

²⁷ 2014 In-Depth Review for Bulgaria, March 2014; Commission's Alert Mechanism Report, November 2014

²⁸ Macroeconomic Imbalances Country Report – Bulgaria 2015, available at:

http://ec.europa.eu/economy_finance/publications/occasional_paper/2015/pdf/ocp213_en.pdf/

²⁹ http://ec.europa.eu/economy_finance/publications/eeip/pdf/ip011_en.pdf/ and

http://ec.europa.eu/economy_finance/publications/eeip/pdf/ip020_en.pdf/

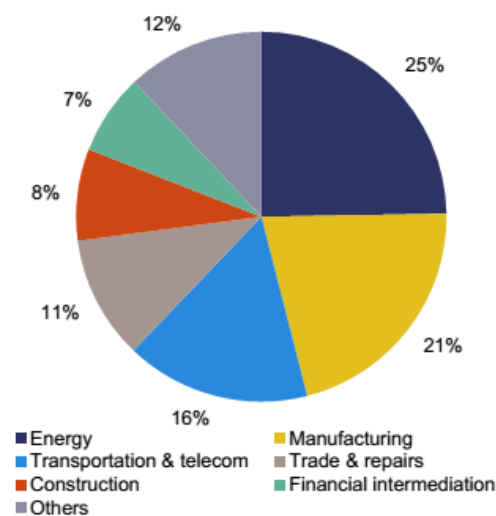
³⁰ http://ec.europa.eu/economy_finance/publications/occasional_paper/2015/op213_en.htm

³¹ http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Gross_value_added_at_basic_prices,_2003_and_2013_%28%25_share_of_total_gross_value_added%29_YB15.png/

The European Commission is promoting a gradual process of re-industrialisation of the European Union³², to bring back industry's weight to 20% of the EU's GDP by 2020, which is the case for Bulgaria currently. FDI inflows have benefited the economy as a whole and, in particular, sectors like manufacturing and financial services, by raising productivity and improving the country's export performance. A large proportion of FDI in the pre-crisis period went also into construction and real estate investments, and indirectly tourism.

The FDI flows in the post-crisis period have been more balanced in their industry (sectoral) composition. Notably, the energy sector, including renewable energy sources, has particularly attracted the investor's attention (25%). Manufacturing has attracted 21% of the investment flows, followed by transport and telecom investments (16%), while investment in construction and real estate has slowed down considerably.

Figure 2 FDI inflows, 2010-2014 (Bulgaria)



Source: Bulgarian National Bank

There is no statistical evidence that Foreign Direct Investment (FDI) is being attracted by innovation-related incentive schemes or the existing science base, except for possibly ICT-related and outsourcing services. FDI presence seems to be linked to the affordable labour force (esp. with foreign language skills) and the low flat level of corporate tax. Bulgaria predominantly specialises in low-tech production, and the export structure is still biased towards raw materials and primary products, instead of high value-added products and knowledge-intensive services. The sectors that continue to possess competitive advantages are defined as (NACE definitions): food, beverages and tobacco; wood, paper, paperboard and articles thereof; furniture; basic metals and fabricated metal products except machinery and equipment; cars and other vehicles; computer and electronic products, electrical equipment; pharmaceuticals.

R&D intensity increased from 0.62% of GDP in 2012 to 0.65% in 2013 and to 0.8% in 2014. Public R&D intensity (the lowest in the EU) decreased sharply from 0.31% in 2009 to 0.21% in 2013, as during the peak of the economic crisis the government considerably reduced national funding for innovation.

³² Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the regions for a European industrial renaissance (com/2014/014 final)

Although not fully utilised, European funds became the main and largest source of investment for R&D in Bulgaria. Private R&D intensity increased from 0.15% in 2009 to 0.38% in 2012, 0.4% in 2013 and 0.52% in 2014. The investment has one of the lowest rates in the EU28 (in both absolute and relative terms), the difference being drastic. In 2014 GERD per capita in Bulgaria equals 46.3 euro, while the EU28 average reaches 558.4 euro. According to the Global Innovation Index (GII) for 2013³³, Bulgaria ranks 41st out of 142 countries.

Yet, the ranking for 'Investment' is 114th, together with the 'University/Industry Research Collaboration'. The GII 2014³⁴ overall rank is 44th out of 143 countries and the GII 2015³⁵ improved to 39th out of 141 countries.

Tackling the challenges for R&D&I is crucial to achieving sustainable economic growth in perspective. In 2013 the European Commission³⁶ reported the Index of Economic Impact of Innovation for Bulgaria to be 0.234, far below the EU average of 0.612. Bulgaria has a strategic focus to move up the value chain and away from a sectoral specialisation in low technologies. Intensive private investment and impact have been shown to be possible for example in the ICT sector, and this model can be spread multi-sectorally and capitalised upon. This will require increased public investment in researchers and infrastructures, as well as fostering an environment that is conducive to private investment and mutually-beneficial collaborations between universities and business. In other words, a substantial increase in R&D spending (the country target being 1.5% of GDP by 2020), both in absolute and relative terms, is a prerequisite for Bulgaria to raise its economic competitiveness and secure high-quality jobs, along with key system reforms. The identified hot-spots in key technologies refer to Agriculture, Nano- and Biotechnology, ICT and Energy. A new mechanism for effective coordination between the structures and institutions that support the executive in conducting scientific and innovation policy in Bulgaria is under development. Strategic planning and effective and timely policy implementation define the two fundamental tools for the country to seize the economic growth potential of innovation.

The National Reform Programme: 2015 update³⁷ reports steady progress towards achieving the 2020 target set for the country (1.5), concerning R&D expenditure as % of GDP. In 2015 the Policy Support Facility instrument under the Horizon 2020 programme³⁸ is applied. The first activity requested from the PSF is a Peer Review to support wide-ranging reforms in Bulgaria. The Bulgarian national authorities expressed a strong political commitment to this exercise. More concretely, the aim of the peer review is to provide external advice in the process of evaluating and improving the R&I system. With respect to the target and given stable political and economic situation, the panel recommends that the government makes a renewed and realistic commitment to move upwards in the R&D intensity rankings at least from the current level of 0.65% of GDP in 2013, one of the lowest in the EU, to 1% in 2020, assessed as realistic and achievable one. Public funding is confirmed to play a decisive role in attaining the goal, well beyond the approximate 0.2% level at present. However, as a prerequisite to the success of R&I investment increase, three pillars of major structural reforms are identified:

Improve the funding instruments, especially by concentrating funding to reward high performance and stimulate excellent research results;

³³ http://www.wipo.int/edocs/pubdocs/en/economics/gii/gii_2013.pdf

³⁴ <https://www.globalinnovationindex.org/userfiles/file/reportpdf/GII-2014-v5.pdf>

³⁵ <https://www.globalinnovationindex.org/userfiles/file/reportpdf/GII-2015-v5.pdf>

³⁶ Research and Innovation Performance in Bulgaria: Country Profile 2013

³⁷ <http://www.minfin.bg/en/page/867/>

³⁸ <http://ec.europa.eu/programmes/horizon2020/en/tags/policy-support-facility/>

Strengthen the human resources capacities, especially by investing in talent attraction and retention; and

Incentivise the opening up of the science base to business and support public-private cooperation, especially by creating and developing an innovation eco-system.

Table 4: Main R&I indicators 2012-2014 (Bulgaria and EU)

Indicator	2012	2013	2014	EU average
GDP per capita in €	5,700	5,800	5,900	27,400 (2014)
GDP growth rate in %	0.2	1.3	1.5	1.4 (2014)
Budget deficit as % of public budget	17.6	18.0	27.0	86.8 (2014)
Government debt as % of GDP	-0.6	-0.8	-5.8	-3.0 (2014)
Unemployment rate as % of the labour force	12.3	13.0	11.4	10.2 (2014)
GBAORD in €m	101.144	102.476	105.626	92828.145 (2014)
GERD as % of the GDP	0.62	0.65	0.80	2.03 (2014)
GERD (€ per capita)	34.6	36.6	46.3	558.4 (2014)
Employment in high- and medium-high-technology manufacturing sectors as % of total employment	3.6	3.8	3.8	5.7 (2014)
Employment in knowledge-intensive service sectors as % of total employment	29.8	30.3	30.9	39.8 (2014)
Turnover from innovation as % of total turnover	14.2 (2008)	7.6 (2010)	4.2 (2012)	11.9 (2012)
Value added of manufacturing as % of total value added	26.2 (2011)	25.6 (2012)	25.4 (2013)	26.2 (2012)
Value added of high tech manufacturing as % of total value added	0.0 (2011)	1.4 (2012)	1.5 (2013)	2.5 (2012)

Source: JRC (and National Statistical Institute)

1.2 Structure of the national research and innovation system and its governance

1.2.1 Main features of the R&I system

Innovation Union Progress in 2014³⁹ indicates that Bulgaria's research and innovation system face serious challenges. Inefficiencies and fragmentation in the allocation of funds for R&I, coupled with insufficient and falling public funding, impede any build-up of R&I capacities in Bulgaria. Low salary levels and outdated research infrastructures fail to retain young and qualified domestic researchers and to attract foreign ones, leading to a continuous brain drain and an ageing R&D staff. Consequently, the key performance indicators exhibit levels far below EU averages or global competition (e.g. US).

Table 5: Key indicators of research and innovation performance (Bulgaria, EU and US)

Key Indicators of Research and Innovation Performance					
R&D Intensity			Excellence in S&T¹		
2012	0.64%	(EU: 2.07%; US: 2.79%)	2012	24.5	(EU: 47.8; US: 58.1)
2007-2012	+7.1%	(EU: 2.4%; US: 1.2%)	2007-2012	+0.3%	(EU: +2.9%; US: -0.2%)
Innovation output indicator			Knowledge-intensity of the economy²		
2012	65.3	(EU: 101.6)	2012	33.5	(EU: 51.2; US: 59.9)
			2007-2012	+2.8%	(EU: +1.0%; US: +0.5%)
Areas of market S&T specialization:			HT+MT contribution to the trade balance		
Food and agriculture, biotechnology, energy, construction, environment and ICT			2012	-5.2%	(EU: 4.23%; US: 1.02%)
			2007-2012	<i>n.a.</i>	(EU: +4.8%; US: -32.3%)

¹ Composite indicator that includes PCT per population, ERC grants per public R&D, top universities and research institutes per GERD and highly cited publications per total publications

² Composite indicator that includes R&D, skills, sectoral specialization and internationalization sub-indicators

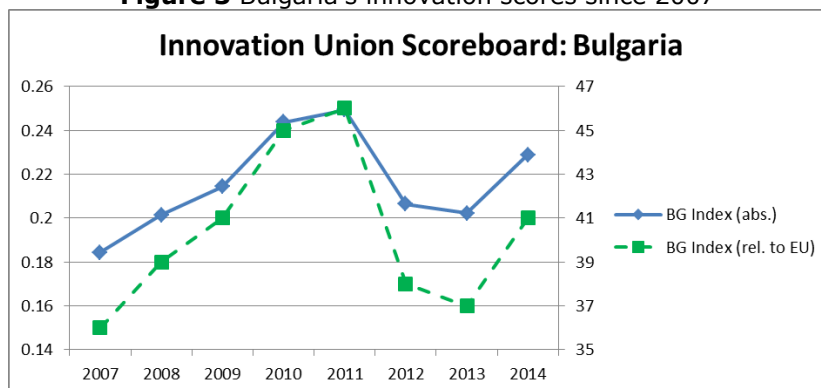
Source: Research and Innovation Performance in the EU: Innovation Union Progress at Country Level 2014, Bulgaria

Innovation Union Scoreboard (IUS) 2015⁴⁰ describes Bulgaria is a modest innovator (ranking 27th out of EU28), although one of the fastest growing countries along with Malta, Latvia, Ireland, the UK and Poland. Innovation performance has been steadily increasing over time until 2011, after which it strongly declined in 2012 and 2013, to increase again in 2014. Performance relative to the EU declined from 46% in 2011 to 37% in 2013, and is at 41% for 2014. Bulgaria's relative strengths are in human resources and intellectual assets. The country has a large share of highly educated people and performs well in applying for community trademarks and designs. Linkages and entrepreneurship and finance and support are the main weaknesses, in particular due to very low venture capital investments. For all indicators, except for youth with upper secondary level education and community designs, Bulgaria is performing below the average of the EU (IUS 2015).

39 Research and Innovation Performance in the EU: Innovation Union Progress at Country Level 2014, Bulgaria

40 http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/files/ius-2015_en.pdf

Figure 3 Bulgaria's innovation scores since 2007



Source: IUS 2015

From an external perspective, Bulgaria has been classified in the past as a country with 'peripheral' participation in international science⁴¹. In 2014 there are 115 Bulgarian scientific publications, referred and indexed in established world databases (e.g. SCOPUS, Thompson Reuters, AGRIS – FAO, CABI, EBSCO Publishing). The SCOPUS list contains 66 publications, out of which 39 active. Towards December 2015 SCOPUS contains 3028 documents of Bulgarian scientists and researchers⁴², published in 2015. According to the August 2015 update, Bulgaria is represented by 18 scientific publications in Thompson Reuters Science Citation Index Expanded⁴³ and by 1 in the Art & Humanities Citation Index⁴⁴. There are no Bulgarian publications in Social Sciences Citation Index⁴⁵. In order to achieve a more effective national research system – including increased competition within national borders and sustained or greater investment in research, Bulgaria has committed itself to active European Research Area (ERA) participation. A key aim for ERA is "to reduce both brain drain, notably from weaker regions, as well as the wide regional variation in research and innovation performance, aiming at excellence across the Union through smart specialisation"⁴⁶. In view of open innovation and the increasingly collaborative nature of science, completing ERA⁴⁷ also means realising the 'fifth freedom' - free circulation of researchers and scientific knowledge, including via digital means.

Internally, the Bulgarian R&I system is composed of (non-integrated) public and private segments. The public segment comprises of the state-owned higher (or tertiary) educational institutions (i.e. universities, as the system can be described as unitary), public research organizations (mainly the two leading academies - Bulgarian Academy of Sciences (BAS)⁴⁸, Agricultural Academy (AA)⁴⁹, both guided by separate laws) and the public research institutes (centres/labs) under different sectoral ministries or agencies (e.g. in the field of criminology under the Ministry of Interior; in the field of veterinary medicine under the Food Safety Agency, etc.).

⁴¹ e.g. Edward Shils, *Center and Periphery: Essays in Macrosociology*. Chicago: University of Chicago Press 1975.

⁴² The number can increase given the varying periods of submission of the publications.

⁴³ http://ip-science.thomsonreuters.com/mjl/publist_sciex.pdf/

⁴⁴ http://ip-science.thomsonreuters.com/mjl/publist_ah.pdf/

⁴⁵ http://ip-science.thomsonreuters.com/mjl/publist_ssci.pdf/

⁴⁶ Communication from the Commission to the European Parliament, the Council, the EESC and the CoR: A Reinforced European Research Area Partnership for Excellence and Growth, COM(2012) 392 final

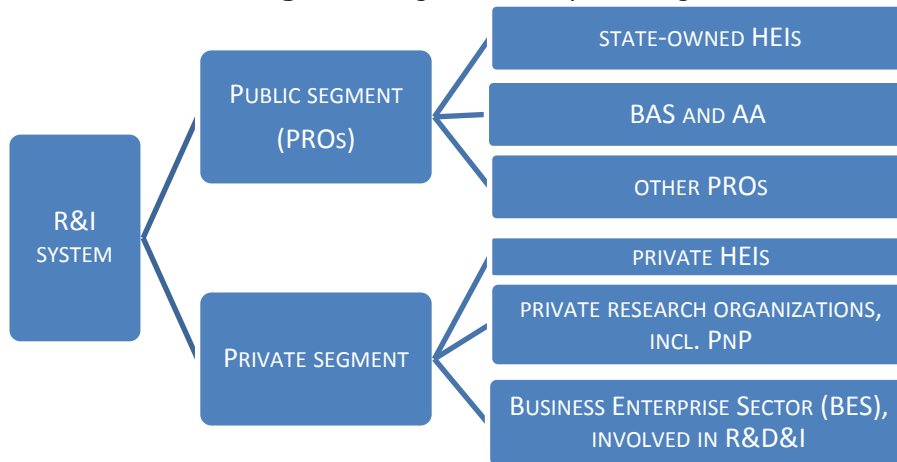
⁴⁷ European Council Presidency Conclusions 3208/11 December 2012

⁴⁸ <http://www.bas.bg/>

⁴⁹ <http://www.agriacad.bg/>

The private segment covers private performers, which could be higher institutions (i.e. private universities), private research organizations (including registered as non-profit NGOs) or enterprises, involved in R&D&I.

Figure 4 Bulgaria's R&I system segments



Source: Authors' Own Data

The system is highly centralised in terms of regulation and control and the regions (NUTS II), the districts (NUTS III) and the municipalities have limited responsibilities in the area of higher education, R&D and innovation policy. The competences have been clearly divided between Ministry of Education and Science⁵⁰ (oriented towards the public segment) and Ministry of Economy⁵¹ (dealing with the private segment). Similarly, policies are devised and implemented separately, whilst funding and support depend on the type of beneficiary, not the R&I field or the opportunities for joint projects and initiatives. The only exception from this 'rule of thumb' relates to ERDF 2007-2013 financing for Priority Axis 1 'Development of a Knowledge-Based Economy and Innovation Activities' of OP Competitiveness⁵², whereby:

The Ministry of Education and Science (MES) initiates and subsequently implements the key legislative acts, which constitute the legislative framework of the whole education and science system, each element of which being governed by a separate legal act:

- Law on Public Education (<http://www.mon.bg/>)
- Law on the Educational Degrees, General Educational Minimum and Curriculum (<http://www.mon.bg/>)
- Law on Pre-School and School Education (<http://www.mon.bg/>)
- Law on Secondary Education (<http://www.mon.bg/>)
- Law on Professional Education and Training (<http://www.mon.bg/>)
- Law on Higher Education (<http://www.mon.bg/>)
- Law on Promotion of Scientific Research (<http://www.mon.bg/>)
- Law on Development of Academic Staff (<http://www.mon.bg/>)
- Law on Student and Doctoral Credits (<http://www.mon.bg/>)

⁵⁰ <http://www.mon.bg/>

⁵¹ <http://www.mi.government.bg/>

⁵² <http://www.opcompetitiveness.bg/>

- Law on Youth (under the responsibility of the Ministry of Youth and Sports) (<http://www.mpes.government.bg/>)
- Law on Physical Education and Sport (<http://www.mpes.government.bg/>).

The legislative acts are directed at each specific element of the system, allowing for in-depth regulation. Yet, it might be advisable to take into account also the continuity within the system and the interdependency of the stages involved, as well as the different complementarities - science, scientific infrastructure and innovation with accent on excellence. Similarly, up till now strategic policy-making and implementation (including the set-up of administrative structures and the evaluation of strategic policy documents) have focused on the above-mentioned individual elements. The following list of applicable strategic and policy documents is by no means exhaustive:

- Strategy for Development of Higher Education (<http://www.mon.bg/>)
- Strategy for Secondary Education (<http://www.mon.bg/>)
- Strategy for Life-Long Learning (LLL) (<http://www.mon.bg/>)
- Strategy for Research Development (<http://www.mon.bg/>)
- Strategy for Educational Integration (<http://www.mon.bg/>)
- Strategy for Effective implementation of ICT in Education and Science (<http://www.mon.bg/>)
- Strategy for Professional Education and Training (<http://www.mon.bg/>)
- Strategy for Development of Pedagogic Staff (<http://www.mon.bg/>)
- Strategy for Promoting and Increasing Literacy (<http://www.mon.bg/>)
- Strategy for Reducing the Share of Early School Leavers (<http://www.mon.bg/>)
- Strategy for the Child 2008-2018 (<http://www.mlsp.government.bg/>).

As already discussed, the high number of strategies provides an opportunity for more detailed and concrete guidance and clearer implementation principles. Nonetheless, the continuous 'compartmentalization' of education levels and eventually science may impede overall reform, since gaps in individual (earlier) elements eventually affect all (later) elements of education and science, as visible by the low number of PhD students (6 617 for academic year 2014/2015⁵³) in Bulgaria. For example, the strategies mentioned above could with equal effect be integrated as chapters in one policy document (e.g. Vision for Education and Life-Long Learning (LLL) in Bulgaria: 2020). At the same time, educational and scientific activities are somehow negligently merged with respect to, for instance, ICT penetration, as the two require completely different policy and support instruments. Last but not least, a national innovation and science agenda is possibly under way with the integration of the research policy and infrastructure within the Innovation Strategy for Smart Specialization.

The institutional autonomy is legally guaranteed for state-owned universities and the two academies (BAS and AA), but all of them remain highly (if not fully) dependent upon centralised financial support. Besides EC programmes, MES directs at present the financing for scientific research in Bulgaria, both on an institutional basis (for HEIs⁵⁴ and BAS) and competitively (through the Scientific Research Fund). All public HEIs are financed per number of (accepted and enrolled) students, rather than on the basis of performance. In other words, each institution receives a fixed amount allocated budget based on academic headcount. Research on the other hand has been traditionally in the realm of the Bulgarian Academy of Sciences, which hardly engages in direct teaching. The public research institutes of BAS receive their budget as approved by the Parliament, where MES is an intermediary without supervisory power. Despite this practically 'binary' system and the scarcity of allocated public resources, funding for research is distributed widely across nearly all public participants in the system.

⁵³ according to the National Statistical Institute (NSI) data

⁵⁴ also on the basis of Ordinance No9

The HEIs receive on average 2.6% of their funding targeted for research⁵⁵. Thus, spreading the limited research budget thinly and enabling the possibility for its re-allocation for non-core research activities leads to quality gap and young researcher deficits.

Regarding the competitive funding for scientific research, MES supervises the governance of the Scientific Research Fund (SRF)⁵⁶, covering diverse priorities so far, and both basic and applied research. The SRF was established in 1990 as a modern structure for financing of scientific research and innovation. This was one of the first steps in introduction of project financing for R&D in Bulgaria. Throughout the years, the SRF has faced the challenge to establish itself as a reliable institution promoting the development of the Bulgarian science and research activities and their contribution to economic development. The rules for SRF (www.mon.bg) stipulate an open competition for bidding among all eligible research performers. SRF is also responsible for the Bulgarian Research Information System (BulCRIS) as a single register for detailed information about Bulgaria's research, development and innovation resources.

The private segment of the Bulgarian R&I system on the other hand interacts predominantly with the Ministry of Economy (MoE), coordinating the national budget and external financing for private R&D&I activities. The main instrument for disbursements of public funding for R&D in the private sector since 2006 is the National Innovation Fund (NIF), governed by its rules (www.sme.government.bg) and MoE policy, while implemented by the Bulgarian Small and Medium Enterprises Promotion Agency (BSMEPA). NIF allows for competitive funding for applied research and innovation on a project basis. Most EU and other external funding platforms directed at private actors are also within the scope of responsibility of MoE: Operational Programme 'Development of the Competitiveness of the Bulgarian Economy' 2007-2013 (OPC), including JEREMIE⁵⁷, Operational Programme 'Innovation and Competitiveness' 2014-2020 (OPIC), Operational Programme 'SME Initiative' 2014-2020, COSME, Eureka, Eurostars, European Space Agency (ESA) cooperation and others.

Currently, the most serious challenge for the country's R&I system is the continuous lack of shared research infrastructures, which play an increasingly important role in the advancement of knowledge and technology. They are the key instrument to stimulate public-private partnerships and also to help shape scientific communities. Despite Sofia Tech Park and other regional initiatives, there are concerns⁵⁸ regarding the feasibility of implementing the National Research Infrastructure Roadmap⁵⁹ and even Bulgaria's participation in the ESFRI Roadmap. The ESFRI projects Bulgaria is participating in are EGI.eu, PRACE, EuroBioImaging and CLARIN (National coordinators are invited to join the Euro Argo-ERIC, EPOS-ERIC, ESS-ERIC and EATRIS-ERIC). In any case, there is scope for more effective use of existing facilities and strategic investment into future ones in line with RIS3.

⁵⁵ Audit Report No 0700010614 (Изпълнение на Националната стратегия за научни изследвания за периода от 01.08.2011 г. до 31.12.2014 г.)

⁵⁶ in addition to EU Operational Programme 'Science and Education for Intelligent Growth' 2014-2020

⁵⁷ managed by European Investment Fund (EIF)

⁵⁸ e.g. the PSF Panel Report, available at: <https://rio.jrc.ec.europa.eu/en/library/horizon-2020-policy-support-facility-peer-review-bulgarian-research-and-innovation-system/> or <http://horizon2020.mon.bg/>

⁵⁹ <http://www.mon.bg/>

1.2.2 Governance

Bulgaria is a parliamentary republic and thus the highest policy-making body is the National Assembly of the Republic of Bulgaria (National Parliament)⁶⁰. The Parliament exercises its power mainly through the state budget and its distribution. Related to the themes of research and innovation, there are Standing Committees on Economic Policy and Tourism, on Education and Science, and on European Affairs and Oversight of European Funds. Since 2012 the Parliament has also controlled the research output of the Bulgarian Academy of Sciences (BAS).

The Council of Ministers⁶¹ endorses the most important strategic documents. The Ministry of Economy (MoE) defines national innovation policy and provides (national) funding predominantly to private enterprises for applied research through NIF, implemented by BSMEPA. At the start of the 2007-2013 programming period the Agency also performed the functions of OP Intermediate Body, which was eliminated in 2012. Ministry of Economy, the General Directorate "European Funds for Competitiveness" is the Managing Authority of Operational Programme "Development of the Competitiveness of the Bulgarian Economy", co-financed by ERDF during programming period 2007-2013 and of Operational Programme "Innovation and Competitiveness" for 2014-2020 programming period.

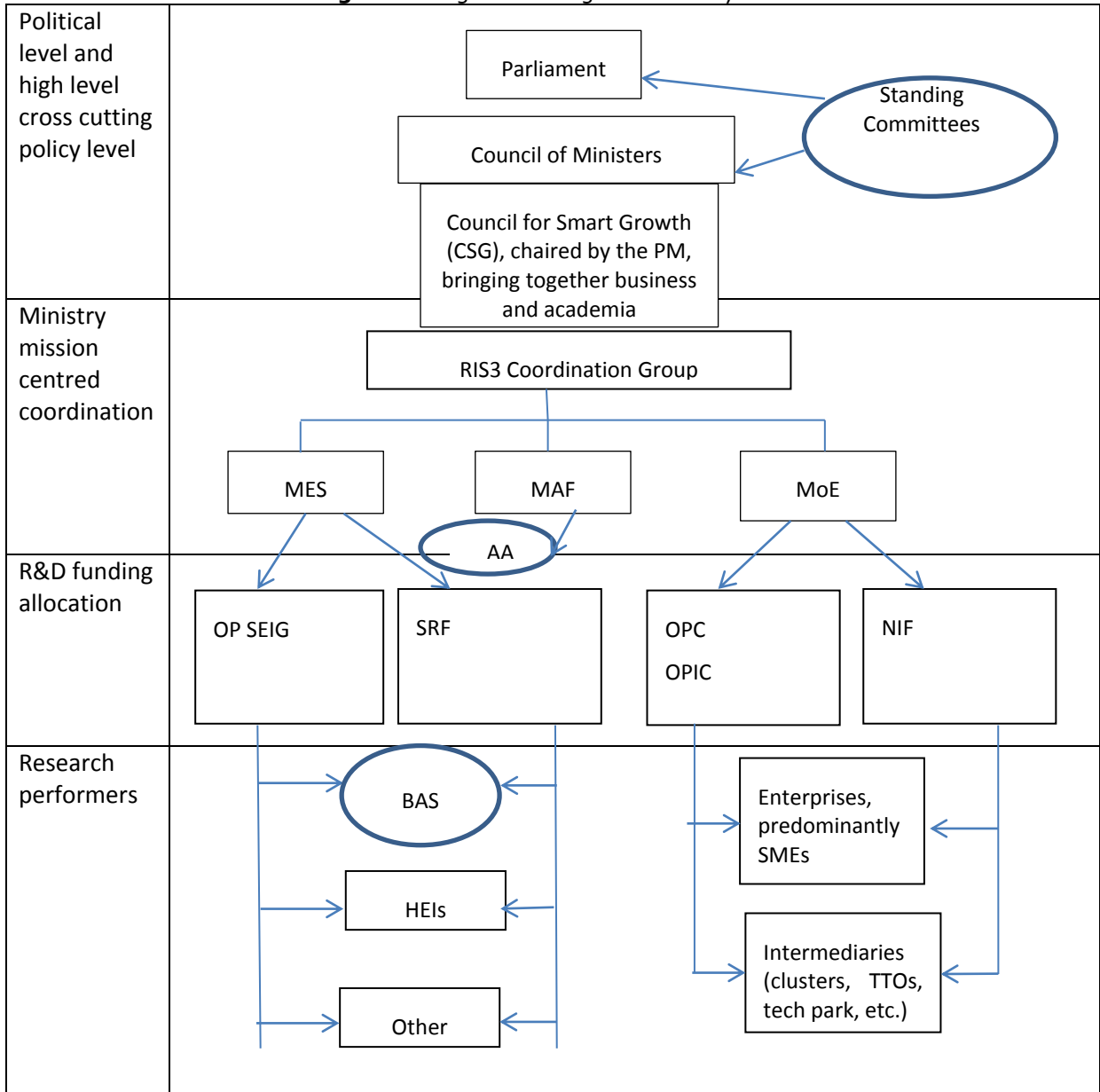
The Ministry of Education and Science (MES) designs and carries out national science and scientific research policy and oversees the functioning of the main public research funding instrument – the SRF. MES also hosts the National Contact Point (NCP) for the EU framework programmes and Horizon 2020 (within the Directorate "Science"). During 2007-2013 period MES contained Intermediate Body under Operational Programme "Human Resources Development", co-financed by ESF and managed by the Ministry of Labour and Social Policy. For 2014-2020 programming period there is Directorate "Structural Funds and International Educational Programmes", Managing Authority of Operational Programme "Science and Education for Intelligent Growth" with dual funding from ESF and ERDF.

Other ministries support policy-making with respect to their specific competences. The Ministry of Agriculture and Food manages the Agricultural Academy, which champions Bulgarian research policy in agriculture. Similarly, the Ministry of Health oversees the National Centre for Public Health Protection. The Ministry of Transport, Information Technology and Communications is responsible for the Digital Agenda and e-government, especially through its Executive Agency "Electronic Communication Networks and Information Systems" (EA ECNIS).

⁶⁰ <http://www.parliament.bg/>

⁶¹ <http://www.government.bg/>

Figure 5 Bulgaria's R&I governance system



Source: Authors' Own Data

The national R&I system appears to be characterised by vertical coordination with insufficient linkages and coordination mechanisms. Only an overall mission-oriented approach (as RIS3 conduces) fosters cooperation among different ministries and would in perspective give scale to public funding through the pooling of resources. So far there have been few incentives for ministries, agencies and research and innovation funds to collaborate. Due to the 2014-2020 ex ante conditionality related to Research and Innovation Strategies for Smart Specialisation (RIS3), joint planning of public investments for research and innovation has started. A policy mix with a portfolio of complementary instruments is under development. This novel approach (RIS3) concerns funding levels as well as the choice and evaluation of specific tools and instruments to direct R&I public spending. Such instruments are planned to be stable over a period of time to provide the right set of incentives for stakeholders and intermediaries and produce the medium and long term effects on the Bulgarian system for research and innovation.

The RIS3 process allows for three levels of governance and coordination, non-existent before. At the macro-level, Council for Smart Growth is established⁶² with reputable representatives from science and business community under the Chairmanship of the Prime Minister. The intention is to ensure high-level political commitment. At mezzo-level two networks - administrative and regional function as integrative facilities for innovation policies. At micro-level, the two operational programmes in the programming period 2014-2020 with priorities within the scope of thematic objective 1 "Strengthening research, technological development and innovation" of the Common Strategic Framework (OPIC and OPSEIG) synchronize their efforts within a Coordination Group (encompassing also the Ministry of Agriculture and Food, both policy-makers and representatives of Rural Development Programme 2014-2020). Building-up an overall quality governance system and managing effectively funding instruments in the sphere of innovation is more complex than providing OP governance map, but in any case the RIS3 approach of multi-layered coordination required by ESIF 2014-2020 already generates a predictable policy and budgetary framework, especially given the relative size of EU funding, compared to national budget instruments.

The two national budget funds, NIF and SRF, have relatively limited resources⁶³, but are managed independently and have autonomous objectives and targets, without any mechanism in place for coordination. The amount of funding available is not guaranteed multi-annually and does not enable Bulgaria to create synergies with EU programmes and enhance integration in international networks. The system functions on an irregular basis, with unpredictable budgets and irregular calls for proposals. At the same time, the resources are dispersed for a large number of projects without clear focus and reference to impact for society and the economy. The characteristics of the two funds in terms of their management models are diverse. While the NIF is a programme under BSMEPA (Bulgarian SME Promotion Agency), the SRF has a complex structure, almost similar to a funding agency, but without the capacity, procedures and competences of that type of organisations, typical for other Member States. Researchers cannot predict when they would be able to submit an application for funding. This reduces their ability to plan and coordinate their research activity with partners, especially internationally. Reimbursements and payment mechanisms are similarly irregular with long time lags occurring between approval to expenditure and reimbursement.

The main gap in the functioning of the funds however remains access to independent international reviewers. In addition, state aid issues⁶⁴ and accusations of malpractice and unfair competition have seriously damaged trust in the national financing instruments on the side of both the national and international communities. As already discussed in RIO Country Report Bulgaria 2014⁶⁵, and although it is mandatory⁶⁶ that SRF report statistics, at present there are no details about the distribution of funds across the spectrum of research performers – i.e. universities, scientific institutes, or NGOs, or the success rate of bids within and across these categories. NIF also does not report systematically the details about the size and the composition of the private sector research community, or the number and the type of its beneficiaries, i.e. multi-nationals, SMEs, high-tech firms, NGOs, or public sector actors that contribute to commercial research and innovation activities.

⁶² by Council of Ministers Decree No 116/12.05.2015

⁶³ approximately €15m planned for both in 2015

⁶⁴ e.g. <https://rio.jrc.ec.europa.eu/>, News Section, 07 September 2015

⁶⁵ <http://publications.jrc.ec.europa.eu/repository/handle/JRC96561>

⁶⁶ Lists of beneficiaries are published online.

Currently, there is the need for established dialogue between the two (national budget) funding bodies, SRF and NIF, to ensure complementarity and coordination. Alternatively, the PSF panel welcomes the possibility to establish a new agency (PARI). The proposal is to develop an independent agency capable of designing and implementing multi-annual research programmes, also with a view of synergies with Horizon 2020 and other funding options. A simple merging of the two funds will not solve the problem. Transparency, predictability and the involvement of high-level expertise/international peer review will be critical for restoring confidence and trust among researchers. This means adequate regulation preventing conflicts of interest, stable and proficient enforcement of these regulations as well as regular feedback to the project developers and researchers. Outsourcing evaluation of project proposals under NIF and SRF (to EC or European Science Foundation) is also an option, but only for a limited amount of time, while building national capacity.

In fact, the international Policy Support Facility (PSF) panel concludes that so far the national system as a whole has been characterized by silo thinking, uncoordinated priorities and on-going concerns with regard to alleged malpractice. There is a strong need to rebuild long-term trust in the country's scientific achievements and to rebrand Bulgaria as a business and working place based on knowledge and innovation, going beyond the narrow scope of research policy⁶⁷.

1.2.3 Research performers

As mentioned above, the largest research performing institutions in Bulgaria are the Bulgarian Academy of Sciences (BAS), the Agricultural Academy (AA), i.e. public research institutions, and some of the Bulgarian universities (i.e. HEIs such as Sofia University⁶⁸ and the Technical University in Sofia⁶⁹), though increasingly applied research is carried out in smaller private sector organizations – private universities, private research institutions and private enterprises. Although a relatively new phenomenon (mainly due to Operational Programme "Development of the Competitiveness of the Bulgarian Economy", co-financed by ERDF during programming period 2007-2013), clusters, Technology Transfer Offices (TTOs), networks and platforms in Bulgaria disseminate information and research results as well as facilitate the search for partners in Bulgaria and EU for joint innovative projects, promote cooperation and the development of scientific, technological and business collaborations.

Proof of ability to conduct excellent research and participate in international partnership can be demonstrated by results under Seventh Framework Programme, given EU-wide competitive procedures. Below are listed the most successful Bulgarian beneficiaries under FP7 (Table 6).

⁶⁷ <https://rio.jrc.ec.europa.eu/en/library/horizon-2020-policy-support-facility-peer-review-bulgarian-research-and-innovation-system/> or <http://horizon2020.mon.bg/>

⁶⁸ <http://www.uni-sofia.bg/>

⁶⁹ <http://www.tu-sofia.bg/>

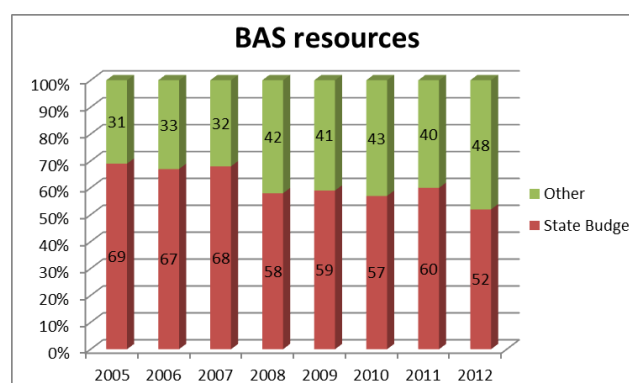
Table 6: Top 10 beneficiaries, EC financial contribution, granted in FP7 (Bulgaria)

Name	Number of Participations	EC Contribution (in million euro)
SOFIA UNIVERSITY "ST. KLIMENT OHRIDSKI"	45	9.02
INSTITUTE OF INFORMATION AND COMMUNICATION TECHNOLOGIES (IICT) – BULGARIAN ACADEMY OF SCIENCES	35	6.86
ONTOTEXT AD	15	5.00
INSTITUTE OF SOLID STATE PHYSICS – BULGARIAN ACADEMY OF SCIENCES	3	4.50
UNIVERSITY OF PLOVDIV	11	2.75
INSTITUTE OF OCEANOLOGY – BULGARIAN ACADEMY OF SCIENCES	21	2.33
INSTITUTE OF POLYMERS – BULGARIAN ACADEMY OF SCIENCES	2	2.23
PENSOFT PUBLISHERS LTD (PENSOFT)	8	1.81
TECHNICAL UNIVERSITY OF SOFIA	22	1.77
NEW BULGARIAN UNIVERSITY	2	1.59

Source: Seventh FP7 Monitoring Report, 11 March 2015, Country Profile: Bulgaria

The success of the Institutes in the Bulgarian Academy of Sciences (BAS), especially in the fields of ICT and physics, is a result of primarily internal reform and increasing project orientation. BAS as a whole is shifting towards a model of combined state and external financing, which shows a positive trend (Figure 6). The total amount of the subsidy also matters, displaying a positive correlation with the attraction of other funding (contracts, participation in programmes and projects, etc.).

Figure 6 Bulgarian Academy of Sciences Funding Model



Source: BAS budget and annual financial reports

According to the Strategy for Higher Education (2011 update), the higher education system in Bulgaria comprises 51 higher education institutions (37 state and 14 private), including 44 universities and specialized higher schools and 7 independent colleges. The register of accredited HEIs currently contains 51 entries⁷⁰, although the number is growing. However, the publishing and patenting activities vary immensely across these universities and higher educational colleges. Participation in framework and other programmes is also different with only a limited number of universities having managed to receive and use FP6/FP7/H2020 financing. The situation with infrastructure is similar – only a one-digit number of HEIs possess and manage adequate research facilities, and mostly thanks to EU and other donor programmes. Practically, the predominant share of Bulgarian universities represent educational and training centres of local importance with neither scientific and research orientation, nor any significant research activities and results. The remaining restricted share of HEIs need fast investments in infrastructure and quality improvement, not to be additionally ‘emptied’ of talented scientists and researchers. The system is still binary, in terms of HEIs vs. BAS division, instead of distinguishing BAS and HEIs with research potential vs. non-research HEIs.

In terms of bibliographics and science metrics, in 2015 SCOPUS data base contains 3028⁷¹ documents of Bulgarian scientists and researchers. The leading institutions in terms of number of publications are the Bulgarian Academy of Sciences, Sofia University “St. Kliment Ohridski” and the Medical University in Sofia. The disciplines with highest number of publications are the following:

- Medicine (667)
- Physics and Astronomy (661)
- Engineering (496)
- Biochemistry, genetics and molecular biology (384)
- Agrarian science and biology (379).

In 2015 Web of Science data base contains 5 266 publications of Bulgarian authors.

The correlation with the RIS3 priority areas is significant. With respect to comparative data, the sub-indicators within the Research Excellence Composite Indicator (Table 7) are all improving in the period 2007-2012 with the exception of the share of highly-cited publications per total publications, although the performance remains below EU28.

Table 7: Research Excellence Composite Indicator (Bulgaria and EU)

Research Excellence Composite Indicator Scores										
	Highly Cited Publications per Total Population		PCT Patents per Population		Sum of ERC Grants per public R&D		Top Universities and PROs per GERD		Overall Score	
	2007	2012	2007	2012	2007	2012	2007	2012	2007	2012
Bulgaria	33.08	21.33	10.88	11.00	41.73	65.55	22.67	23.29	24.16	23.46
EU28	53.91	55.38	37.70	37.90	46.21	81.77	31.11	30.41	41.34	47.80

Source: JRC, <https://rio.jrc.ec.europa.eu/en/stats/research-excellence-composite-indicator>

⁷⁰ <http://www.mon.bg/?go=page&pageld=8&subpageld=167>

⁷¹ The number can increase given the varying periods of submission of the publications.

The World Bank Report⁷² describes the situation related to innovation performance of Bulgaria at the stage right before the start of the 2014-2020 programming period and the pending implementation of RIS3 strategy. Bulgaria's innovation performance over the last decade has fallen short of expectations. The innovation system is operating below its potential, whether measured by the system's inputs (based on R&D spending), outputs (according to the number of patents), or by the contribution of innovation to economic growth (as measured by high-tech exports). The report emphasizes the fact that still institutional support is predominant for a large number of research organizations, whilst the share of performance-based/project financing is low. There are weaknesses in the competitive environment and insufficient independent external (international) expertise of scientific ideas, developments and results. The practice of granting Intellectual Property (IP) rights is yet to be established. The case of specifically important concerning management of intellectual property and relations with third parties, such as companies, clusters or other consortia. To quote the WB report, only IPR policy and its effective implementation can intensify both entrepreneurship among academics and research investments in PROs from business.

⁷² "Input for Bulgaria's Research and Innovation Strategies for Smart Specialization" (February 2013), available at: <http://www.mi.government.bg/>

2. Recent Developments in Research and Innovation Policy and Systems

2.1 National R&I Policy

National Strategy for Scientific Research Development

At national level the National Research Development Strategy (NRDS)⁷³ provides the scientific organizations, universities and the whole academic research community with the necessary framework within which they can formulate their views and plans for participation in national R&D activities, by giving priority to programme funding. Furthermore, the Strategy provides the society and the legislator with information about the Government striving for effective use of public funds for R&D.

At international level, the NRDS reflects the efforts of Bulgaria to raise the investments in science and technological development to 1.5% of GDP in line with the objective of "Europe 2020" (3% of EU's GDP). The strategy envisages achieving accelerated use of the results of research and innovation, modernizing the scientific process and implementing efficient European models and practices. The Strategy also reflects the EU priorities of building a European Research Area:

- concentration of public resources and investments in priority research areas;
- support for research infrastructure and sustainable development of effective research organizations;
- inclusion of the private sector into the research and innovation processes;
- better coordination of education, research and innovation policies;
- promotion of the free movement of people, knowledge and technologies.

The NRDS is oriented towards the following key aims:

- a.) contributing to the transformation of the Bulgarian society into "knowledge society";
- b.) contributing to the development of a national economy based on eco-technologies;
- c.) formulating national science policy that will provide opportunities and define prospects for achieving the targets set forth in the Europe 2020 Strategy; and
- d.) contributing to the creation of integrated European Research Area.

Thus, its orientation is both inward looking at the restructuring and financing of the current science capabilities in Bulgaria and outward-looking to facilitate the participation of Bulgarian research organisations in European framework programmes and initiatives such as: FP5, FP6, FP7, Horizon 2020, European Cooperation in Science and Technology (COST); the Science Europe Roadmap (Science Europe, 2013); European Strategic Forum for Research Infrastructures (ESFRI); cooperation with the Joint Research Centre (JRC) and the Joint Technology Initiatives (JTIs) – among others.

In the NRDS six important obstacles have been identified in relation to the R&D&I development in the country. Firstly, Bulgaria has lacked strategic vision and stable policy for the development of science. Secondly, there is the unfavourable ratio between public and private investment in contrast with developed systems whereby the "non-state sector" investments predominate. Thirdly, there still exists an unfavourable expenditure structure in the public sector and lack of resource concentration. The wide-spread institutional support to numerous scientific organizations prevails at the expense of performance-base and project financing.

⁷³ Council of Ministers Decision No 737/30.10.2014 for approval of updated NRDS and Action Plan for the Implementation of NRDS 2015-2020

There is no effective competitive environment, involving independent and external (international) expertise of scientific ideas, developments and results. Fourthly, the residues of the 'binary' model lead to artificial separation of science from the higher education and the difficulties for overcoming the perception of universities as purely educational structures. Fifthly, national instruments contain limited budget, while specialized national programmes in a specific scientific field and support for scientific infrastructure are deficient. Finally, the various available sources of funding are inefficiently used in terms of both absorption and ability to solve specific scientific tasks or significant economic or social problems. The NRDS is approved by the Parliament in 2011 and is updated in 2014, together with 2015-2020 Action Plan⁷⁴.

The scientific priority areas identified in the NRDS by 2020 are:

1. Energy, energy efficiency and transport. Development of green and eco-technologies;
2. Bio-technologies and ecological foods;
3. New materials;
4. Cultural and historical heritage

Fundamental research under programme and competitive principles is developed to the amount of 15% of the public expenses on science.

Information and communication technologies will be developed as a horizontal topic that affects all spheres of life and economy.

Table 8: Bulgaria's National Research Development Strategy

TASK	MEASURES
INCREASING THE INTENSITY, EFFECTIVENESS AND EFFICIENCY OF R&D ACTIVITY IN FAVOUR OF ECONOMY AND SOCIETY	<ol style="list-style-type: none"> 1. INTRODUCTION OF FINANCING MODEL STIMULATING COMPETITION, DEVELOPMENT AND APPLICATION OF RESULTS IN SOCIETY AND ECONOMY AND INCREASE OF THE FUNDS FOR RESEARCH AND INNOVATION 2. INTRODUCTION OF SCIENTIFIC RESEARCH PRIORITIES 3. RESEARCH POTENTIAL DEVELOPMENT THROUGH CREATION OF ATTRACTIVE CONDITIONS FOR A SCIENTIFIC CAREER, PROFESSIONAL GROWTH, QUALIFICATION AND SPECIALISATION OF SCIENTISTS 4. INTEGRATION OF BULGARIAN SCIENCE INTO THE EUROPEAN RESEARCH AREA
ESTABLISHMENT OF THE KNOWLEDGE TRIANGLE AS A BASIS FOR THE DEVELOPMENT OF A KNOWLEDGE-BASED ECONOMY	<ol style="list-style-type: none"> 1. STIMULATION OF PRIVATE SECTOR INVOLVEMENT IN SCIENTIFIC ACTIVITY 2. STRENGTHENING THE INTEGRATION BETWEEN THE KNOWLEDGE TRIANGLE ELEMENTS
CREATION OF FAVOURABLE ENVIRONMENT FOR SCIENTIFIC ACTIVITY	<ol style="list-style-type: none"> 1. INTRODUCTION OF SCIENTIFIC ACTIVITY EVALUATION 2. DEVELOPMENT OF RESEARCH INFRASTRUCTURE 3. STRENGTHENING THE SOCIAL DIMENSIONS OF SCIENCE
DEVELOPMENT OF INFORMATION AND COMMUNICATION TECHNOLOGIES	<ol style="list-style-type: none"> 1. CREATING ENVIRONMENT FOR THE INTRODUCTION AND DEVELOPMENT OF INFORMATION AND COMMUNICATION TECHNOLOGIES 2. PROVISION OF OPEN ACCESS TO RESEARCH INFORMATION AND RESEARCH FIGURES

Source: NRDS, 2014 update

⁷⁴ Council of Ministers Decision No 737/30.10.2014

The NRDS contains detailed set of monitoring (strategic and specific) indicators for achievement of the objectives and implementation of the tasks and measures. The only additional elements that could be considered in the case of a forthcoming updates within the NRDS relate to:

a.) the monitoring and evaluation per priority area (the five priority areas mentioned above) to guarantee the focus of investments and the focus on quality in the chosen areas;

b.) the financial breakdown per type of funding source, per year and per priority area, in line with the country target of 1.5% of GDP in 2020.

In addition, according to the RIO Country Report Bulgaria 2014⁷⁵, the NRDS needs to further articulate the vision for frontier science that builds upon close science – education – innovation integration, as well as the urgent need for consolidation of knowledge capabilities within the publicly-funded segment of the system. It also needs additional emphasis on the public-private cooperation potential, which remains insufficiently explored in relation to both BAS and HEI research.

Infrastructure Roadmap

The European Strategic Forum for Research Infrastructure (ESFRI) Roadmap identifies new Research Infrastructures (RI) of pan-European interest corresponding to the long term needs of the European research communities, covering all scientific areas, regardless of possible location. First published in 2006, with 35 projects, it was updated in 2008 bringing the number of RIs of pan-European relevance to 44. The latest update focusing on projects dealing with energy, food and biology was published in December 2010. Having identified 48 projects of new research infrastructures (or major upgrade on existing ones) so far, ESFRI focuses more on their implementation. The Roadmap 2016 update process was launched in September 2014 in Trieste.

The National Research Infrastructure (NRI) Roadmap in Bulgaria was created in 2010 for the first time as a response to the EU-level initiative. In its essence the NRI Roadmap aims to create incentives for the restructuring of competitive knowledge and technology assets across BAS, the HEIs, the other stakeholders from the public and private sphere. Initially individual infrastructure projects were linked across the European science space, but with insufficient connectivity to local stakeholders and business at national and regional level. The infrastructure projects included in the approved selection from 2012 and the amendments from 2014 ensured a stronger co-alignment with European infrastructure consortiums and good representation of scientific coordinators and participants from Bulgaria:

- National University Complex for Biomedical and Applied Research (BBMRI)
- Centre for Fundamental and Applied Microscopy Research in Biology, Medicine and Bio-Technology (EuroBioImaging)
- Sea and Ocean Research and Marine Technologies for participation in collaborative research under EURO-ARGO
- Technologies for Renewable Energies and for Improved Energy Efficiency
- Regional Astronomy Centre for Scientific Research and Education
- Integration and Development of Digital Resources in Bulgarian for Language and Cultural Heritage under the European programmes CLARIN (Common Language Resources and Technology Infrastructure) and DARIAH (ClDa)
- European Social Survey for Bulgaria (ESS)
- Supercomputer Research, Computer Modelling, Simulations and Applied Research for the Industry, Pharmaceuticals, Medicine, Energy, Transportation and Environmental Science (EGI.eu and PRACE)

⁷⁵ <http://publications.jrc.ec.europa.eu/repository/handle/JRC96561>

- National Cyclotron Centre for applied research in nuclear medicine, nuclear physics, nuclear energy research, radiochemistry and radio pharmacy.

Five additional infrastructure projects are highlighted as national priority and approved for project development:

- Advanced Material Technology Research and Manufacturing Facility with Application to Conservation Technologies (INFRAMAT)
- Innovation Research in Agriculture and Food
- Alliance for Cell Technologies (EATRIS)
- National Geo-Information Centre (EPOS)
- Eco and Energy Saving Technologies.

Throughout all stages of selection of projects and consortiums, the implementation of the NRI Roadmap envisaged complementary financing from the state budget, from SRF, Horizon 2020, as well as the OP 'Science and Education for Intelligent Growth' and the private sector. Although the NRI Roadmap from 2014 has completed all stages of national and European level consultations and has approved budget for its implementation, the level of coordination and the guarantees for sustainable investment in individual projects are still under development.

Implementing the thematic preconditions from the Partnership agreement between Bulgaria and the EU, an update is being undertaken on the NRI Roadmap. Mapping of the available research infrastructure and equipment in the country has been implemented, and is being verified. With the support of external experts a review and development of the business plans of the research infrastructures from the NRI Roadmap is being implemented. All available (mapped current infrastructures) and priority projects for establishment of research infrastructure (NRI Roadmap projects) are bound with the priority thematic areas of the National Innovation Strategy for Smart Specialization by regions of planning in Bulgaria (NUTS II).

Strategy for the Development of Higher Education

The national R&I system is weakened, mostly because of significant underfunding in absolute and relative terms (approx. 0.65% of GDP in 2013), but also because of unclosed gaps within the tertiary education system⁷⁶. According to the S2E Facts&Figures for Bulgaria⁷⁷, levels of R&D expenditure by Business Enterprise Sector and Government Sector are close to EU13, but the same indicator for the higher education sector is three times lower. In other words, increasing R&D expenditure potential involves focusing on HEIs and the quality of their R&I activities. The data concerning the total stock of researchers reinforce that conclusion. Bulgaria has 4.43 per 1000 active labour force (Eurostat, 2011) compared with an EU average of 10.55. The number of new doctoral graduates per 1000 population (aged 25-34) is only 0.6 whereas the EU average is 1.7 (Eurostat, 2011). This is in the context of the number of doctoral candidates having almost doubled between 2000 and 2015. The low numbers of researchers most clearly demonstrates the need to stimulate human resource development policy in HEIs as well as public and private investment in R&D, performed by HEIs with research capabilities.

⁷⁶ S2E Report, Bulgaria, 2015:

http://s3platform.jrc.ec.europa.eu/documents/20182/117536/S2E_Report_BG.pdf/dc1285cb-e7f6-42ef-9252-44f201b11bbe

⁷⁷ S2E Facts and Figures, Bulgaria, 2015:

http://s3platform.jrc.ec.europa.eu/documents/20182/117536/S2E_BG_national_profile.pdf/f1155ae7-1421-41dc-9a34-0805372f42e6

Consequently, the Strategy for the Development of Higher Education (SDHE) 2014-2020 has been given high importance by the government, by the European Commission and recently⁷⁸ by the academic community in Bulgaria, whereby the situation is assessed as 'critical'. The SDHE and the Action Plan 2014-2020⁷⁹ is approved by Parliament in February 2015. The specific objectives of the SDHE can be summarized as follows:

Table 9: Bulgaria's National Strategy for the Development of Higher Education

STRATEGY FOR THE DEVELOPMENT OF HIGHER EDUCATION (SDHE) 2014-2020	
SPECIFIC OBJECTIVE 1.	IMPROVING ACCESS AND INCREASING THE SHARE OF GRADUATES
SPECIFIC OBJECTIVE 2.	SIGNIFICANTLY IMPROVING THE QUALITY OF HIGHER EDUCATION AND THE COMPATIBILITY WITH THE EUROPEAN HIGHER EDUCATION SYSTEMS IN ORDER TO OCCUPY A DIGNIFIED PLACE IN EUROPEAN HIGHER EDUCATION AREA (EHEA)
SPECIFIC OBJECTIVE 3.	BUILDING A SUSTAINABLE AND EFFECTIVE LINK BETWEEN HIGHER EDUCATION AND THE LABOUR MARKET, AND ACHIEVING DYNAMIC COMPLIANCE OF DEMAND AND SUPPLY OF SPECIALISTS WITH HIGHER EDUCATION
SPECIFIC OBJECTIVE 4.	PROMOTING THE RESEARCH ACTIVITIES IN HEIS AND THE DEVELOPMENT OF INNOVATIONS ORIENTED TOWARDS THE MARKET ECONOMY
SPECIFIC OBJECTIVE 5.	UPGRADING THE HIGHER EDUCATION INSTITUTIONS MANagements AND CLEAR DEFINITION OF THE HEIS TYPES AND THE EDUCATIONAL AND QUALIFICATION DEGREES
SPECIFIC OBJECTIVE 6.	INCREASING THE FUNDS FOR HIGHER EDUCATION AND SCIENCE AND THE EFFICIENCY OF THEIR USE BY IMPLEMENTING AN ADVANCED MODEL OF FUNDING
SPECIFIC OBJECTIVE 7.	OVERCOMING THE NEGATIVE TRENDS IN CAREER ADVANCEMENT OF LECTURERS IN HEIS, AND PROMOTING THE BEST ONES
SPECIFIC OBJECTIVE 8.	EXPANDING AND STRENGTHENING THE LIFE-LONG LEARNING (LLL) NETWORK; BROAD APPLICATION OF THE VARIOUS ELECTRONIC FORMS FOR DISTANCE LEARNING.

Source: SDHE, 2015

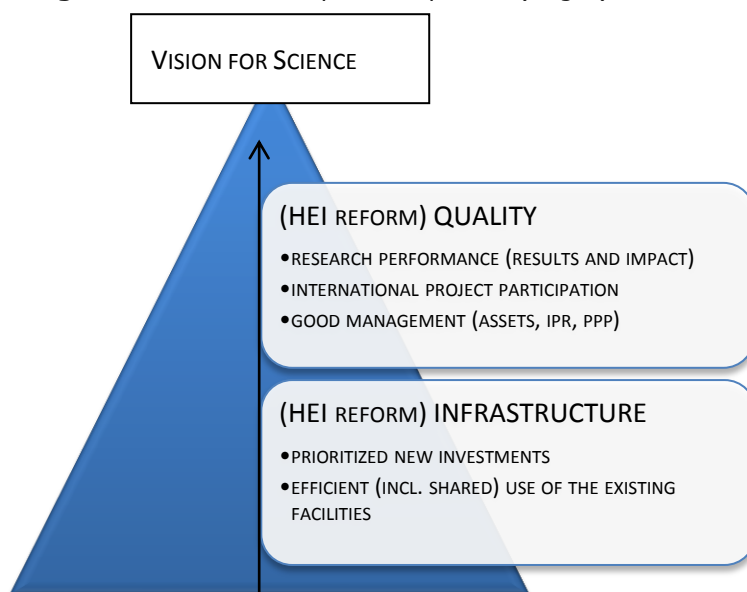
The specific objectives of the SDHE are further disintegrated into activities and measures with expected results (with 53 indicators). The multitude of objectives reflects the fragmentation of the system itself. Although practicality and concreteness support the overall reform effort, the multitude of objective to be implemented simultaneously may lead to chaotic effects. Therefore, the two strategic directions of the HEI reform agenda need to be additionally underlined and given priority. Firstly, since quality presents the most serious challenge, the fundamental policy line needs to address quality gaps by rewarding excellence (research performance, good management practices, high participation rate in international projects). Both the World Bank and the PSF Panel have recommended the gradual introduction of performance-based and project funding as the predominant model for financial support. The funding model is expected to provide incentives for consolidation in the HEI sector, as well as visible differentiation between research-oriented HEIs and HEIs focused on tuition.

⁷⁸ <http://www.kultura.bg/bg/article/view/23877>

⁷⁹ Council of Ministers Decision No 683/02.10.2014

Secondly, since infrastructure continues to suffer from underfunding and lack of attractiveness, more collaboration between HEIs and business and more joint utilisation of infrastructure and resources need to be fostered. Wider use of mechanisms for public private partnerships and knowledge transfer is indispensable. The whole HEI reform agenda with respect to R&I necessarily belongs to the larger science reform agenda, if the 'criticality' of the situation is to be solved. The PSF panel also emphasizes that 'a commonly shared vision and policy story line of how science and innovation should change Bulgaria in the next five to ten years is key'⁸⁰.

Figure 7 HEI reform aspects as part of (larger) science reform agenda



Source: Authors' Own Data

More generally, there should be stimuli for "transformation of the 'traditional' model of a university, which focuses its efforts [distinctly] on teaching and research, towards an innovative and entrepreneurial higher education institution (HEI), which is designed to empower students and staff to demonstrate enterprise, innovation and creativity in teaching, research and third mission, directs its activities to enhance learning, knowledge production and exchange, in the dedication of creating public value via processes of open engagement" (HEInnovate, 2014)⁸¹. The latter joint OECD and EC report recommends for example the creation of HEInnovate Fund (co-financed by ESIF or other EU source) to become the main vehicle to promote and sustain organisational change in HEIs in Bulgaria.

⁸⁰ PSF Report, Bulgaria 2015, p. 10 and p. 21

⁸¹ https://heinnovate.eu/sites/default/files/heinnovate_bulgaria_final_report.pdf/

2.2 R&I Policy initiatives

2.2.1 Evaluations, consultations, foresight exercises

In October 2013 within the context of the DG RTD Expert Groups advising on development of Smart Specialization in EU12 plus Greece, Portugal and Spain, the report⁸² on the Smart Specialization Strategy of Bulgaria also explored the system developments and the ways to support the process of Research and Innovation Strategy for Smart Specialisation (RIS3) preparation and consultation, the RIS3 itself being envisaged as a comprehensive innovation strategy that will enhance country's capacity to deliver smart, sustainable and inclusive growth as set out as an objective in the "Innovation Union" flagship initiative of October 2010⁸³.

The underfunding, fragmentation and lack of coordination of the national R&I system are identified as bottlenecks for the development of innovations in Bulgaria. Yet, potentially more serious threat mentioned in the report than the lack of immediate finance is the rapidly escalating loss of scientific talent to other European countries and the USA, exacerbated in demographic trends. On-going migration (not encouraged mobility) of scientists and particularly young scientist to international positions is highly significant. This may have a profound impact on all R&I activities and planned projects, where there may simply not be enough qualified personnel. The specifics of the problem also suggests that the phenomenon cannot be rapidly reversed. Without attractive research infrastructures of its own or major initiatives to reconnect with the diaspora, Bulgaria faces a potentially critical impasse for its science and innovation base. As knowledge has become an increasingly essential factor of growth and competitiveness, the issue of the migration of the science base may have far-reaching repercussions for the implementation of economic strategy and policy in Bulgaria.

Given the growth of R&D investments from 0.65% in 2013 to 0.8% in 2014 of GDP, efforts continue in order to increase research funding by both the state and the business sector to reach the national target of 1.5% of GDP by 2020. Nonetheless, given the overall low level of funding, only focused investments in the identified priority sectors (including the bio-sector and agriculture, as described within RIS3) could be expected to bring tangible effects and close the gap between business and science.

Policy Support Facility 2015

The Directorate-General for Research & Innovation of the European Commission set up a 'Policy Support Facility' (PSF) under the European Framework Programme for Research & Innovation 'Horizon 2020' to support Member States in reforming their national science, technology and innovation systems. In 2015 the Bulgarian national authorities requested a Peer Review to support wide-ranging reforms in Bulgaria. More concretely, the peer review has set a focus on three main areas:

- Assessment of R&I funding and performing bodies and instruments.
- R&I Human resources capacity development.
- Tackling the gap between research and business.

⁸² co-authored by Daniela Mineva and Lisa Cowey

⁸³ COM (2010) 546 final

The peer review undertaken stands in the tradition of previous mutual learning models under the auspices of the CREST and ERAC groups. The Horizon 2020 PSF panel comprised senior officials⁸⁴ from Austria, Poland, Portugal, Slovenia, and Spain working in policy-making at the national level and acting in a personal capacity, and high-level independent experts⁸⁵ from Germany, Ireland, Norway, the Netherlands and the UK with expertise in relevant research and innovation fields.

On the basis of the desk research, quantitative and qualitative analyses, responses to an online survey as well as in-depth discussions with various experts and the many comments received during the two field visits, the PSF expert panel arrived at the following Ten Policy Messages⁸⁶, each one supported by a number of detailed recommendations presented in the report of the PSF peer review panel.

1. Bulgaria has a historic opportunity to strengthen its economic potential by increasing science and innovation funding to at least 1% of GDP in 2020.

Achieving sustainable impact from such increased funding will require major structural reforms of the research and innovation system to boost efficiency and quality. More and better funding will also need coordinated and effective planning and use of the European Structural Funds. Bulgaria has to:

2. Establish long-lasting support for science and innovation investments and reforms by seeking broad political consensus in matters of science and innovation, and launch a structured, committed and sustained dialogue with the Bulgarian science and innovation community. This dialogue should lead to a 'National Science Agenda' capable of rebuilding trust in the system. The Council for Smart Growth is best placed to take leadership in this process.

3. Set up a professional, independent and robust national research agency to design and manage research and innovation funding programmes and support the successful implementation of the research and innovation structural reforms package.

4. Improve the processes for the evaluation and funding of project proposals, and bring those processes to international standards.

5. Increasingly concentrate funding for institutions that perform research, so as to reward high performance.

6. Encourage the participation of Bulgarian scientists and innovation entrepreneurs in European programmes.

7. Take rapid action to rebuild incentives for research careers at all stages and to retain and attract young talent from Bulgaria and from abroad into science and innovation.

8. Incentivise the opening up of Bulgaria's science base to businesses and step up the schemes to support public-private cooperation.

9. Create the conditions for specific regional and local innovation ecosystems to develop in Bulgaria using the Sofia Tech Park as a strategic innovation test bed.

10. ще се върнем... (We'll be back...) The Bulgarian government should favour an assessment of the implementation of those recommendations within a three-year time span.

⁸⁴ Mateusz Gaczynski, Clara E. Garcia, Luisa Henriques, Armin Mahr, Stojan Sorčan

⁸⁵ Luc Soete, Lisa Cowey, Liv Langfeldt, Conor O'Carroll, Steffen Preissler

⁸⁶ <https://rio.jrc.ec.europa.eu/en/library/horizon-2020-policy-support-facility-peer-review-bulgarian-research-and-innovation-system/> or <http://horizon2020.mon.bg/>

2.3 European Semester 2014 and 2015

In May 2015, the European Commission published the annual country-specific recommendations (CSRs)⁸⁷ for each Member State, including Bulgaria. The comparison of CSRs 2015 with previous CSRs demonstrates the persistence of a number of issues: tax collection and shadow economy, healthcare and pension systems, labour market and educational exclusion, energy sector reform, business environment and investment climate. Limited progress is persistently reported concerning 2015 CSR 3. and CRS 5⁸⁸.

Table 10 compares extracted CSRs which can be of importance for the overall research and innovation environment in Bulgaria:

Table 10: Comparison of Country Specific Recommendations (2013-2015) – extract

CSRs 2013	CSRs 2014	CSRs 2015
<p>1. Preserve a sound fiscal position by ensuring compliance with the MTO and pursue a growth-friendly fiscal policy as envisaged in the Convergence Programme. Implement a comprehensive tax strategy to strengthen all aspects of the tax law and collection procedures with a view to increase revenue, in particular by improving tax collection, tackling the shadow economy and reducing compliance costs. Establish an independent institution to monitor fiscal policy and provide analysis and advice.</p>	<p>1. Reinforce the budgetary measures for 2014 in the light of the emerging gap relative to the preventive arm of the Stability and Growth Pact requirements. In 2015, strengthen the budgetary strategy to ensure that the medium-term objective is reached and, thereafter, maintained. Ensure the capacity of the new fiscal council to fulfil its mandate. Implement a comprehensive tax strategy to strengthen tax collection, tackle the shadow economy and reduce compliance costs.</p>	<p>1. Avoid a structural deterioration in public finances in 2015 and achieve an adjustment of 0.5 % of GDP in 2016. Take decisive measures to improve tax collection and address the shadow economy, based on a comprehensive risk analysis and evaluation of past measures. Improve the cost-effectiveness of the healthcare system, in particular, by reviewing the pricing of healthcare and strengthening outpatient care and primary care.</p>
<p>3. Accelerate the national Youth Employment Initiative. Further strengthen the capacity of the Employment Agency with a view to providing effective counselling to jobseekers and develop capacity for identifying and matching skill needs. Enhance active labour-market policies, in particular concerning national employment schemes...</p>	<p>3. Improve the efficiency of the Employment Agency by developing a performance monitoring system and better targeting the most vulnerable, such as low-skilled and elderly workers, the long-term unemployed and Roma. Extend the coverage and effectiveness of active labour market policies to match the profiles of job-seekers, and reach out to non-registered young people who are not in employment, education or training, in line with the objectives of a youth guarantee...</p>	<p>3. Develop an integrated approach for groups at the margin of the labour market, in particular older workers and young people not in employment, education or training...</p>

⁸⁷ http://ec.europa.eu/europe2020/making-it-happen/country-specific-recommendations/2015/index_en.htm

⁸⁸ http://ec.europa.eu/europe2020/pdf/csr2016/cr2016_bulgaria_en.pdf

<p>4. Adopt the School Education Act and pursue the reform of higher education, in particular through better aligning outcomes to labour-market needs and strengthening cooperation between education, research and business.</p>	<p>4. Adopt the School Education Act and pursue the reforms of vocational and higher education in order to increase the level and relevance of skills acquired at all levels, while fostering partnerships between educational institutions and business with a view to better aligning outcomes to labour market needs. Strengthen the quality of vocational education and training institutions and improve access to lifelong learning.</p>	<p>4. Adopt the reform of the School Education Act, and increase the participation in education of disadvantaged children, in particular Roma, by improving access to good-quality early schooling.</p>
<p>5. Take further steps to improve the business environment, by cutting red tape, implementing an e-government strategy and implementing the legislation on late payments. Improve the quality and independence of the judicial system and fight corruption more effectively. Improve the access to finance for SMEs and start-ups.</p>	<p>5. Continue to improve the business environment, in particular for small and medium-sized enterprises, by cutting red tape, promoting e-government, streamlining insolvency procedures and implementing the legislation on late payments. Improve the public procurement system by enhancing administrative capacity, strengthening the ex ante checks performed by the Public Procurement Agency and taking concrete steps for the implementation of e-procurement. Enhance the quality and independence of the judiciary and step up the fight against corruption.</p>	<p>5. With a view to improving the investment climate, prepare a comprehensive reform of the insolvency framework drawing on international best practice and expertise, in particular to improve mechanisms for pre-insolvency and out-of-court restructuring.</p>
<p>6. Accelerate the absorption of EU funds. Ensure sound implementation of public-procurement legislation by extending ex ante control by the Public Procurement Agency to prevent irregularities.</p>		

Source: http://ec.europa.eu/europe2020/making-it-happen/index_en.htm

Bulgaria is in process of addressing the challenge of improving the overall quality and efficiency of its education system, starting with the School and Pre-School Education Act⁸⁹, approved by Parliament in September 2015. The changes introduced concern:

- state subsidy for private schools (provided 20% free access based on need and talent);
- four stages of the school education (1st to 4th grade; 5th to 7th grade; 8th to 10th grade; and 11th and 12th grade), compulsory until 16 years of age;
- new types of schools (e.g. innovative, in terms of curricula and teaching methods) and principles of autonomy;

⁸⁹ <http://dv.parliament.bg/DVWeb/showMaterialDV.jsp?idMat=97877>

- support schools transformation into centres for support of personal development;
- public councils affiliated to each school in order to allow for additional civil society control and involvement in the educational process;
- new control institution (National Educational Inspectorate).

“In higher education, reforms have made very limited progress. The existence of an important disparity between higher education outcomes and labour-market demand worsens structural unemployment and hampers the development of high-value, innovative sectors. The poor performance of higher education is linked to a lack of incentives at institutional level as well as to the standard of individual researchers and teachers”⁹⁰. The Higher Education Act itself has been modified 45 times since its introduction in December 1995, or 2.25 times per year on average. The trend continued in 2015 with 2 updates in July 2015 and October 2015. The expectation is that with the new Strategy for the Development of the Higher Education 2014-2020, the necessity for revisions will diminish.

2.4 National and Regional R&I Strategies for Smart Specialisation

The Research and Innovation Strategy for Smart Specialisation (RIS3) is an obligatory pre-condition under Regulation 1303/2013 for the new programming period 2014-2020, in relation to the funding from ESIF in the field of Thematic Objective 1 "Strengthening research, technological development and innovation" in the Common Strategic Framework. The Bulgarian RIS3 (directly concerning two Operational Programmes, OP "Innovation and Competitiveness" and OP "Science and Education for Intelligent Growth") has been provisionally approved by the Council of Ministers Decision 761/06.11.2014, along with the required Action Plan. The document has been updated in 2015 by the Council of Ministers Decision 857/03.11.2015⁹¹. The established organisation of the RIS3 process provided for involving a wide range of stakeholders and exchanging information at national and regional level, improving the dialogue, creating conditions for increasing participation, determining the diverse forms of partnership ('quadruple helix'). The 28 NUTS III level regions participated through the regional network⁹². The 6 NUTS II level regions through their Councils for Development could provide regional prioritization of the national priorities.

The technical assistance from the World Bank and the European Commission additionally strengthened the information gathering, the entrepreneurial discovery process (EDP) and the compliance with the regulatory requirements. The broad public debate on this topic, conducted over a period of more than three years, is an expression of the will to achieve the common goals:

Vision: By 2020 Bulgaria should make a qualitative leap in its innovation performance at EU level to tackle public challenges in the field of demography (reverse brain drain and youth entrepreneurship), sustainable development, intellectual capital and the nation's health.

Strategic Goal: By 2020, Bulgaria will move from the group of "modest innovators" into the group of "moderate innovators", which will be implemented by achieving two operational objectives:

Target 1: Focus the investment for the development of innovation potential in the smart thematic areas (for creation and development of new technologies leading to competitive advantages and increase in the added value of domestic products and services).

⁹⁰ CSR 2013

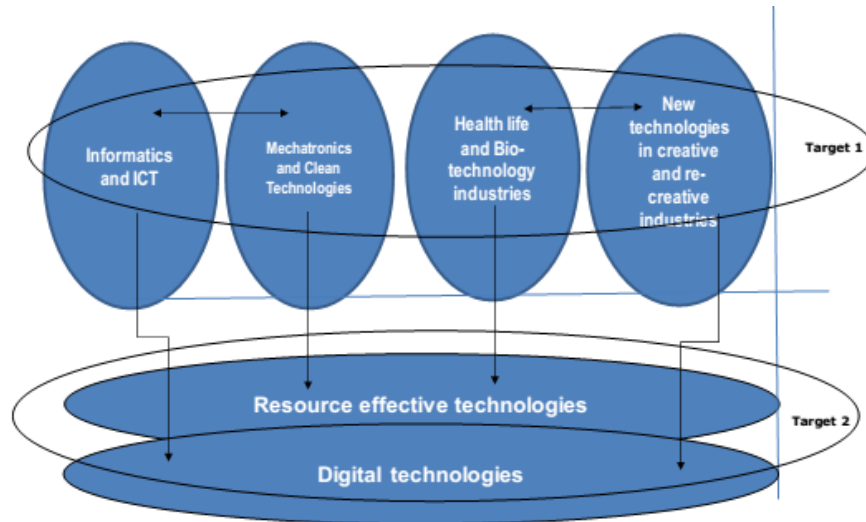
⁹¹ <http://mi.government.bg/bg/themes/inovacionna-strategiya-za-inteligentna-specializaciya-na-republika-balgariya-2014-2020-g-i-proces-na-i-1470-287.html>

⁹² see 1.2.2 Governance

Target 2: Support for accelerated implementation of technologies, methods, etc. improving resource efficiency and application of ICT in industry.

The targets chosen have demonstrated the commitment of policy-makers to concentrate policy efforts and funding upon a limited number of RIS3 vertical ('smart') thematic areas and two horizontal priorities (addressing the Bulgarian resource efficiency gaps and Digital Agenda):

Figure 8 Smart Thematic Priority Areas and Horizontal Policies

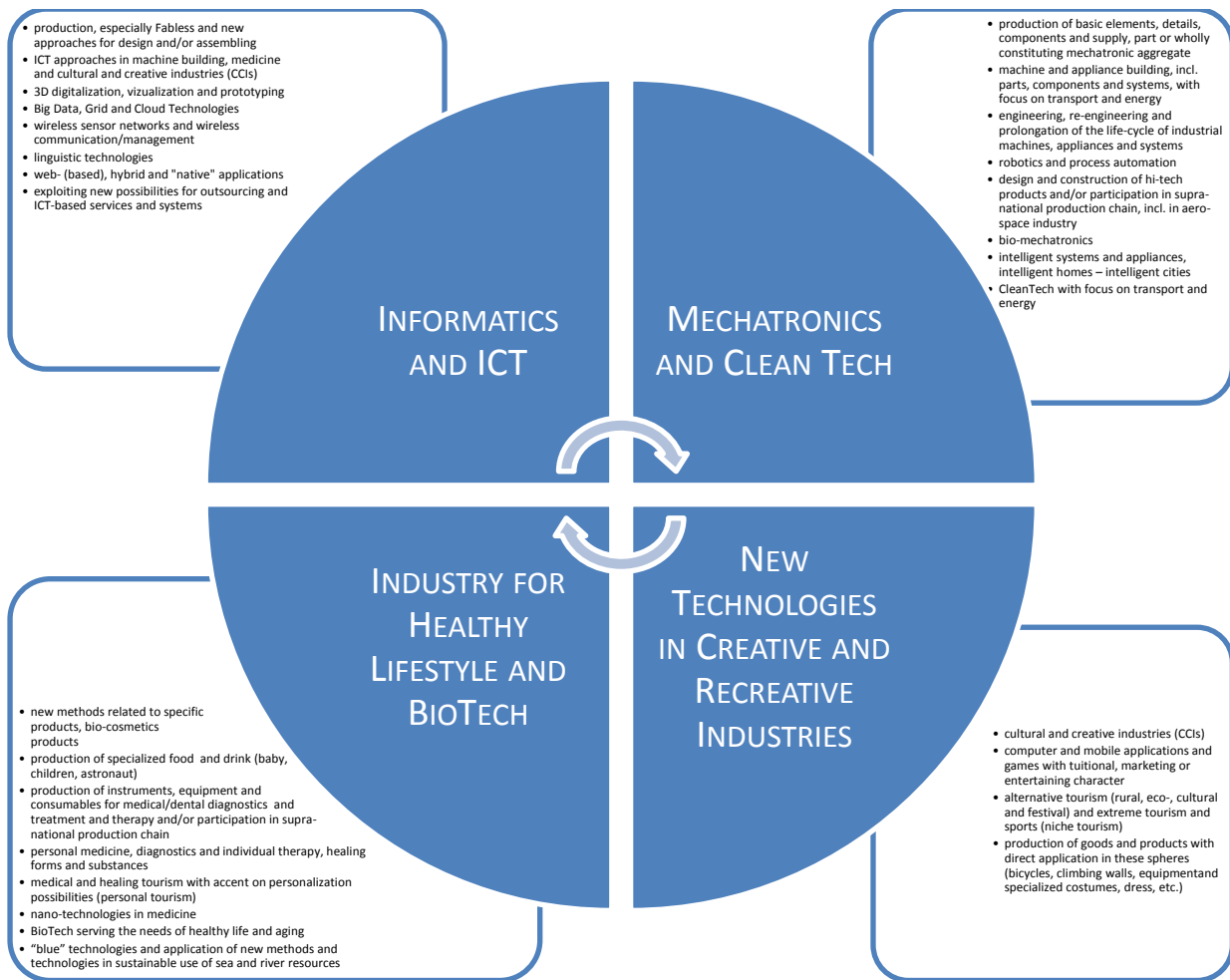


Source: RIS3, Bulgaria, November 2015

The 'smart' areas allow multiple linkages and mutually reinforce each other, given the applicable skills set in an environment of scarcity of highly-qualified human capital, leaving room for 'emerging' knowledge-based industries. The Entrepreneurial Discovery Process (EDP) has allowed for deepening of the 'smart' areas and identifying specific niches, where Bulgaria possesses potential for break-through achievements. The areas capture the research capacities in the country and match them to the economic strengths of the country (in terms of comparative and competitive advantages, higher added value sectors and expected market demand growth niches). The traditions of Bulgarian agriculture and medicine are combined with achievements in ICT and automation, recognizing that 'the industries of the twenty-first century will depend increasingly on the generation of knowledge through creativity and innovation'⁹³.

⁹³ Landry, Charles; Bianchini, Franco (1995), *The Creative City*; see also Florida, Richard, *The Creative Class*.

Figure 9 Bulgarian RIS3 Priority Areas and Sub-Priority Areas



The RIS3 Action Plan approved in November 2014⁹⁴ included the implementation of the following objectives:

- Improving the organizational structure for the governance of implementation of RIS3 and coordination with the OPs;
- Promotion of private investments in R&D;
- Aligning research infrastructure and scientific priorities with economic priority areas in RIS3;
- Ensuring synergy to solve national and regional challenges – identifying the mechanism of implementation of horizontal and vertical links in the implementation of RIS3;
- Intensifying the entrepreneurial discovery process, activating the links between science and business by identifying the specific challenges and the ways to overcome them.

⁹⁴ [Council of Ministers Decision No761/06.11.2014](#)

The Action Plan is close to completion, including the monitoring and evaluation mechanism, whereby EC support has been requested. The finalization of the governance structure has benefited from the PSF panel recommendations with respect to the proposal for a new R&I Agency. In the version of RIS3 as of November 2015 five additional sub-priority areas have been added, related to the achievements of Bulgarian innovators in bio-based economy and clean energy. The infrastructural mapping and prioritization is ongoing, foreseen to be completed by the end of April 2016. The OP "Science and Education for Intelligent Growth" 2014-2020 has introduced a multi-tier approach to infrastructure financing, whereby higher share of the budget is allocated to a limited number of projects with the most importance (Centers of Excellence and Competence Centers), aligned with RIS3 priority areas. The NRI Roadmap is planned to be finally updated by April 2016 on the basis of the project maturity of the 14 infrastructures already identified⁹⁵.

The RIS3 approach is currently national. Bulgaria has 6 NUTS II level regions (North-Western, North-Central, North-Eastern, South-Western, South-Central and South-Eastern), but without a separate regional governance system. There are 28 districts (NUTS III) with district governors, appointed by central government. The districts are divided into 265 municipalities (община, obshtina) at LAU level 1. Although Regional Development Plans are elaborated for the 2014-2020 programming period, no regional operational programme or RIS3 exists at this stage. Excluding Sofia City, the country's capital where R&D&I activities are predominantly concentrated, regional (NUTS II level) heterogeneity hardly exists in view of R&D&I policy and instruments. Sofia City with the support of the S3 Platform⁹⁶ is piloting the local level RIS3 process⁹⁷. Cross-border projects, e.g. in the Greek-Bulgarian cross-border region⁹⁸, have also provided novel opportunities for RIS3 at sub-national level.

2.5 Main policy changes in the last five years

The preparations for and the start of the new programming period 2014-2020 with the concept of ex ante conditionalities have provoked intensive strategic planning and policy changes, including National Development Programme: Bulgaria 2020, Partnership Agreement 2014-2020, OP Innovation and Competitiveness 2014-2020 and the unique for the country new OP Science and Education for Intelligent Growth 2014-2020. The challenge remains tied to implementation mechanisms, policy coordination and especially monitoring and evaluation. Without proper impact assessment not only the effect of the resources allocated to R&I policy and their economic contribution cannot be measured, but also evidence-based policy making in the future cannot be guaranteed.

⁹⁵ see 2.1.2 Infrastructure Roadmap

⁹⁶ <http://s3platform.jrc.ec.europa.eu/>

⁹⁷ <http://www.sofia-da.eu/en/strategic-documents/innovation-strategy-for-smart-specialization-of-sofia.html>

⁹⁸ http://www.greece-bulgaria.eu/index.php?option=com_projects&view=item&id=105/

Table 11: Summary table indicating the timeline of the recent policy changes

Main Changes in 2011

Introduced differentiated financing for the tertiary education establishments

National Research Development Strategy 2020 (www.mon.bg) – setting up the new targets for Bulgaria according to Europe 2020; introducing a new mechanism for more efficient financing of R&D and justifying five priority areas for the development of scientific research in Bulgaria

Changes to the Law for the Bulgarian Academy of Sciences (www.bas.bg) – changing the governing structure, establishing a Board of Trustees to allow public influence to its research agenda, and introducing the obligation to submit to the Parliament Annual Reports

National Reform Programme 2011-2015 (www.minfin.bg) – sets the national R&D spending aim of 1.5% of GDP by 2020

Main changes in 2012

National Development Programme: Bulgaria 2020 (www.minfin.bg)

Law for Public-Private Partnership (www.minfin.bg)

Revision of the National Qualification Framework – introducing nine qualification levels across all stages of the education system (www.mon.bg)

Law on Innovation (under discussion) (www.mi.government.bg) which will reinstitute the National Innovation Fund, the activities of the National Council on Innovations, and most probably will introduce new tax incentives for research and public procurement (under discussion)

Main changes in 2013

Law for Promotion of Scientific Research (www.mon.bg)

Launch of the Bulgarian University Ranking System (www.mon.bg)

Actualisation of the Law on School Education – towards introducing additional evaluation criteria for assessment of quality and accessibility (under discussion) (www.mon.bg)

Main Changes in 2014

Europa 2020: National Reform Programme 2014 update (www.minfin.bg)

Innovation Strategy for Smart Specialisation (provisional) (www.mi.government.bg)

National Development Programme: Bulgaria 2020, Action Plan 2014-2016

Strategy for the Development of Higher Education (under discussion) (www.mon.bg)

National Research Infrastructure Roadmap (www.mon.bg)

Rules for the Scientific Research Fund (www.mon.bg)

Rules for Management of the National Innovation Fund (www.sme.government.bg)

National Strategy for Life-long Learning 2014-2020 (www.mon.bg)

National Research Development Strategy 2020 update (www.mon.bg)

National Strategy for the Promotion of Small and Medium Size Enterprises 2014-2020 (www.mi.government.bg)

National Strategy for Development of Public Procurement (www.mi.government.bg)

Main Changes in 2015

Strategy for the Development of Higher Education (www.parliament.bg)

Ordinance No. 3/27.11.2015 on the conditions and procedure for the planning, distribution and spending of the subsidies from the state budget allocated for the specific scientific research or artistic activities of the state higher education institutions (www.dv.parliament.bg)

National Open Data Portal (opendata.government.bg)

Europa 2020: National Reform Programme 2015 update (www.minfin.bg)

Innovation Strategy for Smart Specialisation (final) (www.mi.government.bg)

National Development Programme: Bulgaria 2020, Action Plan 2015-2017 (www.minfin.bg)

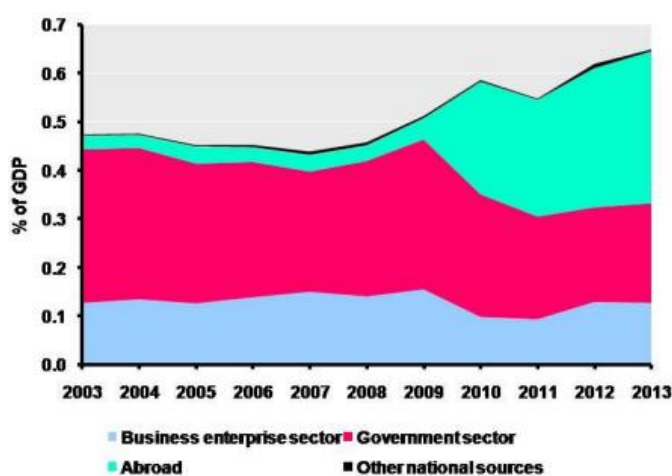
H2020 Policy Support Facility (www.ec.europa.eu)

3. Public and private funding of R&I and expenditure

3.1 Introduction

The decline in public expenditure for R&D and innovation started in the early 90s and the tendency can be observed to reverse only around 2007, when Bulgaria entered the EU. Nonetheless, the comparisons with EU28, and even with other transition economies, such as Slovenia, Czech Republic or Hungary, demonstrates the level of R&D investments is drastically low, varying around 0.5-0.6% share of GDP. HES share of funding and performance of R&D is also negligible. The decline in public R&D intensity contrasts sharply with the rapidly growing private R&D and in particular foreign R&D investments in Bulgaria, still far from EU28 averages. Restricted data availability due to confidentiality limits any detailed analysis of the degree of internationalisation or inward R&D penetration over the period 2011-2014.

Figure 10 Shares of R&D investments



Source: Eurostat, December 2014⁹⁹

Whatever the evidence on the possible “new” role of the business sector, domestic or foreign, in increasing overall investment in R&D in Bulgaria, it is unsustainable in the long term, unless public funding in research and innovation becomes in line with other similarly-positioned EU countries. Relying only on foreign investments may, and already does, create huge discrepancies in the functions of BAS (Bulgarian Academy of Sciences), AA (Agricultural Academy) and HEIs (Higher Education Institutes), for the economy and scientific development of the country. If not reversed, the tendency might lead to a further downward adjustment in the structure of the Bulgarian economy. The gaps in public investments negatively shape the training and skill acquisition of the human capital needed to perform R&D. Simultaneously, insufficient funding negatively affects the existing pool of knowledge available within the system and key stakeholders, including companies benefit less from spill-over effects and positive externalities. The wide coverage of the available limited public funds additionally aggravates the situation, since it fails to provide the conditions for excellence, even with respect to the remaining research ‘islands’.

⁹⁹ http://ec.europa.eu/eurostat/statistics-explained/index.php/Europe_2020_indicators_-_research_and_development

Table 12: Basic indicators for R&D investments

Indicator	2011	2012	2013	2014	EU average (2014)
GERD (as % of GDP)	0.55	0.62	0.65	0.8	2.03
GERD (€ per capita)	29.8	34.6	36.6	46.3	558.4
GBAORD (as % of GDP)	0.24	0.25	0.25	0.25	0.67
GBAORD (€ million)	96.42	101.14	102.48	105.63	2736.3
R&D funded by BES (% of GDP)	0.09	0.13	0.13	n.a.	n.a.
R&D funded by PNP (% of GDP)	0	0.01	0	n.a.	n.a.
R&D funded by HES (% of GDP)	0	0	0	n.a.	n.a.
R&D funded by GOV (% of GDP)	0.21	0.20	0.21	n.a.	n.a.
R&D funded from abroad (% of GDP)	0.24	0.29	0.31	n.a.	n.a.
R&D performed by HES (% of GDP)	0.06	0.05	0.06	0.07	0.47
R&D performed by GOV (% of GDP)	0.20	0.19	0.19	0.20	0.25
R&D performed by BES (% of GDP)	0.29	0.38	0.40	0.52	1.3

Source: Eurostat, December 2015

The data below is presented in tables containing budgetary expenditure for R&D&I through the two leading ministries MES and MoE, based on national budget and operational programmes.

Table 13: MES budget by policy framework related to R&D&I, including budgets for HEIs and BAS for 2011-2014 (€ million)

MES budget by policy framework	2011	2012	2013	2014
Higher education and development of the science potential, incl.:	37.482	45.552	33.899	25.951
• Student support	0.813	4.618	4.602	4.598
• International exchanges	1.411	1.403	1.506	1.375
• Monitoring and development of the science outputs and building a knowledge-based link between education-science-business	0.440	0.286	0.679	12.136
• Coordination and monitoring of the science potential for integration in the European science space and the global information network	11.284	11.378	9.434	6.132
• Promotion of scientific research based on programme-based finance	18.647	18.604	16.054	0
HEI budget (education and research)	170.282	176.521	192.271	192.141
BAS budget	31.478	31.767	31.857	38.371

Source: National Budget

The budgets for BAS and HEIs may be referred to as following an upward trend, although the scale of funding per policy framework in principle remains the same. In contrast, the financing through the SRF unpredictable until 2013 appears to have stabilized around €10 million per year.

Table 14: National Financing through SRF (€ million)

	2011	2012	2013	2014	2015
SRF	2.08	7.84	10.56	10.55	10.74 ¹⁰⁰

Source: SRF

In the 2007-2013 programming period the interventions related to education and training, research and innovation activities and research infrastructure were integrated into two different operational programmes. The soft measures were part of ESF-funded OP "Human Resources Development" 2007-2013, managed by the Ministry of Labour and Social Policy (MLSP), while the innovation and infrastructure-related activities – into the ERDF instrument, OP "Development of the Competitiveness of the Bulgarian economy" 2007-2013, managed by MoE. The thematic priorities of the latter programme uniquely for the country integrated mutually-complementary and reinforcing policies, and R&I infrastructures fitted with the overall innovation eco-system:

Table 15: ERDF and National Financing through OP Competitiveness 2007-2013 (as programmed)

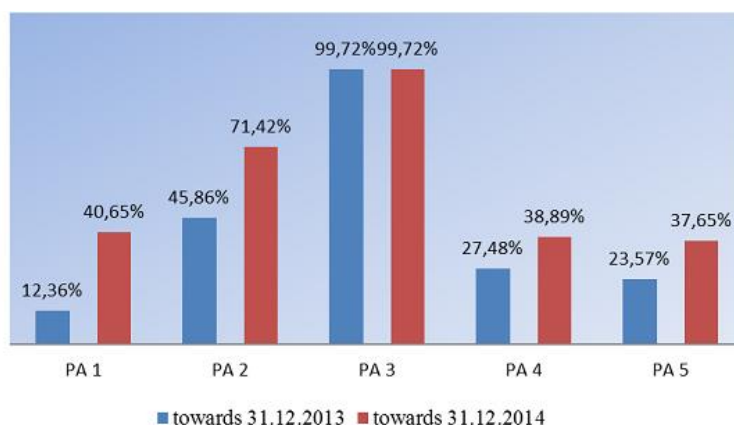
	Community Funding (a)	National Counterpart (b)	Total Funding (c) = (a) + (b)
Priority Axis 1 Development of knowledge-based economy and innovation activities	209 525 000	36 975 000	246 500 000
Priority Axis 2 Increasing efficiency of enterprises and promoting supportive business environment	504 762 113	89 075 667	593 837 780
Priority Axis 3 Financial resources for developing enterprises	170 000 000	30 000 000	200 000 000
Priority Axis 4 Strengthening of the international market position of the Bulgarian Economy	73 960 090	13 051 780	87 011 870
Priority Axis 5 Technical Assistance	29 636 016	5 229 885	34 865 901
Total	987 883 219	174 332 332	1 162 215 551

Source: <http://www.opcompetitiveness.bg/>

According to the Annual Implementation Report (issued in June 2015) data concerning certified expenses, innovation activities (PA1) and institutional support (PA4) demonstrate lower levels of absorption, compared to business support (PA2) and financial instruments (PA3). Priority Axis 1 itself comprises two thematic sub-priorities – one with higher rates of certification (supporting innovative activities of firms) and one facing difficulties due to the complexity of the type of investments (supporting the development of innovation infrastructure).

¹⁰⁰ actually disbursed €3.243 million, according to updated SRF Annual Programme: https://www.fni.bg/sites/default/files/documents/12_2015/GOPact2015.pdf

Figure 11 Financing through OP Competitiveness 2007-2013



Source: Annual Implementation Report 2014 (June 2015)¹⁰¹

Nonetheless, it should be noted that OP modifications happened to reflect the possibilities for adequate reaction to the economic reality, e.g. the size of the JEREMIE instrument (under PA3) was augmented. In addition, year 2015 is crucial for disbursement and certification, i.e. the share has risen substantively¹⁰². Concerning innovative activities, it should be clarified that although they were concentrated in PA1 with targeted support, they were in principle possible through Priority Axis 2 and especially Priority Axis 3 Financial REsources for Developing Enterprises (FREDE). The most interesting example in this direction is the EIF's Entrepreneurship Acceleration and Seed Financing Instrument¹⁰³.

Table 16: MoE budget by policy framework related to R&D&I for 2011-2014 (€ million)

	2011	2012	2013	2014
Policy 1 'Sustainable economic development and competitiveness', incl.:	15.547	16.501	16.145	18.375
• Programme 2 'Promotion of entrepreneurship and innovation'	0.174	0.208	0.260	0.310

Source: National Budget

Funding from MoE is generally programme based and involves specific calls either via NIF, or as part of Eureka and Eurostars frameworks.

Table 17: Financing through NIF (€ million)

	2011	2012	2013	2014	2015
NIF	2.5	2.5	2.5	2.7	0.0

Source: NIF, <http://www.sme.government.bg/>

There are significant structural changes in the thematic R&D expenditure by sciences for the period 2000-2013 based on NSI data. R&D expenditure for medical sciences increases from 4-8% during the period 2000-2008, to 44-43% in 2011-2013. Contrary to this trend, the R&D expenditure in agriculture science decreases from 30% in 2000, to 7% in 2012 and 2013. Government spending dominates the natural sciences (46% for 2013), which are of primary importance in R&D spending for growth. In contrast, R&D expenditure by the business enterprise sector is greater in medical sciences (68% for 2013).

¹⁰¹ http://opcompetitiveness.bg/module6.php?menu_id=382 or <http://www.eufunds.bg/>

¹⁰² see 3.4.3 Project funding

¹⁰³ fi-compass.eu: Case Study 'Maximising the impact of financial instruments in Bulgaria: The JEREMIE Eleven/LAUNCHub instrument' (*forthcoming*)

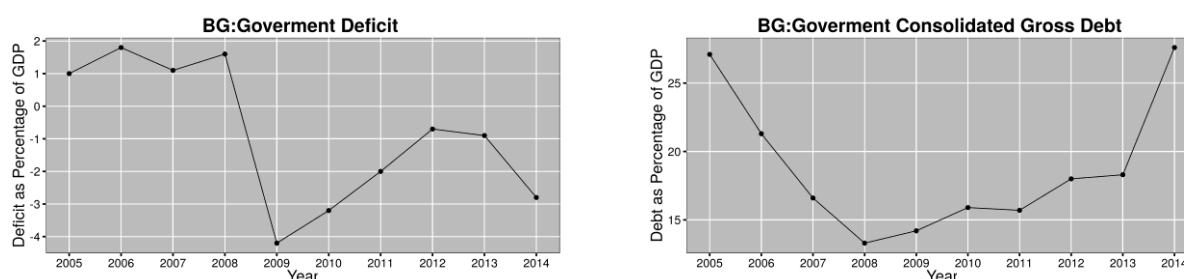
3.2 Smart fiscal consolidation

3.2.1 Economic context¹⁰⁴ and public R&D indicators

Bulgaria has been moderately hit by the economic crisis, losing 5% of its real GDP in 2009. However, the economic performance has remained subdued during the post-crisis period, with growth fluctuating around 1% per year. In 2015 growth started to accelerate slowly (2.2%) due to public investments as well as a strong rise in net exports. In 2016 growth is projected to fall back to 1.5% as a consequence of decreasing volume of EU-funded investments. However, in 2017 growth is expected to pick up again to 2.0% supported also by household consumption on the back of slowly improving labour market conditions.

At the outburst of the crisis Bulgaria had rather healthy public finances. The government budget had a surplus of 1.6% of GDP and the 13.3% debt level was one of the lowest in Europe. The crisis had a strong negative impact on the budget turning its surplus into a 4.2% deficit. Public debt started to grow but at a moderate pace of ca. 1-1.5% p.a. Due to the subsequent fiscal consolidation that took place in 2010-2013 the deficit decreased to 1.2% of GDP and the public debt has been kept under control (18.3% in 2013). In 2014 public debt increased significantly by 9% as a consequence of a liquidity crisis provoked by reliability issues of reported financial sector data at two of the largest commercial banks¹⁰⁵. The deficit increased again to around 5.8% of GDP partly due to increase in interest costs. However, it is projected to fall to 2.0-2.3% of GDP during 2016-2017 due to higher revenues (enhanced tax compliance) and savings on the expenditures side. Further increases in the debt level, up to 30.7% by 2016-2017, are foreseen, broadly due to financing of the government deficit and to one off measures such as the previously mentioned financial sector stabilisation support.

Figure 12 Government deficit and public debt



Data source: Eurostat

Total GERD in Bulgaria was €266.7 million in 2013. There are three main sources of R&D funding: the business sector (€52 million), the government (€84.3 million), and foreign funding (€128.8 million). Direct funding from the government goes to business enterprises (€3 million), the government (€67.4 million) and the higher education sector (€13.5 million).

¹⁰⁴ Sources: DG ECFIN, http://ec.europa.eu/europe2020/pdf/csr2016/cr2016_bulgaria_en.pdf

¹⁰⁵ DG ECFIN: Country Report for Bulgaria, p. 8

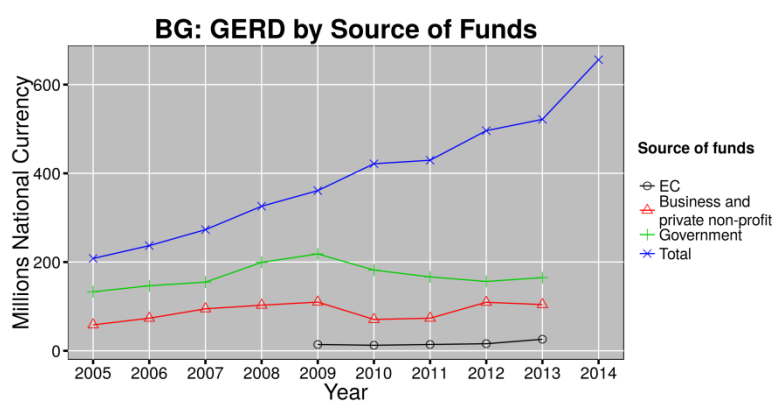
Table 18: Key Public R&D Indicators (Bulgaria)

	2007	2009	2013
GBAORD, % of gov. exp.	0.65	0.80	0.65
GERD, % of GDP	0.44	0.51	0.65
out of which GERD to public, % of GDP	0.30	0.35	0.25
Funding from GOV to, % of GDP			
Business	0.00	0.01	0.01
Public (GOV+HES)	0.25	0.30	0.19
Total	0.25	0.31	0.21
EU funding, % of GDP	n.a.	0.02	0.03

Source: Eurostat

3.2.2 Funding of R&D activities

The sources of R&D funding according to the Frascati Manual¹⁰⁶ are: Government sector (GOV), Higher education sector (HES), Private non-profit sector (PNP) and Abroad (including EC). In this analysis the public sector as source of funds is given by the GOV part of the total intramural R&D expenditure (GERD), whereas the public sector as a sector of performance is the aggregation of GOV and HES.

Figure 13 Funding of the total GERD

Source: Eurostat

Figure 13 Funding of the total GERD shows that the total R&D expenditures (GERD) in Bulgaria follow an upward trend from 2005 onwards, with possibly one year of stagnation in 2011. On the other hand, starting in 2010, the direct support from the government declines. Similarly contribution from the private sector dropped 2010 and 2011, but it recovered the following year and in 2013 (last available year) the level is back to that of 2009.

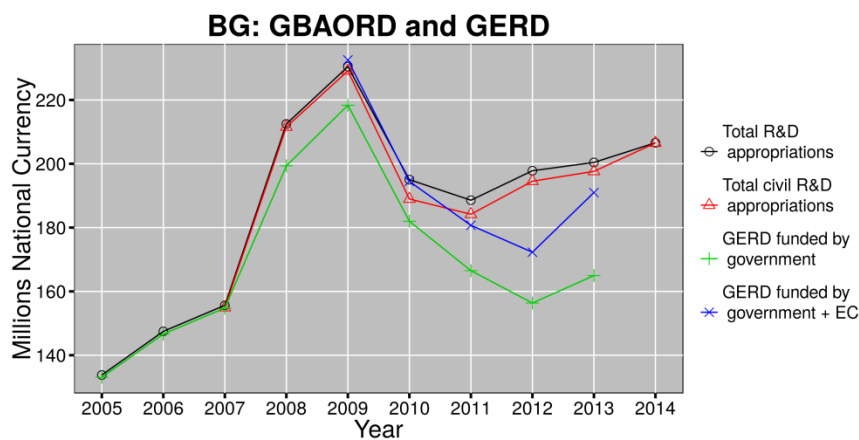
¹⁰⁶ <http://www.oecd.org/publications/frascati-manual-2015-9789264239012-en.htm>

Support from the European Commission, for which only a few data points are available, remains stable in size and very low in comparison to the other sources of R&D financing.

This behaviour indicates that the continuous increase of GERD is financed by another source. In fact, as seen in section 2.3, the financial support from abroad has dramatically increased and in 2013 corresponds to 48% of the total GERD. Since Bulgaria does not systematically report on the detailed categories, i.e. Business, Governments, etc., it is not possible to trace the real source. For 2013 there is enough evidence to believe that the external source of financing is the (foreign) business sector with R&D investments accounting for €110.572m that is 41.4% of the total GERD and 86% of the financing from abroad.

3.2.2.1 Direct public funding from the government

Figure 14 R&D Appropriations and Government Funded GERD in BGN millions (€1 = BGN 1.95583)



Data source: Eurostat

Figure 14 shows that after a sharp increase from 2007 to 2009, the total R&D appropriations (GBAORD) measured in national currency drop significantly in 2010 and 2011. GBAORD, despite the increasing trend from 2012 onwards, has not fully recovered yet. Interestingly, when expressed in relative terms (% GDP), the picture is slightly different especially for the period 2005-2007 due to the significant fluctuations of the GDP. It should be noted that the total GBAORD as percentage of total government expenditure in 2013 is down to 2007 level.

The GERD funded by the government follows the GBAORD trend between 2007 and 2013, with the exception of the period 2011-2012 when measured in units of national currency. During that period a significant cut in the GERD funded by the government occurred. At the same time there was an increase in the support from the European Commission through structural funds for R&D and FP programmes which somehow compensated for the cuts in the direct support from the government.

3.2.2.2 Direct public funding from abroad

Table 19: Public Funding from Abroad to Bulgarian R&D 2005-2013 in BGN millions (€1 = BGN 1.95583)

Source from abroad	2005	2006	2007	2008	2009	2010	2011	2012	2013
Total	15.79	15.39	20.77	22.30	30.26	166.94	188.71	229.63	251.83
BES					11.07				216.26
EC					14.20	12.50	14.20	15.93	26.02
GOV						1.79	1.28		
International Organizations					0.82	1.64	1.44	2.25	1.88
Total as % GERD	7.59	6.49	7.6	6.84	8.38	39.59	43.93	46.28	48.27
EC as % GOVERD					6.5	6.87	8.53	10.19	15.78

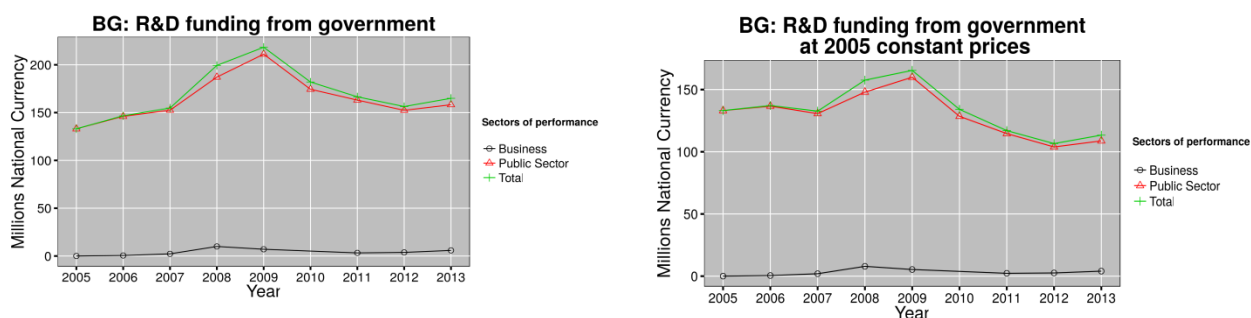
Source: Eurostat

Table 19 shows a dramatic increase in the R&D funding from abroad between 2009 and 2010 (from 8% to almost 40% of the total GERD) which continues until 2013 at a slower rate. Unfortunately, Bulgaria does not systematically report data on the individual sources that comprise the 'category R&D from abroad' and therefore it is difficult to draw conclusions regarding the reason for this growth. However, based on 2013 data only, it can be inferred that responsible for the continuous increase in the R&D investments is the foreign business sector, which (in 2013) accounts for 86% of the total financing from abroad.

The marginal increase in the support from the EC in relative terms (% GERD funded by the government), cannot explain the sudden rise between 2009 and 2010. Consequently, assuming no errors in the reporting, funding predominantly comes from the business sector (although not registered in detail for confidentiality and other reasons).

Distribution of public funding

Figure 15 Government Intramural Expenditure by Sectors of Performance in BGN millions (€1 = BGN 1.95583)



Source: Eurostat

Figure 15 illustrates how the government funded GERD is distributed among the public and the business sectors. The public sector is almost exclusively the recipient of government funded GERD. The share of direct public funding going into the business sector is negligible until 2007, then increases in 2008, before decreasing again in 2009. In 2013 there is a slightly positive trend.

3.2.3 Indirect funding – tax incentives and foregone tax revenues

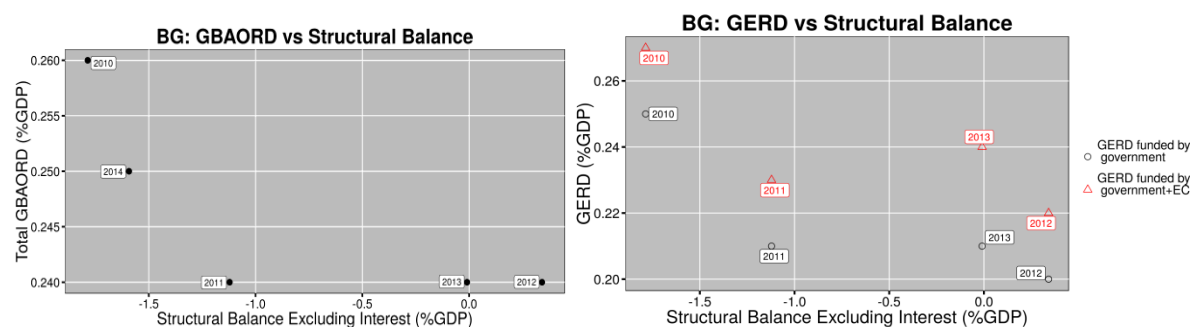
Bulgaria offers very basic R&D tax incentives, and their scope is limited¹⁰⁷. In most cases the publicly performed R&D is eligible for tax incentives. The local experts are not aware of systematic targeting by sector (outside the scope of the smart specialization process currently ongoing as ex ante conditionality for ESIF 2014-2020), although individual ministries might informally practice sectoral preferences, e.g. the Ministry of Tourism.

There are no impact evaluations available with respect to implementation. However, according to the local experts, implementation lags behind best practices in other member states in Western or Northern Europe. The focus is on publicly performed R&D and implementation is governed and monitored by government bodies. The R&D incentive system needs to be adjusted to serve the private sector. Moreover, data which would allow econometric evaluations of the R&D tax incentives are not available.

3.2.4 Fiscal consolidation and R&D

As mentioned in Section 3.2.1, the Bulgarian government started fiscal consolidation in 2010. It is visible in Figure 14 that after a further drop in 2011 GBAORD has been increasing in nominal terms (in 2012 it already reached the 2010 level). Figure 16 below compares as % of the GDP structural balance with GBAORD, as well as with GERD¹⁰⁸.

Figure 16 Fiscal consolidation and R&D



Data source: AMECO, Eurostat, OECD

It could be observed that the 2010-2013 fiscal consolidation had an overall small negative impact of around 0.02-0.04% of GDP on GBAORD/government funded GERD. In both cases there was initially a larger drop (0.02% in GBAORD, 0.04% for the government funded GERD) in 2011 followed by smaller fluctuations. Until 2013 the structural balance was improving, although at the expense of the public support to R&D (especially as government funded GERD). EC financing through Structural and Cohesion Funds (SCF) and Framework Programmes (FPs) was not sufficient to compensate for the losses, as the overall public support never reached the 2010 levels.

¹⁰⁷ A study on R&D tax incentives. Annex: Country fiches. Draft final report, TAXUD/2013/DE/315

¹⁰⁸ Structural balance data comes from the AMECO database, the other indicators were taken from Eurostat, OECD and the Irish governmental websites.

In 2014 the situation appears to be different with negative structural balance and increased GBAORD. Gaps in data for the GERD funded by the government restricts further conclusions.

Based on the above discussion, there is certain evidence that the Bulgarian post-crisis fiscal adjustment process has come to an expense of public support to R&D.

3.3 Funding flows

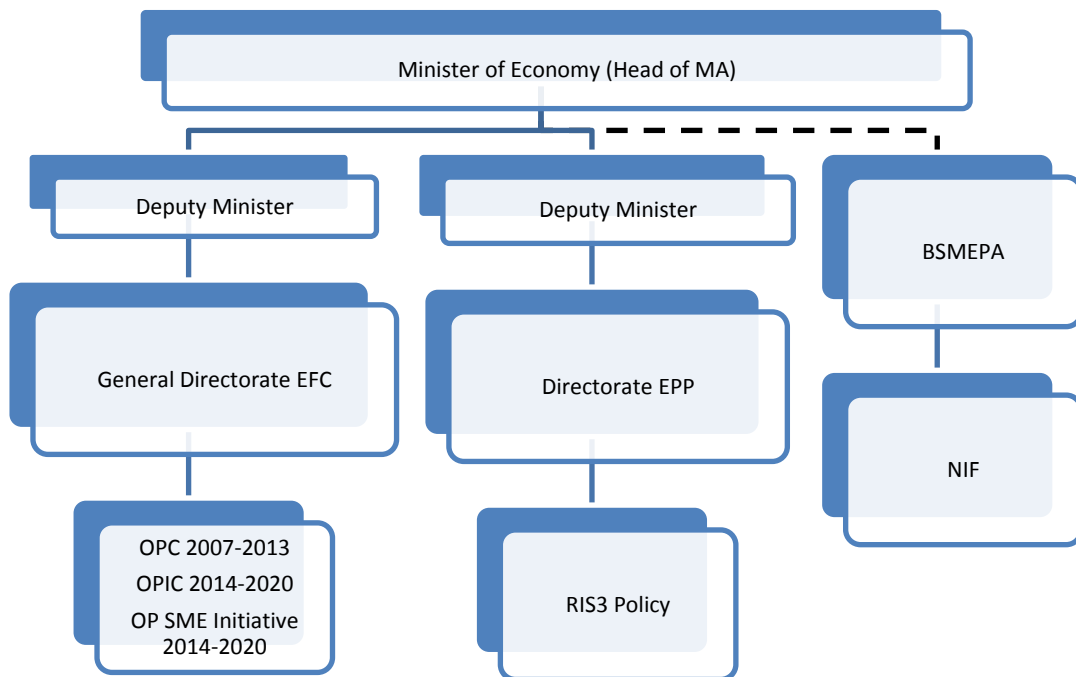
3.3.1 Research funders

The two main institutions responsible for EU and national funding in the area of R&D&I as already explained are the Ministry of Education and Science (targeting the public segment of the system) and the Ministry of Economy (in view of the private segment)¹⁰⁹. The system in Bulgaria includes Managing Authorities, but also a Central Coordination Unit for all ESIF resources, situated within the Council of Ministers Administration. In the MoE two directorates under different deputy ministers manage the funding (DG "European Funds for Competitiveness") and coordinate policy (Directorate "Economic Policies for Promotion"). BSMEPA used to be an Intermediate Body for OP Competitiveness until the May 2012 reform, but the functions are now performed by the Managing Authority. BSMEPA still manages the budget resources within the NIF framework. The EFC General Directorate "European Funds for Competitiveness" (former Phare Implementing Agency) is part of the specialized administration of the Ministry of Economy, acting as Managing Authority of Operational Programme Competitiveness 2007-2013 and OPIC 2014-2020 (and recently OP SME Initiative 2014-2020) and comprises six departments:

- Legislation, Internal Control and Irregularities Department
- Coordination, Publicity and Technical Assistance Department
- Programming, Monitoring and Evaluation of the Operational Programme Department
- Grant Support and Contracting Department
- Monitoring and Financial Management Department (with regional units)
- Legality of procedures and Procedural Representation.

¹⁰⁹ In addition to sectoral ministries such as MAF

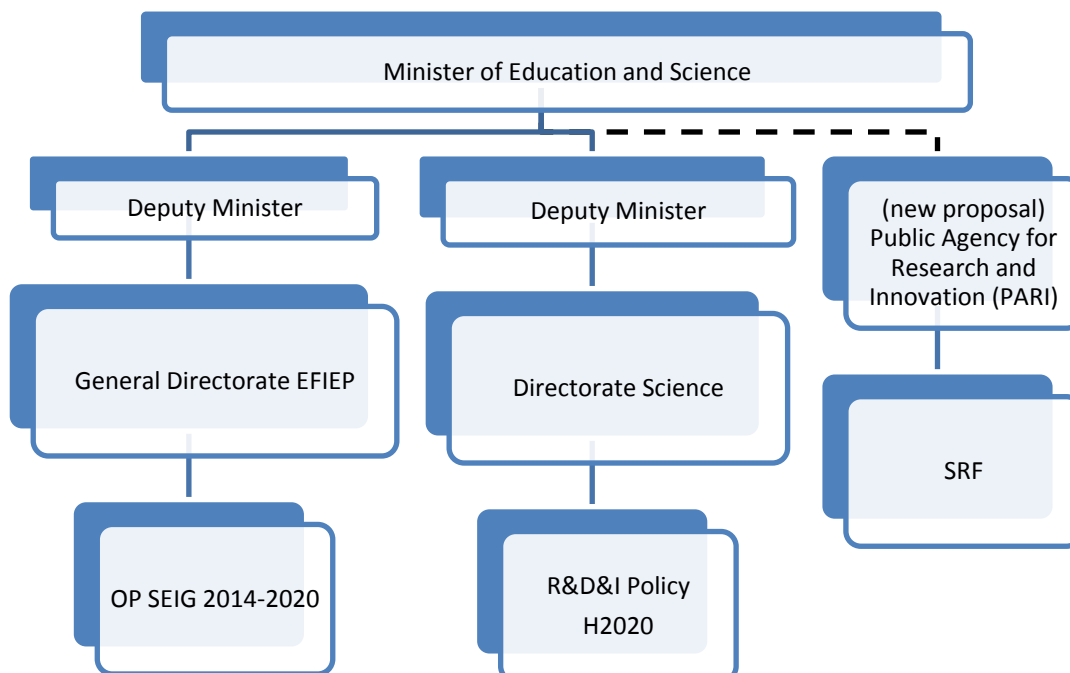
Figure 17 Ministry of Economy as programme and project funder



Source: Authors' Own Data

Similarly, the Ministry of Education and Science also contains a dual division of competences. The general directorate "Structural Funds and International Educational Programmes" (former Intermediate Body under OP HRD 2007-2013) manages OP SEIG 2014-2020, while Directorate "Science" remains the key policy-making body in the area of science, research and innovation, as well as national coordinator with respect to FPs/Horizon 2020.

Figure 18 Ministry of Education and Science as programme and project funder

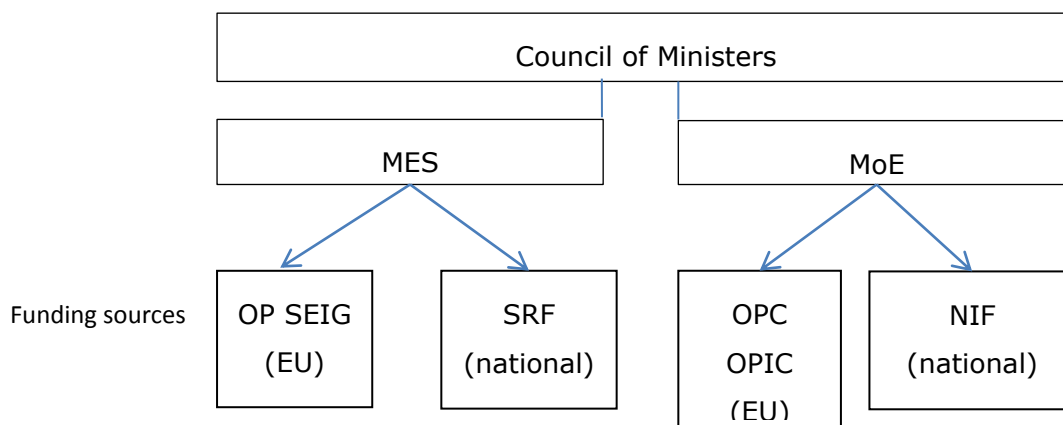


Source: Authors' Own Data

3.3.2 Funding sources and funding flows

The funding sources for research and innovation in Bulgaria are national (the state budget) and external (EU and other donor programmes). In addition to the institutional financing, the financing from the budget is distributed on a project basis through the Scientific Research Fund and the National Innovation Fund.

Figure 19 National and EU funding sources



Source: Authors' Own Data

The predominant share of the funding comes from EU funding sources – operational programmes (and framework programmes). During the 2007-2013 programming period the main funding source¹¹⁰ is the OP "Development of Competitiveness of the Bulgarian Economy", Priority Axis 1 "Development of a Knowledge-based Economy and Innovation Activities" with planned budget of approximately €250 million budget and the following procedures and schemes¹¹¹:

- BG161PO003-1.1.01 Support for the creation and development of innovative start-up enterprises
- BG161PO003-1.1.02 Support for the introduction of innovative products, processes and services
- BG161PO003-1.1.03 Development of innovative start-up enterprises by supporting the introduction of innovative products, processes and services
- BG161PO003-1.1.04 Support for the introduction of innovative products, processes and services
- BG161PO003 -1.1.05 Development of innovations by start-up enterprises
- BG161PO003-1.1.06 Support for R&D activities in Bulgarian enterprises
- BG161PO003-1.1.07 Introduction of innovations in enterprises
- BG161PO003-1.2.02 Creation of new and development of existing Technology Transfer Offices
- BG161PO003-1.2.03 Creation of new and development of existing Technological Centres
- BG161PO003-1.2.04 Development of the applied studies in the research organisations in Bulgaria
- BG161PO003-1.2.05 Creation of a Science and Technology Park.

¹¹⁰ in addition to OP "Human Resources Development"

¹¹¹ Further details, including background data, can be found on: <http://www.opcompetitiveness.bg/>.

For the 2014-2020 programming period ESIF contribute directly to jobs and growth¹¹². Thus, ESIF in the area of research and innovation are present in Bulgaria with two operational programmes and their priority axes 1 (OP "Innovation and Competitiveness", Priority Axis 1 "Technological Development and Innovation" and OP "Science and Education for Intelligent Growth", Priority Axis 1 "Research and Technological Development"), guided by the ex ante conditionality for smart specialization. The funding is distributed (in %) among the following categories in intervention:

Table 20: Categories of Intervention as % of R&D&I 2014-2020

Categories of Intervention	BG	EU28
002. Research and innovation processes in large enterprises	0.0	6.5
056. Investment in infrastructure, capacities and equipment in SMEs directly linked to research and innovation activities	21.2	10.7
057. Investment in infrastructure, capacities and equipment in large companies directly linked to research and innovation activities	10.0	4.1
058. Research and innovation infrastructure (public)	34.4	16.0
059. Research and innovation infrastructure (private, including science parks)	4.3	2.8
060. Research and innovation activities in public research centres and centres of competence including networking	12.1	11.6
061. Research and innovation activities in private research centres including networking	0.0	5.2
062. Technology transfer and university-enterprise cooperation primarily benefiting SMEs	6.5	12.2
063. Cluster support and business networks primarily benefiting SMEs	8.7	5.1
064. Research and innovation processes in SMEs (including voucher schemes, process, design, service and social innovation)	0.0	21.1
065. Research and innovation infrastructure, processes, technology transfer and cooperation in enterprises focusing on the low carbon economy and on resilience to climate change	2.7	4.8
Total R&D&I	100.0	100.0

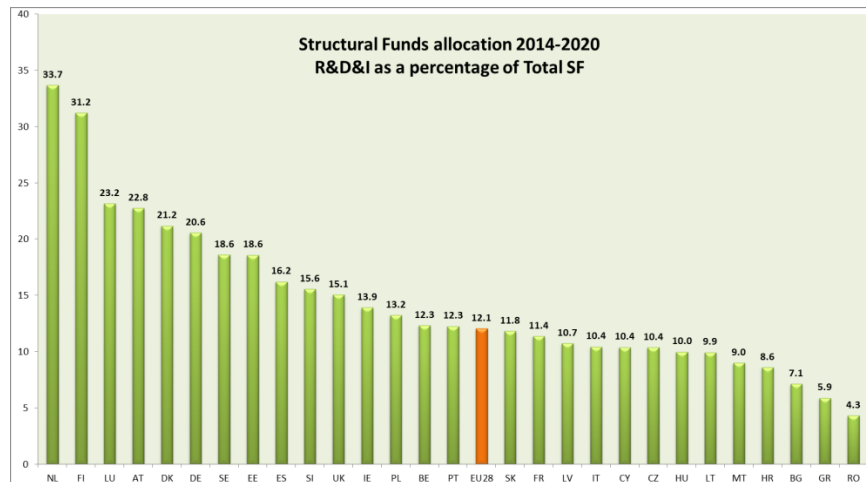
Source: European Commission, <https://rio.jrc.ec.europa.eu/en/library/science-research-and-innovation-performance-eu-2016>

Comparatively, the country is dedicating the third lowest share of ESIF towards R&D&I in the EU28. The planned results can be observed on:

<https://cohesiondata.ec.europa.eu/>.

¹¹² Communication from the Commission: Investing in jobs and growth - maximising the contribution of European Structural and Investment Funds, COM(2015) 639 final

Figure 20 Shares of R&D&I as % of total ESIF 2014-2020



Source: European Commission

Based on the Stairway to Excellence Project¹¹³, the changes that may lead to more effective management/investment of ESIF, specifically related to R&D&I, are the following:

- Fostering performance-based funding and focus on RIS3 areas;
- Introducing predictability and regularity in the calls (e.g. periodic calls), esp. given that R&D&I projects require substantial preparatory phase;
- Further improving inter-institutional coordination and institutional leadership (RIS3);
- Encouraging wide-spread evidence-based policy making and possibilities for learning-by-doing;
- Focusing infrastructural investments into the limited number of institutions with research and innovation capacity and potential;
- Reducing administrative burden and introducing full electronic project submission and reporting;
- 'Purifying' the project evaluation process by including English language, international evaluators and proper compensation for the high-expertise evaluation work (guaranteeing impartiality, confidentiality and protection of IP rights);
- Transforming information dissemination to project preparation support and capacity building, esp. at regional and local level.

¹¹³ <https://ec.europa.eu/jrc/en/research-topic/stairway-excellence-s2e>

3.4 Public funding for public R&I

3.4.1 Project vs. institutional allocation of public funding¹¹⁴

The institutional funding for R&D&I is regulated by a set of legislative acts, depending on the institution being supported. The main form is block funding, provided the institution is accredited. Regular institutional and programme assessments in principle should be performed, but resources and administrative capacity seem to be insufficient:

- Law for Higher Education (www.mon.bg)
- Law for BAS (www.bas.bg)
- Law for Promotion of Scientific Research (www.mon.bg).

Additionally the Law for Public-Private Partnership, approved by Parliament in 2012, taking effect in 2013, could be considered applicable. However, in 2014 PPP law cancellation was voted as inoperative, unnecessary and restrictive, in addition to being 'a mere compilation of the Obligations and Contracts Act, the Concessions Act, and the Public Procurement Act'¹¹⁵, as well as the Municipal Property Act. Up to the present date distinctive legal basis in this sphere hardly exists, whilst some municipalities have developed their own regulations (e.g. Sofia, Varna, etc.) or decide upon using other legal frameworks.

There is institutional allocation of funds for R&D&I to all state HEIs, the institutes of the Bulgarian Academy of Sciences (BAS) and the Agricultural Academy (AA). This is disbursed by two sectoral ministries (MES and the MAF) and regulated by three separate legislative acts - Law for Higher Education, Law for BAS, and Law for the Agricultural Academy. BAS subsidies are determined by the Parliament, where the Academy submits its annual reports for evaluation, although the actual financing is transferred via MES. Internally the subsidy is distributed across all research organisations following a decision of the complex governing structure of BAS. A special case is the funding mechanism applied to the Agrarian Academy which is funded by the sectoral Ministry of Agriculture and Food (MAF), but is under dual subordination of MES and MAF.

The project funding for R&D&I is governed by the rules and procedures of the respective funds, attached to MES and MoE:

- Rules for SRF (ww.mon.bg);
- Rules for Management of the NIF (www.sme.government.bg).

¹¹⁴ The following definition is applied: "Institutional funding is defined as the total of national budgets in a given country, attributed to an institution, with no direct selection of R&D project or programmes and for which money the organisation has more or less freedom to define the research activities to be performed." Institutional funding can be in the form of non-competitively allocated Block funding. Institutional funding may also be allocated in a variable/competitive manner tied to institutional assessments. "project funding is defined as the total of national budgets in a given country, attributed to a group or an individual to perform an R&D activity limited in scope, budget and time, normally on the basis of the submission of a project proposal describing the research activities to be done". Steen, J. v. (2012), "Modes of Public Funding of Research and Development: Towards Internationally Comparable Indicators", *OECD Science, Technology and Industry Working Papers*, 2012/04, OECD Publishing. <http://dx.doi.org/10.1787/5k98s8ns1qzs-en>. Assessments of the total share of competitive vs non-competitive funding can be a relevant starting point of the analysis, but the aim is to have the competitive funding separated between project funding and competitively allocated institutional funding. Competitive funding of research infrastructures through e.g. a research council can be labelled as project funding. However when infrastructure funding comes in the form of a lump sum budget or earmarked budget then it should be considered as institutional funding.

¹¹⁵ <http://www.novinite.com/articles/161096/Bulgaria's+Parliament+to+Cancel+Public-Private+Partnership+Act>

Project allocation of funding by MES is regulated by the Law for Promotion of Scientific Research¹¹⁶ and disbursed by the SRF. BAS is the main recipient of both institutional funding and project funding for research and development, as there is relatively low level of research undertaken at universities and HEIs. For 2014, 80% of the BAS subsidy was distributed across all institutes for employee salaries.

National Innovation Fund (NIF) is the national funding instrument in support of innovative companies. The fund is administered by the Bulgarian Small and Medium Enterprises Promotion Agency (BSMEPA) based on the approved Operational Rules for the Management of the NIF Resources and the Internal Procedures setting up the organization, principles, management and activity of the Fund¹¹⁷. There is no prioritization as regards the industrial sector or technological domain of the projects and the enterprises. The National Innovation Fund defines as non-eligible projects in the sphere of agriculture, forestry, fish industry, projects funded by other donor programmes (national, international or EU programmes) and for investment projects as well. Participation of Bulgarian organizations in EUREKA and EUROSTARS scientific research and development projects is funded by the National Innovation Fund's budget. The minimum, maximum grant and the intensity of the allocated grant all depend on the category of the applicants and the type of activity. Those activities can be industrial scientific research or experimental development.

3.4.2 Institutional funding

According to Article 91 (7) of the Law for Higher Education, the funding for the HEIs for their specific scientific research and artistic activities are determined in size no less than 10% compared to the educational subsidy. The Higher Education Law, Article 90, also stipulates that universities can generate income from alternative sources, provided that fees (institutional and administrative) are directed only at covering the related costs, Article 93.

The institutional funding for HEIs is subject to a ministerial decision by MES in accordance with the Law for Higher Education. Starting in 2003 the funding for scientific research and artistic activities in HEIs in Bulgaria has been guided by Ordinance No.9/08.08.2003, regulating the planning, distribution and spending of the subsidies from the state budget. Given the university autonomous status, the academic council of each HEI could determine the exact amount of the subsidy and the nature of the activities. The subsidy has been conceived of as one to be allocated on a competitive basis and ideally fully project-based. Nonetheless, the academic councils have aimed at relative balance among departments, faculties, natural and social sciences. Reports on the subsidy received are presented yearly and half-yearly. They are reviewed and evaluated according to uniform criteria for monitoring, performance evaluation and accounting, stated as appendices to Ordinance No.9. The subsidy can be decreased in case the reports are not provided.

However, according to the auditing performed of the period 2011-2014 of the National Research Development Strategy¹¹⁸ all public universities and other HEIs distribute on average 2.6% of their funding targeted for research. In 2014 HEIs received in total €4.1m, or 2.77%¹¹⁹ institutional funding for research, distributed to all state HEIs in addition to their educational and tuition grant, based on the number of students.

¹¹⁶ <http://www.mon.bg>

¹¹⁷ currently undergoing amendment procedure

¹¹⁸ Audit Report No 0700010614 (Изпълнение на Националната стратегия за научни изследвания за периода от 01.08.2011 г. до 31.12.2014 г.)

¹¹⁹ This ratio has been calculated on the basis of the transfers of different types of subsidies for individual HEIs for 2014 (see document at <http://www.mon.bg/?h=downloadFile&fileId=2145>). This proportion is similar since 2009.

In 2015 Ordinance No.9 has been revoked and replaced by Ordinance No.3/27.11.2015. The act defines the manner in which the subsidy can be utilised, i.e. to cover expenditure incurred by:

- projects for scientific research or artistic activities in the areas where the HEI prepares students and PhDs;
- projects for preparation of participation in international scientific programmes;
- additional financial support to on-going scientific or artistic projects, funded by national or international research organizations;
- projects for partly-financing of scientific or artistic forums;
- projects for related to the artistic activities cultural events – concerts, exhibitions, performances and others;
- infrastructural projects for the quality and excellent scientific research in state HEIs.

With respect to point 3, the HEI can direct up to 30% of the overall subsidy for the specific scientific research and artistic activities towards a constant budget line "Current financing and support" for:

- supporting the ongoing international programs and projects;
- international programmes and projects where VAT is not eligible;
- co-financing of own and national projects of other organizations;
- payment of licenses for software products on current research projects;
- subscriptions for access to international databases;
- patents and other intellectual property rights in current or successfully completed projects;
- payment of membership fees to international scientific and professional organizations in current or successfully completed projects;
- developing strategies and programmes to promote research;
- costs for participation in scientific or artistic exhibitions in current or successfully completed projects.

In addition, Ordinance No.3 re-defines the criteria for the performance evaluation, defined in the appendix. Relating to the scientific research activities, Criterion 1 refers to the "Approved intra-institutional priorities for scientific research"; Criterion 2 – "Scientific results"; Criterion 3 – "Participation in scientific forums with the purpose of spreading the results"; Criterion 4 – "Personnel, involved in project implementation"; Criterion 5 – "Doctoral students, involved in project implementation"; and Criterion 6 – "Funding for the scientific research activity" (transfer from the budget; externally attracted funding; income from the results).

In accordance with the Law for Higher Education, the educational and tuition component of the subsidy itself has a competitive component, as it is constituted on the basis of: 1. differentiated norm for professional fields (subjects), approved by Council of Ministers; 2. the number of students enrolled; and 3. complex evaluation of quality and of compliance with the labour market needs, formed on the basis of criteria, approved by Council of Ministers, including the results from the accreditation of the HEI. weight of different groups of indicators is as follows¹²⁰: education - 30%, R&D - 28%, labour market realisation - 42%. On 26 February 2015 the Parliament adopted a Strategy for the Development of Higher Education in Bulgaria 2014-2020. The Strategy foresees an increasing role of the evaluation (based on quality of the education and the realization of the graduates on the labour market) in the allocation of funds to the HEIs.

¹²⁰ Council of Ministers Decree No. 15/30.01.2015 amending Council of Ministers Decree No.121/25.06.2012 for determining the subsidy for educational expenses in the state HEIs depending on a complex evaluation of quality and compliance with the labour market needs

There are recommendations to change and introduce legislation to supervise the development of the HEI sector. One of the topics high on the agenda is performance-based funding. A World Bank report from 2013¹²¹ recommends that 'funding would be allocated on the basis of regular, independent monitoring and evaluation of each PRO's performance' (p.18). As a first step towards a performance-based system, the Bulgarian government has drafted regulations for monitoring and evaluating the research performance of higher education institutions and research institutes. According to these draft regulations, there will be an annual evaluation of all institutions. According to the planned structural developments, a commission of 13 independent experts appointed by the Minister of Education and Science will be responsible for evaluating the research performance of all institutions, based on fixed metrics, discussed and approved in advance.

The H2020 PSF panel also concludes that the Bulgarian higher education and research system would undoubtedly profit from the higher concentration of resources that performance-based funding schemes, performance contracts or other measures to reward high performance are likely to generate. Competitive funding may be an important stimulus for change. Bulgaria seems to have achieved consensus on the need to introduce performance-based funding. The challenge is now developing the specifics of the funding model and effectively implementing it. Nuanced/sensitive indicators and adequate management systems and databases (for the performance metrics) are essential for the trust in and transparency of performance-based funding.

Taking into account the 10 principles in the Leiden Manifesto¹²² for research metrics as a guideline, the present Bulgarian draft of criteria and indicators for evaluating the research organisations have been reviewed by the H2020 PSF panel and the two key challenges have been identified. On the one hand, whereas many countries have annual reporting and monitoring of research performance (with or without funding implications), annual comprehensive/full scale evaluation including expert panels may be too time-consuming and expensive. On the other hand, the role and level of discretion of the experts may need to be clarified. If the model is intended to be based on peer review (not only science metrics and bibliometrics), there may be a need for international reviewers to ensure impartiality and trust in the assessments. More than one committee may be necessary to handle assessments of research within all different fields of research.

3.4.3 Project funding

The main funding mechanisms for scientific research and innovation in Bulgaria come from EU funding sources – operational programmes and FPs/H2020. The budget of the two national funds discussed above – NIF and SRF is negligible, compared to the EU and other external funding possibilities. It is a different matter, however, to assess the effectiveness and impact of the Bulgarian participation in these programmes. Bulgaria has participated in FP5, FP6 and FP7, as well as in the disbursement of EU structural and cohesion funds 2007-2013. In FP6 Bulgaria received only 371 successful projects for €42m, which is equivalent to success rate of 0.62% from all project participation and 0.24% from the total value of EC contribution. In FP7 the number of projects is 532 with total value €99m, which is almost double of the figures for FP6. The university sector (but a limited number of institutions) has received 32% of all projects from FP7 and has absorbed 45% of the total value of funds, followed by BAS and AA with 26% of grants.

¹²¹ The World Bank. February 2013: Input for Bulgaria's Research and Innovation Strategies for Smart Specialization, available at <http://www.mi.government.bg/>

¹²² e.g. <http://www.nature.com/news/bibliometrics-the-leiden-manifesto-for-researchmetrics-1.17351>

¹²³ e-Corda data

Towards 31 December 2015¹²⁴, the implementation of OPs 2007-2013 shows that OP Competitiveness (93.62%, EC received) and OP Human Resource Development (95.00%, EC received) enjoy the highest percentage of implementation:

Table 21: OPs 2007-2013 State of Play towards 31.12.2015 (in €)

OP Implementation as of 31.12.2015
EURO

OPERATIONAL PROGRAMME	Programme budget *			Contracted		Payments		Received payments from EC	
	Total	EU Funding	National co-funding	Total as of 31.12.2015	% implementation	Total as of 31.12.2015	% implementation	Received payments from the EC (EU part) as of 31.12.2015	% implementation
OP Transport	2 003 481 166 €	1 624 479 623 €	379 001 543 €	2 000 074 024 €	99.83%	1 687 364 055 €	84.22%	1 294 889 308 €	79.71%
OP Environment **	1 717 164 786 €	1 395 379 676 €	321 785 110 €	2 081 686 947 €	121.23%	1 792 220 757 €	104.37%	1 185 161 038 €	84.93%
OP Regional Development	1 601 274 759 €	1 361 083 545 €	240 191 214 €	1 689 192 662 €	105.49%	1 569 539 096 €	98.02%	1 058 619 028 €	77.78%
OP Competitiveness	1 162 215 551 €	987 883 218 €	174 332 333 €	1 174 812 356 €	101.08%	1 114 014 766 €	95.85%	924 878 728 €	93.62%
OP Technical Assistance	54 658 454 €	46 459 686 €	8 198 768 €	58 516 587 €	107.06%	54 544 616 €	99.79%	43 104 838 €	92.78%
OP Human Resource Development	1 213 869 575 €	1 031 789 139 €	182 080 436 €	1 274 272 047 €	104.98%	1 166 796 982 €	96.12%	980 199 682 €	95.00%
OP Administrative Capacity	174 057 556 €	147 948 923 €	26 108 633 €	186 955 714 €	107.41%	169 686 445 €	97.49%	134 487 903 €	90.90%
TOTAL SCF	7 926 721 847 €	6 595 023 810 €	1 331 698 037 €	8 465 510 337 €	106.80%	7 554 166 717 €	95.30%	5 621 340 525 €	85.24%
Rural Development	3 102 663 943 €	2 500 837 171 €	601 826 772 €	3 253 028 153 €	104.85%	3 072 991 628 €	99.04%	2 253 817 136 €	90.12%
OP Fisheries	83 710 892 €	62 783 169 €	20 927 723 €	93 909 970 €	112.18%	77 113 640 €	92.12%	49 409 196 €	78.70%
TOTAL AGRICULTURAL FUNDS	3 186 374 835 €	2 563 620 340 €	622 754 495 €	3 346 938 123 €	105.04%	3 150 105 267 €	98.86%	2 303 226 332 €	89.84%
TOTAL	11 113 096 682 €	9 158 644 150 €	1 954 452 532 €	11 812 448 460 €	106.29%	10 704 271 985 €	96.32%	7 924 566 857 €	86.53%

* The budgets of OPE, OPTA, OPAC, RDP and OPF are decreased with the amounts of decommitments for 2013 and 2014

** The amount of payments under OP Environment exceeds 100% as per the terms of CM Decision 682/2015

Source: www.eufunds.bg

Categories for innovation funding such as venture and seed capital exist, but still gain speed and popularity. The introduction of more pronounced tax incentives for R&D expenditures and indirect support are also discussed. In the programming period 2007-2013 the sphere of EU funding has been regulated through Council of Ministers decisions and decrees. This logic has been flexible enough to allow for adaptation and differentiation between operational programmes. Yet, the Law on the Management of EU Funds, covering ESIF, voted in Parliament at the end of 2015, is expected to mean transparency, predictability and unified procedures and deadlines. New approaches are set out in the law to ensure fairness and clear rights and responsibilities of each participant in the system, especially the beneficiaries. For the first time penalties for civil servants are introduced in the form of fines in cases where they fail to comply with the required timeframe. Structured pathway for appeals (including 'accelerated' ones) and financial corrections is established. The law regulates the creation of the so-called Fund of Funds (above 700 mln. euros, excluding funds under the rural programme) as a separate financial resource that will manage the financial instruments under different operational programmes. The law creates the necessary legal platform and commitment for all communication between various government bodies in the system, which will be carried out electronically. The administrative procedure will be performed entirely in the unified information system for management and monitoring (UMIS).

¹²⁴ preliminary data, January 2016

3.4.4 Other allocation mechanisms

A limited number of public R&D funding programmes that cannot be classified as project or institutional funding appeared recently, predominantly in the form of competitions, award schemes (e.g. through Sofia Tech Park) or theme funds. A positive example is the Fund for Innovations in Culture: Coupling private and public investment for cultural projects¹²⁵ (within Sofia Development Association, itself an instance of Public Private Partnership (PPP)). The Fund supports cultural and creative industries in Sofia as an engine for urban regeneration, encouraging citizens' (particularly young artists') participation and creating cross-sector partnerships (e.g. with education, science and social services).

The establishment of the Fund for Innovations in Culture is part of the city's larger strategy to support the cultural and creative sectors. This public fund is the first of its sort in Bulgaria. The fund proposes a public private partnership model to provide access to funding for more innovative and risky cultural and creative projects: all private funding collected is doubled by Sofia Municipality. It is an innovative solution in support of arts, culture and artistic experimentation in Sofia and the Southwest region. The Fund was created in the context of the candidacy for the title European Capital of Culture 2019 (won by Plovdiv), but also with the goal to become a successful and sustainable practice that helps to encourage new business models, innovative products and services in the field of cultural heritage and cross-sectoral collaboration.

3.5 Public funding for private R&I

3.5.1 Direct funding for private R&I

During the period 2015-2017, €5.11m will be directed each year through the National Innovation Fund to support the innovation environment. In November-December 2014, 80 projects in two successive sessions of the Fund were approved. The subsidy disbursed amounts to €3.42m, as reported in the National Reform Programme, update 2015. Support for increasing the innovation activities of undertakings is also envisaged under Operational Programme 'Innovations and Competitiveness' (OPIC) 2014-2020. Within OPIC, a procedure with a budget of €150m for enhancing the production capacity of undertakings was launched in 2015 with three deadlines, depending on the technology level of the enterprises. 844 project proposals were received at the first deadline. The novel aspect relates to the introduction of a bonus system, which allows projects in the RIS3 'smart' areas to receive additional points in the process of applying for expanded production capacity. Yet another procedure with a budget of €50m for promoting innovation activities in established enterprises is launched in December 2015¹²⁶, following the Council of Ministers Decision on the update on RIS3 in November 2015¹²⁷. Public consultation has been initiated for a procedure with a budget of €10m for promoting innovation activities in start-up enterprises¹²⁸. Meanwhile, OP SME Initiative 2014-2020 with a budget of €102m has been approved by the European Commission¹²⁹. In parallel, the implementation of projects to improve the innovation infrastructure (setting up and development of technology transfer offices, technology centres, clusters, development of "Sofia Tech Park") and to increase the innovation activities in companies under Operational Programme Competitiveness 2007-2013¹³⁰, as well as the JEREMIE initiative continue.

¹²⁵ <http://fond.sofia-da.eu/en/>

¹²⁶ <http://opcompetitiveness.bg/news.php?id=1025>

¹²⁷ Council of Ministers Decision No.857/03.11.2015

¹²⁸ <http://opcompetitiveness.bg/news.php?id=1022>

¹²⁹ 13 October 2015

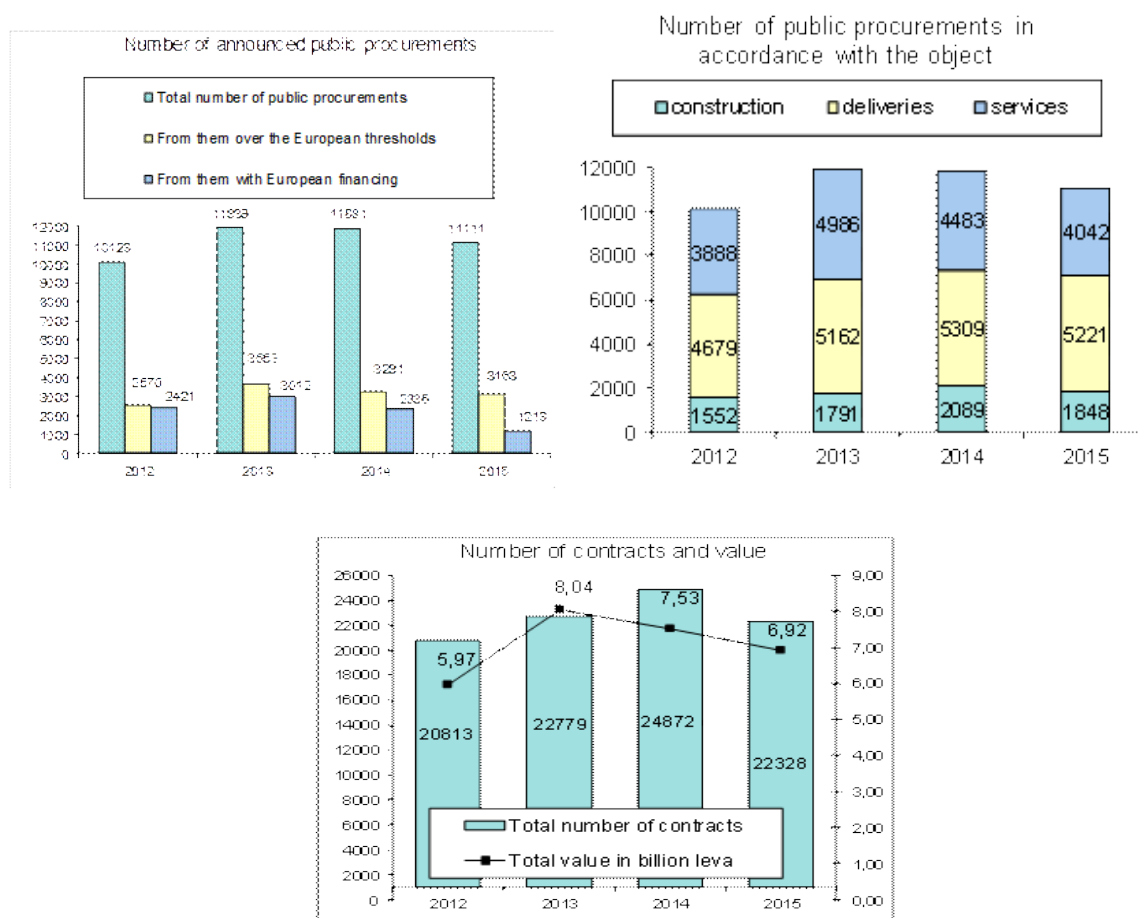
¹³⁰ National Reform Programme, update 2015

3.5.2 Public procurement of innovative solutions

Background

Bulgarian public authorities announced 11,111 public procurements (3,163 over the European thresholds, 1,219 with European financing) in 2015. Among them, the ones related to construction amounted to 1,848, to delivery – 5,221 and to services – 4,042. The public procurement resulted in 22,328 contracts, with a total value of BGN 6.92b (€3.54b). These numbers are relatively well comparable across the years as indicated in the data collection of the Bulgarian Public Procurement Agency.¹³¹

Figure 21 Size of Procurement Sector (Bulgaria)



Source: Public Procurement Agency¹³², Bulgaria

¹³¹ Additional public procurement indicators are available on the Agency webpage: <http://www.aop.bg/>

¹³² http://rop3-app1.aop.bg:7778/portal/page?_pageid=93,1590259&_dad=portal&_schema=PORTAL

Legal Public Procurement framework

Bulgaria transposed the two 2004 Directives on public procurement (2004/17/CE and 2004/18/CE) in 2006 through a modification of articles of its public procurement law (PPL). On 12 August 2015 the Bulgarian Parliament published a draft bill containing the new public procurement law set to replace the existing procurement regulations. The bill fully implements the new EU directives on public procurement (2014/23/EU, 2014/25/EU), which must be transposed by 18 April 2016.¹³³

The bill envisages early introduction of mandatory electronic procurement on 1 July 2017 instead of the directive's deadline of 18 October 2018, A centralised national electronic web platform will be created and it will be mandatory for all contracting authorities. The platform is due to go live on 1 July 2017, but some of its functions will not be available until 2020 – such as the electronic evaluation of offers and electronic signing of contracts, payment, invoicing and others.¹³⁴ The bill also introduces the preliminary market consultations, a new concept for the Bulgarian public procurement legislation. This should make communication between potential suppliers and contracting entities/authorities smoother.¹³⁵

The newly adopted Strategy for Public Procurement¹³⁶ postulates that the regulatory framework for implementation of the new European Directives related to protection of the environment and promotion of innovation should be completed by 2016. The changes in the Public Procurement Law in 2015 lead to the transfer of the PPA from the responsibilities of the Ministry of the Economy to the Ministry of Finance in order to mainstream the processes with the functioning of the Public Financial Inspection Agency (PFIA), the unique competent authority in the country, which has administrative punitive responsibility of the public procurements.

The PCP/PPI landscape in Bulgaria

Besides the transposition of the Directives into the national public procurement legislation, Bulgaria has not set any specific schemes, guidelines, or labels for PCPs (unlike other Member States, such as Finland or the UK).

The Bulgarian Public Procurement Law neither directly encourages nor excludes innovation. But schemes or initiatives, strictly dedicated to PPI, have not yet been put in place. Some use is made of public procurement of innovative solutions as there are tenders that include innovation criteria. Tenders are based on output-based performance specifications and contracts are awarded on the basis of qualitative criteria which favour innovative solutions such as life-cycle analysis, rather than lowest price only. The only concrete initiative that promotes innovation in public procurement is the National Plan for Promotion of Green Procurement 2012-2014 (falling out of the scope of the current exercise) with one of the main objectives of the plan being: "Encouraging the purchase of goods and services with higher "public value" in terms of conservation of the environment, improvement of the social conditions and promoting innovative solutions".

Innobarometer 2014¹³⁷ shows that 69% of the Bulgarian companies have never submitted a tender nor investigated opportunities to bid on a public procurement contract. Perhaps the system, even the innovative component, will need further changes to prove to business that fair competition is guaranteed and participation in public tenders is worthwhile.

¹³³ Source: Bulgaria: Parliament published new public procurement bill, 18 August 2015, <http://www.lexology.com/library/detail.aspx?q=604d872d-486e-4b38-87f1-83ea40bfb81b>

¹³⁴ Ibid.

¹³⁵ Ibid.

¹³⁶ http://www.aop.bg/fckedit2/user/File/bg/novini/Strategy_OP.pdf

¹³⁷ p. 97

PCP/PPI initiatives in Bulgaria

Bulgaria participates in the SPP Regions project¹³⁸. SPP Regions is promoting the creation and expansion of seven European regional networks of municipalities working together on sustainable public procurement (SPP) and public procurement of innovation (PPI). The regional networks are collaborating directly on tendering for eco-innovative solutions, whilst building capacities and transferring skills and knowledge through their SPP and PPI activities. The tenders within the project will achieve 54.3 GWh/year primary energy savings and trigger 45 GWh/year renewable energy. The focus of these tenders will be on: 1) energy use in public buildings; 2) vehicles and transport; 3) food and catering services. The project also pursues to strengthen networking and exchange at the European level by redeveloping the PROCURA+ European Sustainable Procurement Network¹³⁹.

3.5.3 Indirect financial support for private R&I

The proposal for a new Law on Innovation from 2012, not adopted in Parliament, planned to introduce direct tax incentives for research and innovation.

The current system incorporates indirect support for R&I, although the format is rarely known and used by the private sector. BAS, AA and HEIs are exempted from corporate tax and tax on income. Accelerated depreciation tax (100% annually) applies, also for private actors, for assets acquired by means of R&D. Tax deductible expenditure is considered donations (individual and corporate), which may include R&D&I, encompassing donations for HEIs and academies, cultural, educational and scientific exchange under international treaty whereby Bulgaria is a signee, scholarships and stipends, as well as donations to not-for-profit organizations in the central Registry, supported by the Ministry of Justice, for entities for public benefit. The study on R&D tax incentives, performed by DG TAXUD, compares the models implemented in different EU countries and identifies the existence of tax credits and accelerated depreciation in Bulgaria, which are less common compared to other member states, where enhanced allowance and patent box apply¹⁴⁰.

3.6 Business R&D

3.6.1 The development in business R&D intensity

In Bulgaria, the intensity of the business enterprise expenditure on R&D (BERD) is modest (about 0.5% of the GDP in 2014), but it has been on the rise since 2009 (see Figure 22). The rise is most probably related to the increased role of financing inflows from abroad. However, restricted data availability due to confidentiality limits any detailed analysis of the degree of internationalisation or inward R&D penetration. Services and manufacture together account for more than 95% of the BERD expenditure in the period under scrutiny. It is worth mentioning that the services clearly take the lion's share of the BERD (whereas the intensity of the manufacture stagnates in the period 2006-2014) and are strongly correlated to the total BERD intensity.

The business sector is the main funder of the Bulgarian BERD in the period 2005-2009, but the intensity of its funding in 2012-2013 is similar to the pre-crisis level. Despite the lack of data for several years, it is clear that the funding from abroad (which increased from 0.01% of the GDP in 2009 to 0.28% in 2013) is the main driver of the growth of the Bulgarian BERD intensity. Having in mind that the main funding mechanisms for scientific research and innovation in Bulgaria come from EU funding sources – operational programmes, it can be supposed that those sources provide the main share of the funding from abroad.

¹³⁸ <http://sppregions.eu/about-spp-regions/>

¹³⁹ <http://www.procuraplus.org/>

¹⁴⁰ A Study on R&D Tax Incentives. FINAL REPORT. TAXUD/2013/DE/315. FWC No. TAXUD/2010/CC/104

In conjunction with the substantial growth of the services along the same years (see Figure 22), it can be concluded that considerable investments from abroad have targeted the R&D in the services.

Figure 22 BERD Intensity Broken Down by Most Important Macro Sectors (C= manufacture, G_N=services) (Bulgaria)

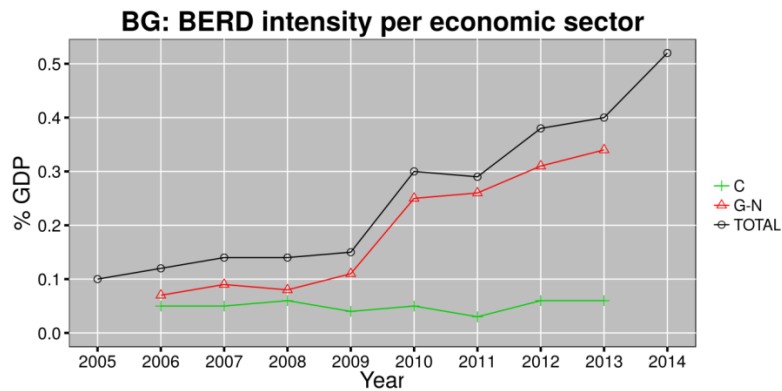
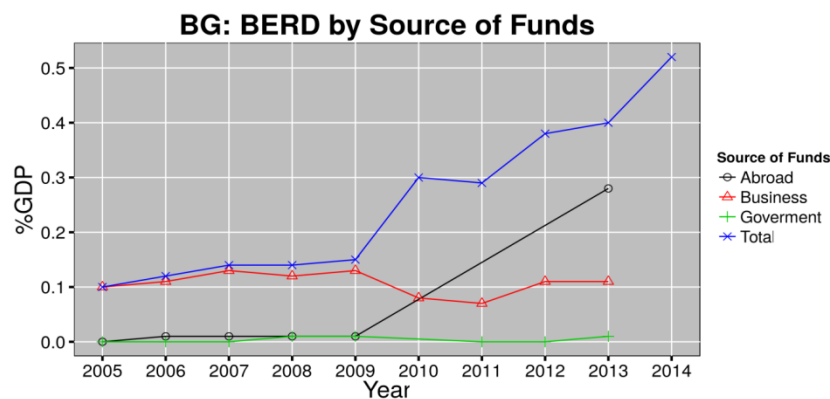


Figure 23 BERD by Source of Funds (Bulgaria)



Source: European Commission

3.6.2 The development in business R&D intensity by sector

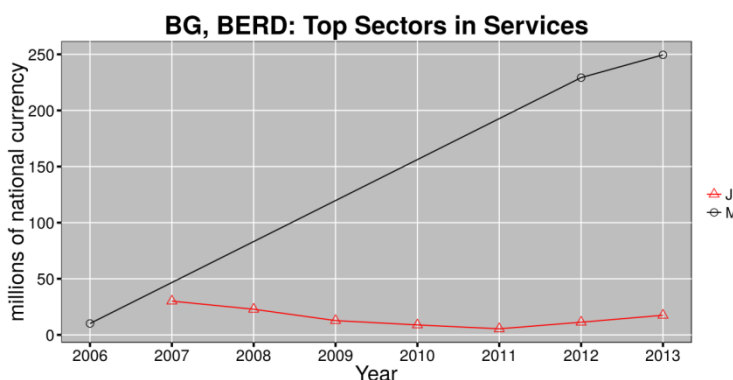
The business expenditure on R&D in the top manufacture sectors in Bulgaria experienced some strong fluctuations in the period under scrutiny (see Figure 24). Despite the aforementioned fluctuations, there is a growing trend in 2009-2013 in the manufacture of machinery and equipment. The pharmaceutical industry is another leading manufacture sector in Bulgaria, and so is (although at lower levels of BERD expenditure) the manufacture in electronics.

Despite the lack of data about the expenditure in the services broken down by sectors, it is clear that the driving force behind the growth of the intensity in the services (see Figure 22) is the professional, technical and scientific services. As already noted above, funding from abroad, and more specifically EU funding sources, have been targeted to the sector in question.

Figure 24 Top Sectors in Manufacturing (C26=manufacture of computer, electronic and optical products; C28=manufacture of machinery and equipment n.e.c; C21=Manufacture of basic pharmaceutical products and pharmaceutical preparations) (Bulgaria)



Figure 25 Top Service Sectors (J=information and communication, M=professional, scientific and technical activities) (Bulgaria)



Source: European Commission

3.6.3 The development in business R&D intensity and value added

Manufacture plays an important role also in terms of gross value added (GVA) in Bulgaria. The services in the automotive industry are also prominent in terms of GVA. Among the top sectors of GVA are also the real estate activities, transport, and agriculture and fishing, which are all relatively low BERD intensity sectors.

Similar considerations apply also for the manufacture sub-sectors ranked according to their GVA. Together with the manufacture of equipment, metals and mineral, low BERD intensity can be found related to sectors like food, beverages and tobacco, and the textile sector.

Figure 26 Economic sectors as percentage of the total GVA. Top 6 sectors in decreasing order: 1) Manufacturing; 2) Wholesale and retail trade; repair of motor vehicles and motorcycles; 3) Real estate activities; 4) Financial and insurance activities; 5) Public administration and defence; compulsory social security; 6) Information and communication.

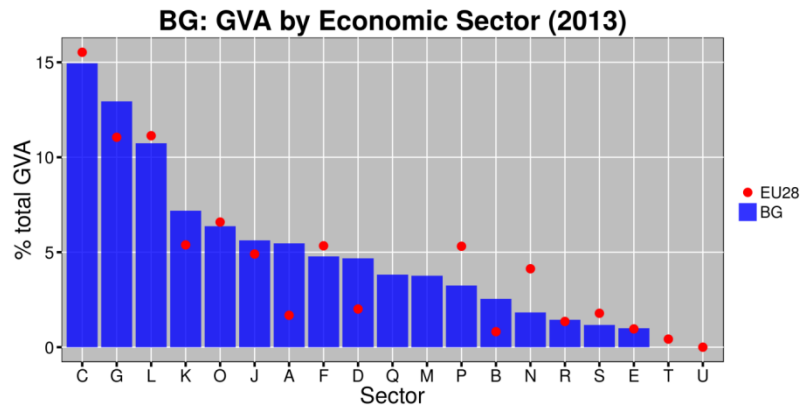


Figure 27 GVA in manufacturing. Top 6 manufacturing sectors: 1) Manufacture of food products; beverages and tobacco products; 2) Manufacture of textiles, wearing apparel, leather and related products; 3) Manufacture of machinery and equipment n.e.c.; 4) Manufacture of fabricated metal products, except machinery and equipment; 5) Manufacture of basic metals; 6) Manufacture of other non-metallic mineral products.

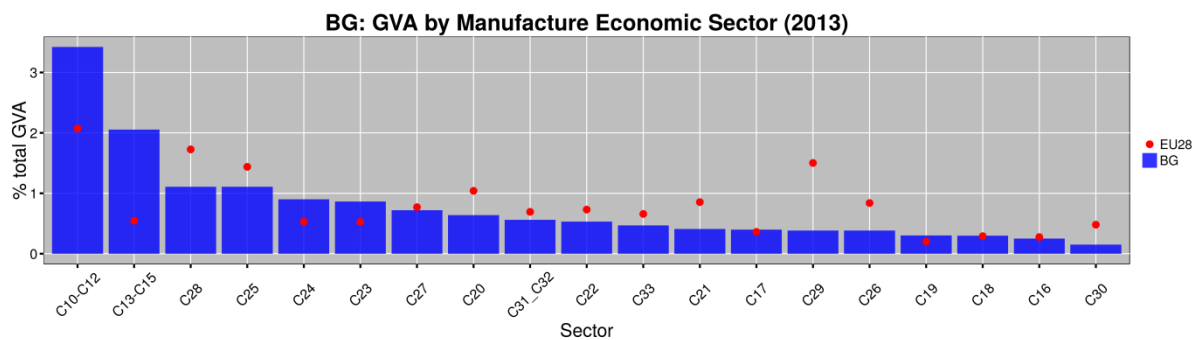
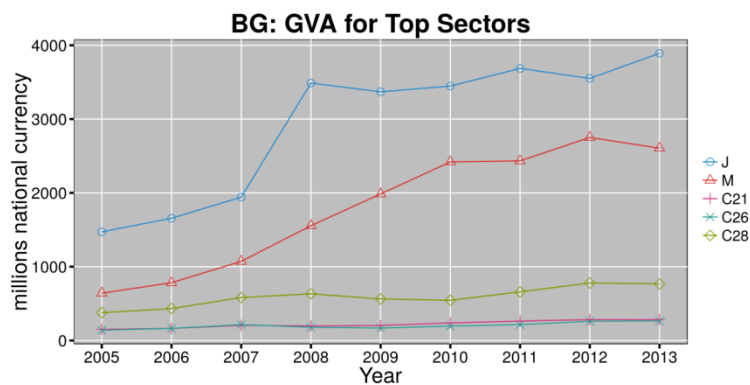


Figure 28 Value added for the leading sectors



Source: European Commission

Concerning the GVA contribution of the top service and manufacture sectors, it can be noticed that the ICT sector and the scientific, professional and technical activities play a major role and distance themselves from the other sectors.

3.7 Assessment

Predictable and efficient sources of funding are particularly important in the Bulgarian system, given its fragmentation and history of underfunding and distrust. Firstly, aside of the OP Managing Authorities, there is a clear lack of professional bodies with administrative capacity and motivated staff to support the policy-making processes, namely in the design of policies and programmes. There appears to be a “culture of benefit” for each participant, with minimal involvement of stakeholders, themselves containing distrust in administration (e.g. the low public procurement interest on the side of business). The lack of professional bodies is then addressed through the sporadic mobilisation of international organisations or other external expertise. Unfortunately, these processes are characterised by a low sustainability and insufficient engagement of actors. In this direction, the PSF supports the creation of an independent funding agency (PARI) with stable funding sources and the ability to design and implement multi-annual programmes.

Secondly, coordinating national research and innovation funds and providing researchers and businesses with predictable funding sources and funding schemes allocated on the basis of clear, transparent criteria that reward research quality and innovativeness is a high priority for the Bulgarian R&I policy. There may also be scope for, and merit in, ‘Europeanising’ national funding capacities and setting up matching-funds schemes that provide national funding to Bulgarian proposals that have been positively evaluated but that were below the threshold to receive funding at the EU level. Such proposal is ingrained for example within the logic of OP SEIG 2014-2020.

Thirdly, the Bulgarian research and innovation system also appears over-regulated due to a lack of systemic trust, and at the same time policy-making is often divided, volatile and not surviving governmental changes. While current legislation mirrors the good intentions of many consecutive governments to make decisions more objective and transparent by creating a strong legal base, the high legislative output may be counter-productive and supporting systemic inertia. Anecdotal evidence provided to the PSF panel seems to suggest a growing weakness and unpredictability in the system due to a considerable turn-over of fragmented legal initiatives and incomplete implementation of legal acts. The laws and regulations might be approved but may have a low level of institutionalisation and of irreversibility. Trust needs to be restored in part by the authorities being seen to be tackling allegations of malpractice and taking steps to restore trust at all levels, even between public agencies and programmes.

Finally, the R&I system cannot excel without a HEI reform. The Bulgarian higher education system is still fragmented and without stimuli for high performance and results. Building stronger and better managed institutions is already a high priority in Bulgaria, but distinguishing the few but excellent institutions in the research and innovation area should be an absolute priority, given the importance of research and innovation for long-term growth and ERA integration. In developing the review and evaluation systems, Bulgaria could profit from the expertise and experiences gathered in international guidelines such as the European Peer Review Guide¹⁴¹, the Principles of the Global Summit on Merit Review¹⁴², and The Leiden Manifesto for research metrics¹⁴³.

¹⁴¹ http://www.esf.org/fileadmin/Public_documents/Publications/European_Peer_Review_Guide_01.pdf

¹⁴² http://www.globalresearchcouncil.org/sites/default/files/pdfs/gc_principles-English.pdf

¹⁴³ <http://www.nature.com/news/bibliometrics-the-leiden-manifesto-for-research-metrics-1.1735>

The introduction of performance-based funding will enhance the accountability of public expenditure on PROs and will facilitate transparent, fair and efficient allocation of resources. By setting up a meritocracy based R&D policy system the Bulgarian authorities will also show to the actors, in particular to the highly-needed new young generation of scientists, that having a PhD and being an excellent researcher is the key to success, in terms of both academic or other professional career. As a first step, PROs could be incentivised to develop and implement research strategies and professionalise their management of research and knowledge transfer. IPR and commercialization are necessarily present in these strategies. Strategy development should take place against a background of policy instruments that encourage integration and synergies.

4. Quality of science base and priorities of the European Research Area

4.1 Quality of the science base

Table 22: Main Output Indicators (Bulgaria and EU)

Indicator	Bulgaria	EU
Number of publications per thousand of population (FULL)	0.52 (2013)	1.43 (2013)
Number of publications per thousand of population (FRAC)	0.36 (2013)	1.22 (2013)
Share of international co-publications	44.7% (2013)	36.4% (2013)
Number of international publications per thousand of population	1680 (2013)	262593 (2013) (total)
Percentage of publications in the top 10% most cited publications (FULL, 2000-2013)	5.71%	11.29%
Percentage of publications in the top 10% most cited publications (FRAC, 2000-2013)	3.29%	10.55%
Share of public-private co-publications	0.9% (2011-2013)	1.8% (2011-2013)

Source: European Commission

Bulgaria ranks among the poorer research performers in the EU, demonstrated by indicators such as the percentage of the top 10% most highly cited publications for the period 2000-2013 (5.71% compared to EU28 average of 11.29% or e.g. 7.83% of Hungary). The EU28 average share of public-private co-publications (2011-2013) is double compared to the same indicator for Bulgaria.

Bulgaria's performance in Horizon 2020 has been poor especially in relation to other "new" Member States of similar size. The total income since the beginning of Horizon 2020 in September 2013 has been €8.6 million. In comparison, countries with smaller populations have been capable of attracting more H2020 funding: Croatia (€9m), Slovakia (€9m), Latvia (€9m). Participation in ERA-net joint calls is also lower than in comparable countries (e.g. Romania), and there is a general view that Bulgaria has been pulling out of co-operations (e.g. an ERIC infrastructure) rather than engaging in new European scale co-operations, due to a lack of national funding priority¹⁴⁴.

¹⁴⁴ PSF 2015

4.2 Optimal transnational co-operation and competition

This sub-chapter deals with cooperation at EU level, including associated countries.

4.2.1 Joint programming, research agendas and calls

Bulgaria participates in a number of transnational cooperation initiatives, strengthening both the competitiveness of the national research performers and their collaborative capabilities. One of the leading strategic co-alignment projects is the country participation in the EU Strategy for the Danube Region (EUSDR), in practice a multilateral (and macro-regional) strategy developed by the Commission in cooperation with 14 countries in the Danube region. Significant results are expected in the innovation related areas, especially Priority Area 07 "To develop the Knowledge Society (research, education and ICT), Priority Area 08 "To support the competitiveness of enterprises", Priority Area 09 of the EUSDR "To invest in people and skills" and Priority Area 10 "To step up institutional capacity and cooperation", coordinated by the City of Vienna (Austria) and Slovenia.

Bulgaria has been involved in 30 joint calls (NETWATCH). It supports also a number of bilateral and multilateral initiatives. Under the collaborative Swiss programme¹⁴⁵ for scientific exchange with the new EU member-states, for example, about CHF6m have been invested in thematic priorities such as: eco-farming, agriculture and forestry and waste management, social disparities and regional inequalities, and research into new medication forms. Norway grants stimulate green industry innovations¹⁴⁶.

The research performers in Bulgaria, and in particular BAS, are involved in the COST initiative, which is coordinated by MES. Bulgaria has been a leader in the nanotechnology COST Action with 28 participating countries. Bulgarian researchers have taken part in collaborative Actions in 11 thematic research areas, which include 414 Action initiatives. Among these are the following actions: Food and Agriculture (FA) – 69 Actions; Materials, Physics and Nano-Sciences (MPNS) – 57 Actions; Forests, their Products and Services (FPS) – 50 Actions; Earth System Science and Environmental Management (ESSEM) – 48 Actions; Individuals, Societies, Cultures and Health (ISCH) – 48 Actions; Information and Communication Technologies (ICT) – 43 Actions; Transport and Urban Development (TUD) – 23 Actions; Trans-Domain Proposals – 6 Actions; and Targeted Networks – 4 Actions. The country participation in COST could prove to be beneficial not only because of direct collaboration, but also because it creates long-lasting partnerships and opportunities for further project development, e.g. related to Horizon 2020.

Similarly, the Bulgarian participation in ERA-NET is relatively strong¹⁴⁷. Concerning the joint programme initiatives, the country participates as observer only in one of the 10 on-going initiatives, namely 'Cultural heritage and global change: a new challenge for Europe' (ERA). Considering the priorities outlined in the National Research Development Strategy (e.g. energy, green and eco-technologies, bio-technologies and bio-foods, health and quality of life), Bulgaria may need to consider in the future the opportunities to join and support initiatives, such as: FACCE-JPI (on agriculture, food security and climate change), Urban Europe (on eco-friendly and intelligent intra- and interurban transport), or JPI Climate (on alternative energy systems) and JPI 'More Years, Better Lives'. MoE coordinates Bulgaria's participation in two Article 185 initiative(s) – EUREKA and EUROSTARS. Although the government approved Bulgaria's participation in 2009, the declaration of the country's accession was signed in June 2010, and the Parliament adopted the Law on Ratification in 2011, opening the application process for Bulgarian companies for funding (EUREKA).

¹⁴⁵ <http://swissbgcooperation.bg/>

¹⁴⁶ <http://eeagrants.org/>

¹⁴⁷ State of the Innovation Union, Taking Stock 2010-2014, COM(2014) 339, Luxembourg: Publications Office of the European Union, 2014

Currently, the NIF rules are amended and their finalization is expected to provide new opportunities for Bulgarian companies and research institutes to obtain funding under the EUROSTARS joint programme (Article 20), whereby the match-funding and costs for participation are covered by the budget of NIF. The Bulgarian institution that is responsible for the organization and coordination of participation in EUREKA and EUROSTARS is BSMEPA, operating under MoE. Additional effort is needed in this respect, since multi-party consortia are approved to implement projects and if the Bulgarian side cannot cover its share of co-financing, international initiatives may be endangered or halted.

There are three successfully completed projects with Bulgarian participation, and seven currently running, three of which are looking for new partners (EUREKA). The successful EUREKA projects are in the field of electronic devices, healthcare and medicine, environmental treatment, and also IT management systems, agri-food, advanced materials, technological innovation in tourism, leisure and cultural sectors.

Bulgaria has also demonstrated high interest in KIC-InnoEnergy and Climate-KIC¹⁴⁸, two of three Knowledge and Innovation Communities (KICs) created in 2010 by the European Institute of Innovation and Technology (EIT). Bulgaria is a member of the European Organization for Nuclear Research (CERN), the European Science Foundation (ESF) (members are BAS and SRF), the International Thermonuclear Experimental Reactor (ITER), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), the European Centre for Medium-Range Weather (ECMWF) and the European Space Agency (10th ESA European Cooperating State since signing of the Plan for European Cooperating State (PECS) Agreement in April 2015¹⁴⁹).

In addition, Bulgaria is implementing its third **Country Programme Framework (CPF)** 2012-2017, which defined the reference for the medium-term planning of technical cooperation between a Member State and the International Atomic Energy Agency (IAEA) and the priority areas:

- Sustainable energy development
- Human Health
- Rural Development and Environment
- Governmental, Legal and Regulatory Framework for Safety.

4.2.2 RI roadmaps and ESFRI

Bulgaria has followed the procedure for evaluation of the scientific infrastructure, its categorisation and the selection and approval of Bulgarian consortiums for integration into the European Strategic Forum on Research Infrastructures (ESFRI). The NRI Roadmap was updated in 2014. Through the ESFRI mapping, Bulgaria has nine approved research infrastructure consortiums, which include a large number of participating research organisations and a budget of €93.268m (NRP 2014) for its implementation until 2019. The implementation of the integration process is coordinated by MES. The infrastructure consortiums, integrating science and technology capabilities, have strategies co-aligned with European consortiums. The infrastructure consortiums are planned to be managed through mid-term R&I programmes, governed by international boards of experts, with the inclusion of NGOs to ensure the socio-economic application of the scientific results:

- National University Complex for Biomedicine and Applied Research – member of BBMRI (Biobanking and Biomolecular Resources Research Infrastructure) since 2010 and aiming for integration with EATRIS (European Advanced Translational Research Infrastructure for Applied Medicine)

¹⁴⁸ <http://www.cleantech.bg/>

¹⁴⁹ http://www.esa.int/About_Us/Welcome_to_ESA/Bulgaria_becomes_tenth_ESA_European_Cooperating_State

- Centre for Advanced Microscope Analysis for Fundamental and Applied Research in the Field of Biology, Medicine and Biotechnology (EuroBioImaging)
- Infrastructure for Sustainable Development in the Field of Marine Research (Euro-Argo, as well as EuroARGO (global monitoring of the oceans and seas), EUROFLEETS, JERICO, SeaDataNet, DANUBIUS-RI, FixO3, EMSO and MyOcean)
- Energy Conservation and Carbon Energy (member of the European Energy Research Alliance [EERA], as well as other European consortiums such as EU PVTP, SmartGrids, Biofuels, EHC, EuMAT, and ERTRAC, Logistics)
- National Centre for High Performance Distributed and Cloud Computing (EGI.eu (the energy grid) and PRACE)
- European Social Study for Bulgaria (ESS-ERIC)
- National Interdisciplinary Research Infrastructure for Resources and Technologies for the Bulgarian Language and Cultural heritage (CLARIN (electronic linguistic models) and DARIAH)
- Regional Astronomy Centre for Research and Education (ASTRONET, OPTICON and the European South Observatory)
- National Cyclotron Centre in the field of nuclear medicine, nuclear physics and energy, radiochemistry, and radio pharmacy.

Five additional infrastructure projects are prioritized at national level:

- Advanced Material Technology Research and Manufacturing Facility with Application to Conservation Technologies (INFRAMAT)
- Innovation Research in Agriculture and Food
- Alliance for Cell Technologies (EATRIS)
- National Geo-Information Centre (EPOS)
- Eco and Energy Saving Technologies.

The national budgets (€484,000 for 2015 and €510,000 for 2016)¹⁵⁰ and the envisaged balanced combination of institutional and programme funding from national and European sources, including MES allocation, SRF, Horizon 2020, as well as OPSEIG, OPIC, and OPRD, have not been implemented yet. The key indicators to measure success are quantitative measures, such as: number of publications of Bulgarian researchers/scientific research units in international journals; number of patents per 100 thousand residents; number of international projects, developed at the centres of excellence and competence centres; number of international projects with Bulgarian researchers involved¹⁵¹.

4.3 International cooperation with third countries

Bulgaria mainly participates in cooperation with third countries on the basis of EU science and technology cooperation agreements. These agreements constitute a framework and a privileged forum to identify common interests, priorities, policy dialogue, and the necessary tools for S&T collaboration. The ones of strategic interest for Bulgaria as of January 2015 are with the United States of America and the BRICS countries. Concerning the EU-US collaboration, the EU-US Cooperation Arrangement on Clusters¹⁵² may prove an effective instrument stimulating consolidation (internally in Bulgaria) and integration (within EU) in order to be present on the international scene.

¹⁵⁰ National RI Roadmap, update 2014

¹⁵¹ National Research Infrastructure Roadmap, update 2014

¹⁵² signed in Washington in April 2015

International cooperation in the fields of science and technology is based on bilateral and multilateral international agreements and implementation of joint programmes. Bulgaria has a number of bilateral and multilateral scientific agreements with 12 countries among which joint research programmes are running with Ukraine, India, China and Switzerland.

4.4 An open labour market for researchers.

4.4.1 Introduction

Statistics on science and technology personnel are key indicators for measuring the knowledge-based economy and its developments. An analysis of R&D personnel in Bulgaria by sector in 2013 (Eurostat, July 2015) shows out of a total of 12.3 thousand full-time equivalents (FTE) that the government sector employed the highest share of researchers in Bulgaria (43%), followed by the HEI sector (33%) and the BES (22%). The structure is skewed compared to EU28, whereby the bias is explicitly towards the business enterprise sector (48%). R&D personnel from all sectors together amounts to 0.5 % of the labour force in 2013, compared with an EU28 average of 1.1%.

ERA-Synthesis Report¹⁵³ examines the issue that while the principles of open, merit-based and transparent recruitment appear increasingly recognised in the regulations and legislation, difficulties persist in implementing them. For Bulgaria creating and developing an open research market presents a challenge internally, let alone integrating into the common EU space. Autonomous institutions decide upon staff without substantive checks or enforceable appeal procedures. The country could be considered to have 'dual' labour market for researchers, whereas employment conditions vary remarkably between researchers with permanent contracts and those without. Broadly speaking the country falls into the group where recruitment and career structure of researchers is largely regulated at the national level. Yet, with the revisions of the regulatory frameworks and start of the HEI reform, aiming at higher autonomy and decentralization, the processes within the institutions have become exceeding hard to monitor and control. Thus, the case usually implies over-regulated environment with hardly any enforcement or practically implemented unified approach.

Simultaneously, based on MORE2 Higher Education Survey 2012, Bulgarian early stage researchers are amongst the most outwardly mobile in the European Union (above 30%), the issue of brain drain out of the country and out of academia being the gravest. Given the already low number of PhDs in the country, the brain-drain phenomenon makes it difficult to retain graduates for doctoral programmes and endangers the high quality section of the labour market. The unattractive salaries for researchers at all career stages from PhD to Professor explain the predominant motive for migration. Nonetheless, a new approach to doctoral training using the Innovative Doctoral Training Principles (IDTP) may help especially if it can be seen that this leads to better employment prospects. In short, in 2011 the ERA Steering Group on Human Resources and Mobility developed the IDTP with seven principles: 1) Research Excellence; 2) Attractive Institutional Environment; 3) Interdisciplinary Research Options; 4) Exposure to industry and other relevant employment sectors; 5) International networking; 6) Transferable skills training; and 7) Quality Assurance.

¹⁵³ http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/30386/1/ipts_erasynthesisreport_final.pdf

In parallel there could also be measures introduced to increase the internationalisation of doctoral education. Between 2000 and 2015 the number of Bulgarian PhD almost doubled from 3,414 to 6,617, however, the number of foreign PhD's remained almost constant. Attracting foreign PhD candidates can increase the number of researchers, changes the culture in predominantly national institutions and, in the long run, can lead to greater international collaboration. There is excellent experience across European universities in this regard and there is currently a European University Association (EUA) project FRINDOC (Framework for the Internationalisation of Doctoral Education)¹⁵⁴ that is developing a framework on good practice and an online tool to support planning and implementing internationalisation strategies.

4.4.2 Open, transparent and merit-based recruitment of researchers

The government and PROs are jointly responsible for the definition of staff categories and recruitment/eligibility criteria. The institutions determine for the number of academic staff and available positions within faculties and departments. The PROs in practice enjoy high level of autonomy. This means that they can play a critical role in changing the researcher career structure, from PhD to Professor. This will require them to become more strategic in their planning for staff recruitment, career development and support. However, it needs to be stressed that implementation of institutional strategies for HR depends heavily on the availability of funding from the government (for example, the overall salary levels and the introduction of significant career development training programmes) as their current budget leaves them little room to manoeuvre. Nonetheless there are structural reforms in terms of recruitment and promotion procedures that can be changed by the institutions using their institutional autonomy, especially in the direction of rewarding exceptional performance and introducing adequate incentive structure.

As can be seen from MORE2 Higher Education Survey 2012 about half of the researchers in Bulgaria believe that the recruitment process in their institution is not open, transparent and merit based. This shows the necessity to focus on the proper implementation of the European Researchers Charter and Code of Conduct for their Recruitment¹⁵⁵ ('Charter and Code'), published in 2005. It lays out clearly the rights and responsibilities of researchers. The criteria for transparent, open and merit-based recruitment involve at least the following elements:

- The vacancy announcement includes the job profile, skills and competences required, and eligibility criteria
- Information on the selection process and criteria is available for the candidates
- A minimum time period between vacancy publication and deadline for application is defined
- Applicants have the right to receive feedback on the results of the recruitment
- Applicants have the right to appeal against the decision
- Selection panels are set up
- Information on the rules for the composition of selection panels (e.g. number and role of members, gender balance) is available for candidates
- The composition of the selection panel is published
- The selection includes national external members
- The selection of the panel includes national and international external.

¹⁵⁴ <http://www.eua.be/FRINDOC>

¹⁵⁵ <http://ec.europa.eu/euraxess/index.cfm/rights/whatIsAREsearcher>

There are 40 principles that can be classified under four broad headings; Recruitment; Ethical and professional aspects; Working conditions; Training. The Charter and Code has been signed by the Bulgarian Rectors Conference and the Free University of Varna. The role of the Charter and Code is central in current ERA policy that focuses on specific targets, the relevant one being an Open Labour Market for Researchers. Adopting and implementing the Charter and Code will give the universities in Bulgaria and also BAS/AA a framework based on European policy to improve the start and the moving up along the academic career path.

In 2009, the Human Resources in Research Award (HRS4R)¹⁵⁶ was introduced as a means for institutions that adopt the Charter & Code to gain recognition with the HR Logo. The Human Resources Strategy for Researchers (HRS4R) supports research performing institutions and funding organisations in the implementation of the principles of the Charter & Code in their policies and practices. The concrete implementation of the Charter & Code by research institutions renders them more attractive to researchers looking for a new employer or for a host for their research project. Funding organisations implementing the Charter & Code principles will contribute to the attractiveness of their national research systems and to the attractiveness of the European Research Area more generally.

4.4.3 Access to and portability of grants

Access to grants

Under the Labour Code in Bulgaria, all PhD students receive fixed grants (including social security cover) for three years. In order to improve research funding opportunities, the Scientific Research Fund (SRF) and EU programmes (previously OP Human Resources Development 2007-2013 and currently OP Science and Education for Intelligent Growth 2014-2020) offer doctoral candidates the possibility of participating in competition-based science projects which can serve as an additional source of income. Approximately 30% of the resources of the SRF are dedicated to young researchers. In addition, European Economic Area (EEA) grants and bilateral research cooperation schemes with foreign partners provide the possibility for improving researchers' funding opportunities.

Current practice spreads research funding broadly over the all PRO's in Bulgaria. Unless research funding is directed towards those with significant research activity based on research excellence, Bulgaria will face a clear challenge with its stock of researchers and the national 2020 target of 1.5% investment of GDP on R&D. It will be essential to ensure that the increase of budget amounts is done in a way to encourage quality improvement and incentivize individual researchers to follow a research career in the country.

In this respect the PSF review panel¹⁵⁷ recommends that a new cohort of researchers within R2 (Recognised Researcher), the postdoctoral researchers, is introduced to increase the flexibility of the Assistant Professor category. The provision of professional development opportunities through skills training should be made available to all researchers at this level. This will enable a greater flux of researchers in the Bulgarian system and stimulate international collaboration. At more senior level there is an opportunity to attract leading research talent from abroad through high-level individual fellowships. This is a practice common in many European countries and can be an excellent way to attract back the Bulgarian research diaspora. There are bottlenecks to career progression at senior level due to age profiles. A complementary set of measures is urgently required to stimulate opening up of the system itself.

¹⁵⁶ <http://ec.europa.eu/euraxess/index.cfm/rights/strategy4Researcher>

¹⁵⁷ see the PSF Panel Report, available at: <https://rio.jrc.ec.europa.eu/en/library/horizon-2020-policy-support-facility-peer-review-bulgarian-research-and-innovation-system/> or <http://horizon2020.mon.bg/>

In the medium and long term, the proper salary (and also grant support) mechanism passes through assessment of researchers themselves, this itself being done in an independent, fair and transparent manner. An optimal method is based on research excellence that is measured through a combination of clear metrics and underpinned by international peer review using the Leiden Manifesto. On examining the different career stages of researchers and the national needs, it seems preferable to introduce individual fellowship schemes for increasing the numbers. In order to have the confidence of the scientific community and ensure excellence, international peer review should be used in the selection process to appoint new researchers. This could be implemented through a single national funding agency (as the proposed PARI). In fact, these fellowships could be introduced as a national programme for researcher career development. Along with scientific excellence, there is a need for career development that includes professional development and training incorporating areas from leadership to technology transfer. The applicable salaries are clearly unattractive, but this model can change if assessment of researchers is conducted. In the short term, a solution would be to use ESIF to augment the salaries and financial stimuli overall. Also use of the Marie Skłodowska Curie COFUND programme for PhD's and postdocs would be helpful, as the salaries do not have to match local levels.

As a first step in researcher career development, all research performing institutions should sign up to the Principles of the European Charter for Researchers and a Code of Conduct for the Recruitment of Researchers. The long-term goal is then for all research performing institutions to obtain the HR Excellence in Research Award. This should become a necessary condition for applying to national funding agencies. It will certainly be important in seeking funding from Horizon 2020. The process of applying for the HR Excellence in Research Award will mean that institutions must examine critically and in detail their own practices in staff recruitment and development following the headings of:

- Recruitment and Selection
- Ethical and Professional Status
- Working Conditions and Social Security
- Training and Professional Development.

In fact it would be preferable if national funding agencies were to adopt the Charter and Code and require its implementation through its funding schemes. Not only will PROs identify areas where they can improve but also any bottlenecks and impediments that can be resolved externally by national legislation and funding agency procedures. This collaborative approach between the PROs and the funders could introduce a system that will develop a new cadre of researchers striving for scientific excellence and with the skills to form close links with business and industry.

Portability of grants

Bulgaria currently has not put in place any specific measures supporting the portability of grants.

4.4.4 Doctoral training

Currently the tertiary education system in Bulgaria includes 51 higher schools which under the Law for Higher Education are state-owned and private, including universities, specialized higher schools and self-contained colleges. There are 37 public (25 universities, 11 specialized higher schools and 1 self-contained college) and 14 private higher schools (5 universities, 2 specialized higher schools and 7 self-contained colleges). The academic year is divided into two semesters and typically includes 32 academic weeks. The exact date of the academic year beginning and end is autonomously decided by the respective HEI. As a result of the active participation in the Bologna process the following key characteristics have been introduced in Bulgaria:

- Three-degree higher education system (1. Bachelor – comprises two levels – “professional bachelor in ...” (ISCED 5B) and “bachelor” (ISCED 5A); 2. Master (ISCED 5A); and 3. Doctor (ISCED 6);
- A credit accumulation and transfer system;
- European diploma supplement.

The universities also have autonomy in relation to the PhD numbers and programmes content. Nonetheless, the funding as already discussed is organized around three elements: 1. differentiated norm for professional fields (subjects), approved by Council of Ministers; 2. the actual number of students enrolled; and 3. complex evaluation of quality and of compliance with the labour market needs, formed on the basis of criteria, approved by Council of Ministers, including the results from the accreditation of the HEI. Doctoral studies options are full-time, part-time and independent doctoral programmes. Full-time study and independent study have a duration of up to 3 years. Part-time study and distance learning have a duration of up to 4 years. In exceptional circumstances, which are regulated individually by the HEI or the research organisation, the duration can be extended, but by no more than a year. There is no differentiation in the length of study between different branches and no specific distinctions in the structure exist. The healthcare taxes for the PhD students in Bulgaria are covered by the state budget.

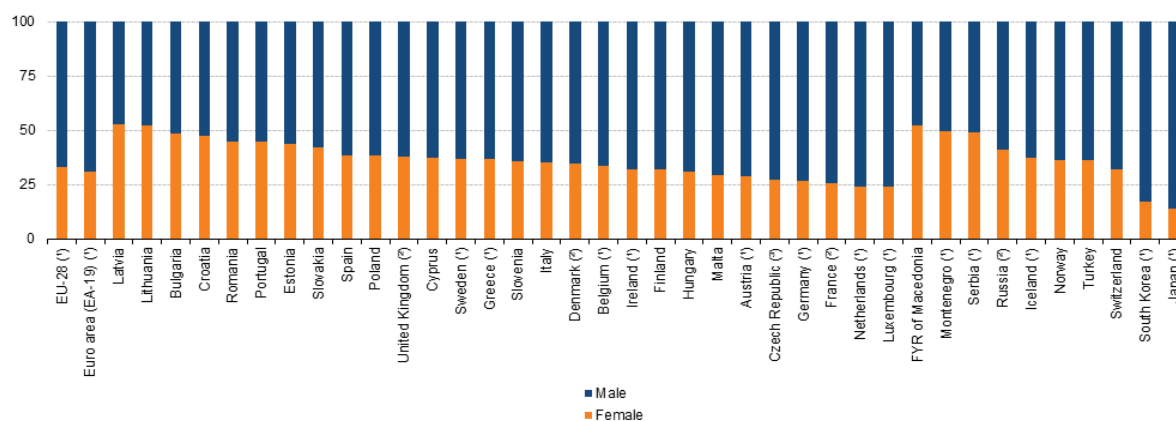
Between 2000 and 2015 the number of Bulgarian PhD students almost doubled from 3,414 to 6,617. However, the number of foreign PhDs remained almost constant. Attracting foreign PhD candidates and researchers can increase the number of researchers, changes the culture in predominantly national institutions and, in time, can lead to greater international collaboration. This can happen through e.g. national-level measures addressing Innovative Doctoral Training and its principles: research excellence, attractive institutional environment, exposure to industry and other relevant sectors, international networking, transferable skills training, quality assurance.

Researcher career progression proceeds from PhD to Professor (or to Professional). Thus, the H2020 PSF panel recommends using international good practice. For PhD students, the Principles of Innovative Doctoral Training apply concerning their education and training. There could be initiatives to increase the internationalisation of PhD programmes and the retention of excellent Bulgarian graduates. Regulations could ensure that accreditation of doctoral programmes and foreign degrees are treated efficiently by the National Evaluation and Accreditation Agency (NEAA).

4.4.5 Gender equality and gender mainstreaming in research

The analysis of gender of researchers in the EU in 2012 (% of total researchers, based on head count), shows that Bulgaria is among the limited number of countries where the shares are close to parity (Eurostat, July 2015). Women accounted for more than half of the total number of researchers in 2012 only in Latvia and Lithuania. The overall data concerning researchers by sex demonstrates that men accounted for 67% of the EU28's workforce in 2011, three percentage points less than in 2003.

Figure 29 Gender in research



(*) 2011.
 (*) Estimates.
 (*) Provisional.
 Source: Eurostat (online data code: rd_p_femres)

The SHE Figures Publication is the main source of pan-European, comparable statistics on the state of gender equality in research and innovation since 2015. It covers a wide range of themes, including the proportions of women and men amongst top-level graduates, academic staff and research boards, the working conditions for women and men researchers, the integration of the gender dimension in the content of peer-reviewed scientific articles, and various indicators measuring gender gaps in the scientific and innovation outputs. According to the 2015 SHE Report¹⁵⁸, in Bulgaria in 2012 the proportion of women (ISCED 6) graduates is 52%. The figures concerning the evolution of the proportion of women researchers in the HEI Sector, by field of science is also positive. The percentage is growing for all fields with the exception of medical and natural sciences, where despite the decrease are balanced. The only indicator according to which Bulgaria is lagging relates to the 11% of the of research and development (R&D) personnel are working in RPOs with adopted Gender Equality Plans, 2013, compared to 70% EU28 average.

4.5 Optimal circulation and Open Access to scientific knowledge

4.5.1 e-Infrastructures and researchers electronic identity

The e-government further development and the investments in building the next generation broadband communication infrastructure (NRP 2015) present priorities within both administrative reform in Bulgaria, as well as in the broader framework to improve the business environment and the investment climate. In 2015 National Plan for Broadband Infrastructure for the Next Generation Access is developed, publicly consulted and adopted. Gradually, e-science is transformed into a field of policy interest, although there is still the need to develop a strategic agenda for e-research support, e-infrastructures and researchers electronic identity.

The Bulgarian Current Research Information System (BulCRIS) is developed and maintained by the Ministry of Education and Science, under Article 7b of the Act for Scientific Research Promotion. BulCRIS¹⁵⁹ is a starting point for detailed information about Bulgaria’s research, development and innovation resources, and for staying in touch with the latest innovations. BulCRIS is targeted to bring together the abilities of universities and scientific institutes in Bulgaria, and of organisations throughout the world to help them make efficient use of these resources.

¹⁵⁸ https://ec.europa.eu/research/swafs/pdf/pub_gender_equality/she_figures_2015-leaflet-web.pdf

¹⁵⁹ <http://www.cris.government.bg/>

4.5.2 Open Access to publications and data

The evolution of open access in Bulgaria cannot necessarily be connected to strategic policy orientation. Instead, it can be examined as a series of steps that the government and educational and research institutions undertake to gradually create an open-access infrastructure. The joining of the eIFL (electronic information for libraries) consortium in 2009¹⁶⁰ suggested project driven open-access in Bulgaria. The next step is participating in OpenAIRE (open access infrastructure for research in Europe) consortium. OpenAIRE National Open Access Desk (NOAD) is established for Bulgaria at the Bulgarian Academy of Sciences' Institute of Mathematics and Informatics to connect researchers and research institutions at a national to OpenAIRE project services.

MES provides national access to scientific information of the best quality, 'bibliometric' resources and analytical tools. It is the institution concentrating the national efforts to implement the digital ERA policies on access and preservation of scientific information through building and maintaining high-performing computing, and access infrastructures such as on-line databases. The beneficiaries are currently 58 research institutions, public and private universities, and research centres in hospitals. Additionally, 'Bulgarian Information Consortium' (BIC) has been set-up as an organization of 38 members, representing academic institutions and libraries, aiming at resource-sharing.

The Bulgarian research community is informed about the benefits of open access and uses open access research publications, and although progress is continuously achieved, the rate of change may often be considered insufficient. The overall level of awareness is increasing among libraries, especially university libraries, though still very few institutions are involved in managing repositories. There are 6 Open Access Bulgarian repositories in OpenDOAR: 1) Bulgarian OpenAIRE Repository; 2) New Bulgarian University; 3) Institute of Mathematics and Informatics at Bulgarian Academy of Sciences; 4) Sofia University "St. Kliment Ohridski"; 5) Medical University of Sofia (MUS); and 6) Bourgas Free University (BFU)¹⁶¹.

In 2013 Bulgaria made available 51 journals in the Directory of Open Access Journals (DOAJ)¹⁶², compared with 6 journals in 2007 (NIF, 2013). In addition, Bulgaria has achieved 56% adjusted score for open access contribution, compared with 58.8% average European participation measure (Archambault, et.al., 2014). According to OpenAIRE data, Bulgaria¹⁶³ participates with 7821 open access publications in 13 on-line repositories. BAS central library provides also free on-line access to digital resources. The resources are accessible via BAS IP addresses. There are different databases for on-line resources (Central Library BAS). Among these is the 'WorldCat' – the largest worldwide bibliographic database, providing the foundation of cooperative library services in metadata management, discovery, resource sharing and collection management (OCLC WorldCat).

Through these activities Bulgaria has made a significant progress toward participation in the 'open access'¹⁶⁴ movement and the 'digital repository infrastructure in European research' (Driver).

¹⁶⁰ <http://www.eifl.net/country/bulgaria>

¹⁶¹ www.openaire.eu

¹⁶² <https://www.doaj.org>

¹⁶³ June 2014

¹⁶⁴ There are 4 types of Open Access: (i) 'Gold' open access (open access publishing): payment of publication costs is shifted from readers (via subscriptions) to authors. These costs are usually borne by the university or research institute to which the researcher is affiliated, or by the funding agency supporting the research.

(ii) 'Green' open access (self-archiving): the published article or the final peer-reviewed manuscript is archived by the researcher in an online repository before, after or alongside its publication. Access to this article is often delayed ('embargo period') at the request of the publisher so that subscribers retain an added benefit. The green access model allows for certain variations: the length of the embargo period and the version that may be archived at different moments in time vary, e.g. depending on the agreements between publishers and authors.

Table 23: Proportion of OA per country, 2008–2013 (extract)

Country	Sample size	Green OA		Gold OA journals		Other OA			Total OA		Adjusted OA
		Found	%	Found	%	Found	%		Found	%	%
Austria	8,764	821	9.4 ± 0.6	775	8.8 ± 0.6	3,450	39.4 ± 1.0		4,855	55.4 ± 1.0	63.5 ± 4.6
Belgium	13,147	1,813	13.8 ± 0.6	968	7.4 ± 0.4	5,210	39.6 ± 0.8		7,841	59.6 ± 0.8	68.4 ± 4.6
Bulgaria	1,707	161	9.4 ± 1.3	126	7.4 ± 1.2	558	33 ± 2		829	49 ± 2	56 ± 5

Source: Proportion of Open Access Papers Published in Peer-Reviewed Journals at the European and World Levels – 1996-2013.¹⁶⁵

Open data initiative also gained speed in 2015. The opendata.government.bg portal exists already as a single, central, web-based public information system that provides publication and management of information for reuse in an open, machine-readable format together with the metadata. The platform is constructed in a manner that allows the complete extraction of the published information, or parts thereof. Technically, at the basis of the project stands open source platform CKAN¹⁶⁶, developed by the Open Knowledge Foundation, the UK, and used extensively by countries like Great Britain, Romania, Slovakia, the Netherlands, Austria, Italy, Sweden, South Korea, including the European Commission. The Vision platform is made of "obshtestvo.bg"¹⁶⁷ and is also open source. Information on all projects that drive the portal and its source code can be found in the GitHub¹⁶⁸ repository.

(iii) Hybrid open access refers to a publishing model in which subscription-based journals allow authors to make individual articles open access on payment of an article publication fee.

(iv) Pay attention to whether the ID/OA mandate (i.e. Immediate deposit/Optional Access) has been introduced in your country (cf., for instance <http://openaccess.eprints.org/index.php?archives/71-guid.html>)

¹⁶⁵ See a.o.

http://science-metrix.com/files/science-metrix/publications/d_1.8_sm_ec_dg-rtd_proportion_oa_1996-2013_v11p.pdf supplemented with any new/more accurate data and new policy developments

¹⁶⁶ <http://ckan.org/>

¹⁶⁷ meaning 'society' in translation

¹⁶⁸ <https://github.com/governmentbg/opendata>

5. Framework conditions for R&I and Science-Business cooperation

5.1 General policy environment for business

“Doing Business”¹⁶⁹ provides an aggregate ranking on the ease of doing business in 189 economies based on indicator sets that measure and benchmark regulations applying to domestic small to medium-size businesses through their life cycle. The distance to frontier score benchmarks economies with respect to regulatory practice, showing the absolute distance to the best performance in each Doing Business indicator. An economy’s distance to frontier score is indicated on a scale from 0 to 100, where 0 represents the worst performance and 100 the frontier.

As per “Ease of doing business ranking” of the World Bank for 2015¹⁷⁰, Bulgaria takes 38 position, where other 11 EU MS are lagging behind it. Although the country is among top 25 in “protecting minority investors” and “getting credit”, it is in the bottom half regarding permitting issues.

Table 24: Ease of Doing Business 2015

Year	Ease of Doing Business Rank	Starting a Business	Dealing with Construction Permits	Getting Electricity	Registering Property	Getting Credit	Protecting Minority Investors	Paying Taxes	Trading Across Borders	Enforcing Contracts	Resolving Insolvency
2015	38	49	101	125	57	23	14	89	57	75	38
2014	36	41	100	122	58	19	13	84	62	74	37

Source: World Bank

As can be observed from the table above, in 2015 the country is increasing its distance from the frontier, almost in all criteria used by the WB Doing Business ranking. This is mainly because in 2015 no significant changes were introduced to make easier for a local entrepreneur to open and run a small to medium-size business when complying with relevant regulations.

Although the number of procedures and the costs associated with complying with the applicable regulations (as per observed by “doing business” 11 areas) are less than the average for Europe and Central Asia, the associated time is longer, which is the main burden for an entrepreneur.

Despite the fact that the business environment hardly improved in 2015, in the period 2010-2014 Bulgaria made starting a business easier by:

- reducing the paid-in minimum capital requirement and enhancing efficiency at the company registry; (the minimum capital requirement was reduced from BGN 5,000 (€ 2,557) to BGN 2.00 (the equivalent of €1.02));
- lowering almost twice the registration fees.

¹⁶⁹ <http://www.doingbusiness.org/>

¹⁷⁰ <http://www.doingbusiness.org/-/media/GIAWB/Doing%20Business/Documents/Annual-Reports/English/DB15-Chapters/DB15-Report-Overview.pdf>

Other significant improvements observed in Bulgaria in 2010-2014 are:

- reducing the time required to register property by launching an integrated web-based property register making it possible to check the ownership and cadastre status of properties online;
- making access to credit information more difficult by stopping the distribution of credit reports to financial institutions by the private credit bureau (Experian);
- reducing employer contribution rates for social security;
- making trading across borders faster by introducing online submission of customs declaration forms;
- amending the commerce act to extend further rights to secured creditors and increasing the transparency of insolvency proceedings that would have a positive impact on third parties to contractual relationships, acting in good faith.

According to data collected by Doing Business for 2015, resolving insolvency takes 3.3 years on average and costs 9.0% of the debtor's estate, with the most likely outcome being that the company will be sold as piecemeal sale. The average recovery rate is 33.2 eurocents on the euro.

Bulgaria scores 2.5 out of 3 points on the commencement of proceedings index, 6.0 out of 6 points on the management of debtor's assets index, 2.5 out of 3 points on the reorganization proceedings index, and 4.0 out of 4 points on the creditor participation index. Hence, Bulgaria's total score on the strength of insolvency framework index is 15.0 out of 16, and the country globally stands at 38 position in the ranking of 189 economies on the ease of resolving insolvency. Still, the insolvency reforms in the country have marked a slow progress, which is one of the main obstacles for entrepreneurs.

Bulgaria is in process of implementing its National Strategy for SME Development 2014-2020¹⁷¹ in line with Small Business Act¹⁷².

5.2 Young innovative companies and start-ups

The EIF's Entrepreneurship Acceleration and Seed Financing Instrument delivered through Eleven and LAUNCHub is part of the JEREMIE Initiative in Bulgaria, funded under ERDF and national budget within the framework of OP Competitiveness 2007-2013, Priority Axis 3 Financial REsources for Developing Enterprises (FREDE). The budget of the instrument is €21m aiming to support small and medium-sized enterprises (SMEs) at their seed and start-up stage by providing funding in the form of either equity or quasi-equity in order to enhance the access to financing to emerging entrepreneurs with innovate ideas.

The instrument resulted in the reduction of the market gap for early stage while it is also related to the change in mentality to use financial instruments (equity) as alternative to grants. These two funds have helped to create nearly from scratch an early investment market in Bulgaria in a period still dominated by the financial and economic crisis. In practice, Eleven¹⁷³ and LAUNCHub¹⁷⁴ have marked a step change in the Bulgarian start-up eco-system by establishing a model replicating the best world examples (e.g. from the US and UK) for making investments at early business stages, with market orientation and professionalism that can build companies with global reach. In 2014 Sofia is ranked among the top 5 European capitals for supporting start-up businesses with risk finance for a second consecutive year.

¹⁷¹ www.mi.government.bg

¹⁷² Small Business Act (SBA): http://ec.europa.eu/growth/smes/business-friendly-environment/small-business-act/index_en.htm

¹⁷³ <http://www.11.me/>

¹⁷⁴ <http://www.launchub.com/>

The result is active (financial and soft) support for over 170 companies and technology based businesses in strategically important sectors to Bulgaria including Information and Communication Technologies, Mobile, Software & Hardware and Engineering. The challenge now is to expand the same model to other sectors with innovative potential such as agri-business.

In terms of outputs, currently €16.3m has been invested in developing enterprises¹⁷⁵ and about 263 jobs have been supported. The total amount of follow-on invested capital by third-party investors in the portfolio companies of Eleven and LAUNCHub surpasses €11m. Private investment is attracted at the level of individual company, not at the level of fund. In this way, the investment decision is substantially more informed and targeted, and individual companies receive the maximum stimuli to excel.

5.3 Entrepreneurship skills and STEM policy

Both the National Strategy for Promotion of Small and Medium Size Enterprises 2014-2020 and RIS3 explicitly describe the need to create synergy across the support measures for innovation and for entrepreneurship. RIS3 also highlights the fact that Bulgaria has established the economic foundations for entrepreneurship, offering the lowest income tax for individuals (10%), and the lowest corporate tax (10%), and is among the countries with the lowest VAT (20%).

Two significant aspects need to be mentioned in view of the developments of science-based entrepreneurship in Bulgaria, both funded through EU operational programmes. Firstly, the advancements due to OP Competitiveness in relation to technology centres, TTOs, Sofia Tech Park and clusters and the provision for an entrepreneurship training for young talents and scientists. Since 2012 under the OP Human Resources Development, young people who have completed their doctoral studies have been encouraged and supported to engage in R&D practice for one month internships in high-tech R&D and infrastructure centres. OPHRD supports also the setting up and running of structured innovative doctoral training programmes, providing funds for mentoring, research training, and developing entrepreneurial skills.

The lack of entrepreneurial education in professional schools and the HEI sector is recognised as the main obstacle to growth of entrepreneurship in the technology and innovation sector. Therefore, RIS3 emphasizes that the main challenge for innovation entrepreneurship is its integration in pan-European value-chains and international scientific research partnerships. The new OPIC also puts strong emphasis on applied research oriented towards the business sector, as well as the enhancement of science-business intermediaries, such as Sofia Tech Park, and strengthening of the network of technological centres, thematic laboratories and technology transfer offices. Cluster support is planned to happen on the next level – after clusters have been established, the financing will focus on innovation activities and enlarged opportunities for training, commercialization of knowledge and skill acquisition.

5.4 Access to finance

JEREMIE (Joint European Resources for Micro to Medium Enterprises) was launched as a joint initiative by the European Commission and the European Investment Bank (EIB) Group to improve access to finance for Micro, Small and Medium-sized Enterprises (SMEs) in the EU within the Structural Funds framework for the period 2007-2013. The investment strategy of the JEREMIE Initiative in Bulgaria envisaged and is in process of implementing a balanced mix of private equity, venture capital, debt and guarantee instruments targeting to enhance the access to finance for the Bulgarian SMEs and thus address the market gaps between the supply and demand of financial engineering instruments.

¹⁷⁵ up to 30 June 2015, excluding management fees & costs

The JEREMIE budget has been increased to approximately €350m, thus becoming the most reliable and diverse (including through funds and banks as financial intermediaries) source of funding for enterprises in Bulgaria.

5.5 R&D related FDI

The internationalisation of Bulgarian firms is still relatively low and the impact of foreign direct investment (FDI) is limited¹⁷⁶ (except for the pre-crisis pre-EU entry period). These factors serve as the key impediments to accelerated growth along with the low productivity of labour combined with the highest energy inefficiency in the EU.

FDI in Bulgaria recorded a net inflow of €1.1816b (2.8% of GDP) in 2014¹⁷⁷, dropping by €93.5m (7.3%) compared to 2013 (an inflow of €1,275.1m, 3.1% of GDP). By branch, the largest investments for January-December 2014 were in Real estate, renting and business activities (€478.3m), Financial intermediation (€163.8m), and Electricity, gas and water supply (€102.5m). The structure of the economy itself is characterised by low firm-level technology absorption, low level of FDI in technology intensive sectors and in technology transfer activities, low level of staff training, relatively low quality of the management and entrepreneurial education, weak antimonopoly policy and high extent of market dominance, combined with weak tax incentives for investment, low level of company spending on R&D and low level of university-industry collaboration in R&D¹⁷⁸.

On the positive side RIS3 'smart' areas demonstrate expansion¹⁷⁹ and possess the potential to serve as 'nuclei' for domestic and foreign investment activities, given their focus and coordination role with regard to R&D&I and market demand and new niche opportunities.

5.6 Knowledge markets

The system for protecting intellectual property rights constitutes of the Bulgarian Patent Office (under subordination of the Council of Ministers), and the Council for Protection of Intellectual Property Rights (hosted at the Ministry of Culture). The database of the Bulgarian patent office is synchronised with the European patent office.

Table 25: European Patent Filings 2007-2015 per Country of Residence of the First Named Applicant (Bulgaria)

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Bulgaria	33	32	32	36	30	37	69	70	72

Source: European Patent Office¹⁸⁰

While patent activities decline in 2011, compared to 2010, they recover sharply in 2013 and have sustained the number of applications annually (Table 25). The key technological areas where Bulgaria has some distinctive technologies, including high value added, are products and services in the areas of computer technology; engines, pumps and turbines; electrical machinery, civil engineering, apparatus and energy saving machinery; pharmaceuticals; transport; medical technology and measurement technology (Table 26).

¹⁷⁶ Ministry of Finance, Annual Report on the Bulgarian Economy (2014)

¹⁷⁷ based upon Bulgarian National Bank (BNB) data

¹⁷⁸ Global Competitiveness Report 2014-2015

¹⁷⁹ see RIS3 analysis

¹⁸⁰ <http://www.epo.org/about-us/annual-reports-statistics/statistics.html>

Table 26: Patent Applications by Top Fields of Technology (1999-2013)

Field of Technology	Share
Computer technology	8.09
Engines, pumps, turbines	6.78
Other special machines	6.37
Civil engineering	6.19
Electrical machinery, apparatus, energy	5.93
Pharmaceuticals	5.00
Transport	4.64
Medical technology	4.41
Measurement	4.07
Basic materials chemistry	3.89
Others	44.63

Source: WIPO, December 2014

The wide spectrum of patents across 10 specific technology areas and the high volume of others (44.6%) demonstrate the dispersion of technology capabilities in the economy. Despite that, there are no explicit policies that address issues of the knowledge markets either internally, or externally. The financial support offered to firms and research organisations for innovation includes patent registration. This funding, however, does not provide explicit incentives to increase the patent activity. The action plans to promote training in IP protection are also insufficient. There are currently no national trading platforms for IP – to match the supply and the demand.

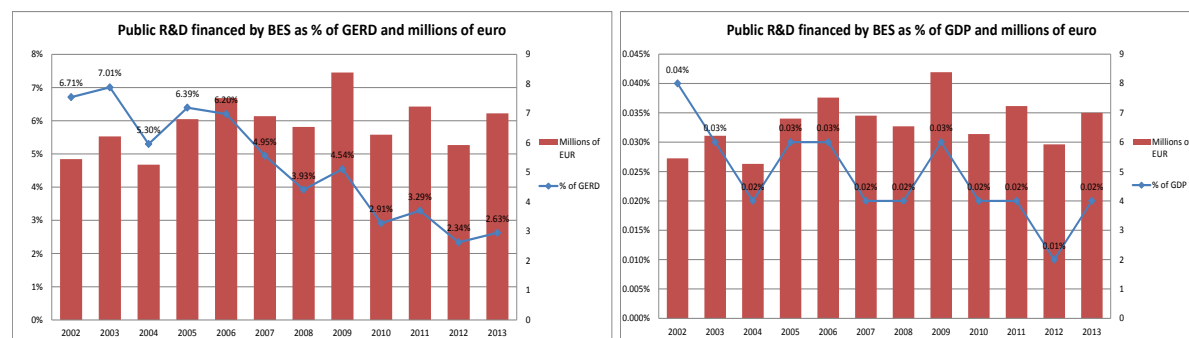
Commercialisation of research thus becomes a major weakness within Bulgaria’s research system. There are only very limited frameworks for supporting collaboration between public research establishments, universities and the private sector. Sharing and support systems are insufficiently developed to facilitate knowledge transfer and the creation of university spin-offs and to attract (venture) capital and business angels. Public policies are still not fostering enough long-term sustainable partnerships among innovation actors and consequently the role of RIS3 is indispensable. Further support mainly through OPIC is envisaged to research and innovation collaboration platforms and intermediaries such as TTOs, technology parks and clusters. The drive to create Sofia Tech is a valuable reference point in this regard. At regional level, more support from the ESIF should be channelled towards carefully selected research and innovation infrastructures.

5.7 Public-private cooperation and knowledge transfer

5.7.1 Indicators

Funding: BES-funded publicly performed R&D

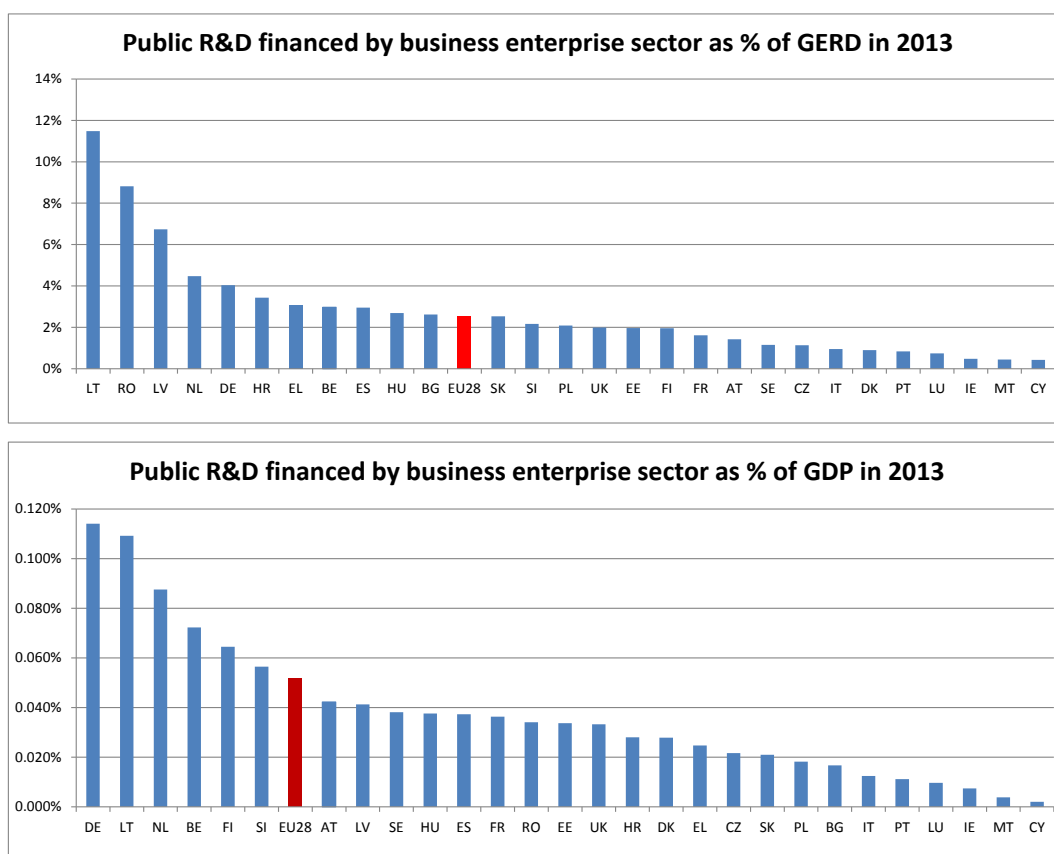
Figure 30 BES-funded public R&D in Bulgaria as % of GERD (in € million) and % of GDP



Source: European Commission

In Bulgaria, the business enterprise (BES)-funded public R&D expenditure as a percentage of GERD shows a descending trend falling down to 2.63% in 2013, which is close to half the value of 6.39% in 2005. The indicator expressed as share of GDP fluctuates between the very low levels of 0.03% and 0.02% of GDP. When expressed in nominal values, the indicators show fluctuations across the years, with a level in 2013 (the latest year available) comparable to the pre-crisis 2007 year.

Figure 31 BES-funded public R&D as % of GERD and as % of GDP in 2013 in Member States¹⁸¹



Source: European Commission

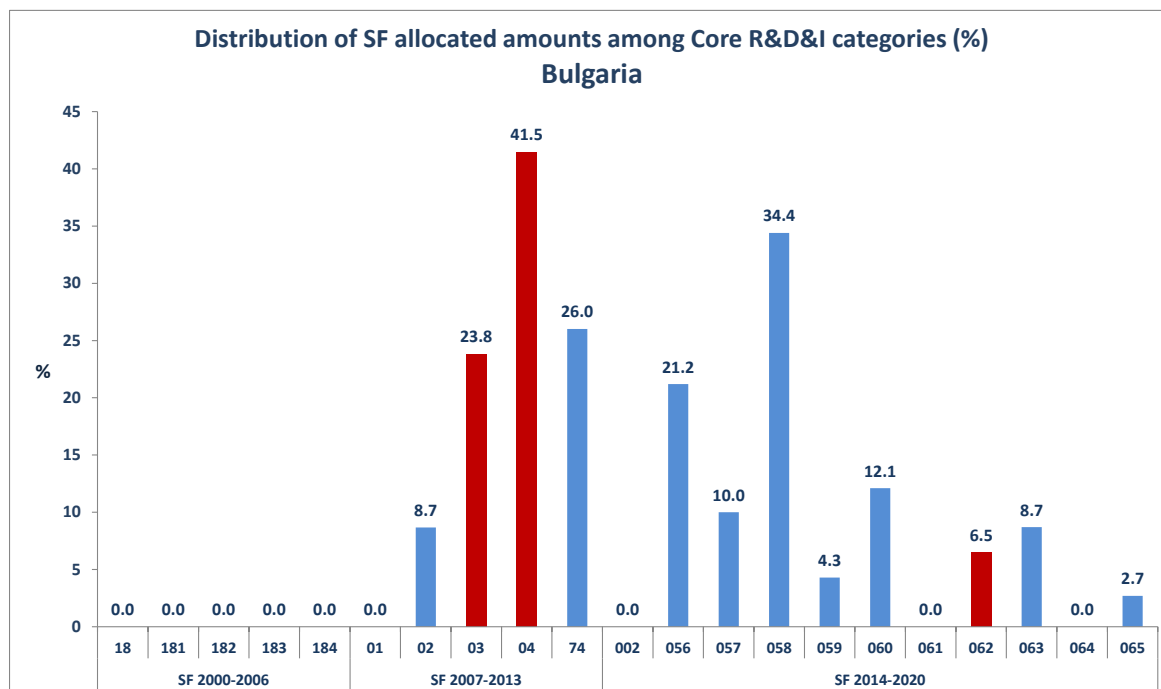
Figure 31 shows the values of BES-funded public R&D in all EU-28 as percentages of GERD and GDP respectively. As percentage of GERD, Bulgaria's level of BES-funded public R&D is slightly above the EU-28 average. However, as percentage of GDP, it is far below the EU-28 average and assigns the 22nd place to Bulgaria in the EU, which reflects the generally low weight of the R&D expenditure.

The overall low level of R&D spending, along with the quality gaps and almost non-existent linkages between research and the needs of the productive sector are key reasons for Bulgaria's low level of business enterprise-funded public R&D expenditure. The private sector is dominated by SMEs (the largest share of which are concentrated in trade), which are at difficulty to allocate funds to R&D. They are specialised predominantly in low-tech production instead of high value-added products and knowledge-intensive services.

¹⁸¹ 2011 was chosen as the latest data series providing a full comparison within EU-28.

Funding: structural funds devoted to knowledge transfer

Figure 32 Structural Funds for Core R&D Activities 2000-2006, 2007-2013 and 2014-2020¹⁸². Categories 182 (2000-2006), 03 and 04 (2007-2013), and 062 (2014-2020) are used as proxies for KT activities (Bulgaria)



Source: European Commission

For the current programming period Bulgaria has allocated 6.5% of its structural funds for core R&D activities to "Technology transfer and university-enterprise cooperation primarily benefiting SMEs" (compared to 65.3% in the 2007-2013 programming period). It is much lower than the EU average of 15.7% (the EU average was 30.1% for 2007-2013).

¹⁸² Figure 32 provides the Structural Funds allocated to Bulgaria for each of the above R&D categories. The red bars show the categories used as proxies for KT. Please note that the figures refer to EU funds and they do not include the part co-funded by the Member State. The categories for 2000-2006 include: 18. Research, technological development and innovation (RTDI); 181. Research projects based in universities and research institutes; 182. Innovation and technology transfers, establishment of networks and partnerships between business and/or research institutes; 183. RTDI infrastructures; 184. Training for researchers.

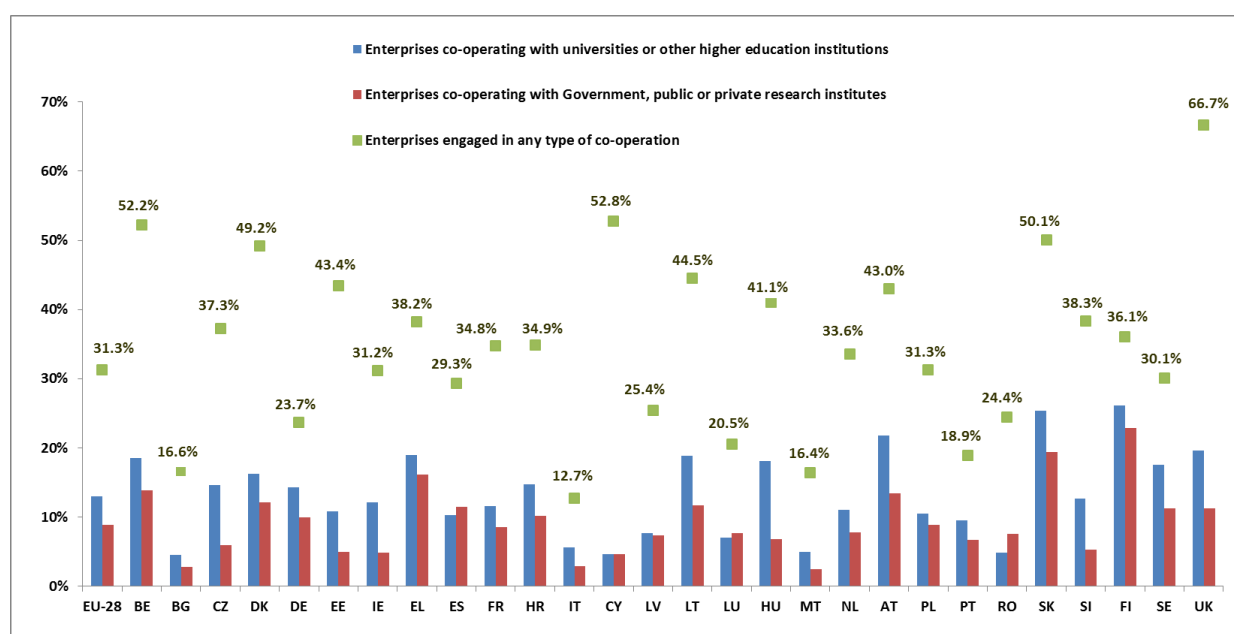
The categories for 2007-2013 include: 01. R&TD activities in research centres; 02. R&TD infrastructure and centres of competence in specific technology; 03. Technology transfer and improvement of cooperation networks; 04. Assistance to R&TD particular in SMEs; 74. Developing human potential in the field of research and innovation.

The categories for 2007-2013 include: 01. R&TD activities in research centres; 02. R&TD infrastructure and centres of competence in specific technology; 03. Technology transfer and improvement of cooperation networks; 04. Assistance to R&TD particular in SMEs; 74. Developing human potential in the field of research and innovation.

The categories for 2014-2020 include: 002. Research and Innovation processes in large enterprises; 056. Investment in infrastructure, capacities and equipment in SMEs directly linked to Research and Innovation activities; 057. Investment in infrastructure, capacities and equipment in large companies directly linked to Research and Innovation activities; 058. Research and Innovation infrastructure (public); 059. Research and Innovation infrastructure (private, including science parks); 060. Research and Innovation activities in public research centres and centres of competence including networking; 061. Research and Innovation activities in private research centres including networking; 062. Technology transfer and university-enterprise cooperation primarily benefiting SMEs; 063. Cluster support and business networks primarily benefiting SMEs; 064. Research and Innovation processes in SMEs (including voucher schemes, process, design, service and social innovation); 065. Research and Innovation infrastructure, processes, technology transfer and cooperation of enterprises focusing on the low carbon economy and on resilience to climate change.

Cooperation: Share of innovative companies cooperating with academia

Figure 33 CIS survey 2012 – share of enterprises cooperating with academia



Source: European Commission

As shown in Figure 33, in Bulgaria, 16.6% of the innovative companies engage in any type of cooperation, which is considerably below the EU average. Yet, only one fourth of them (i.e. 4.5% of the total sample of innovative companies) cooperate with universities or other higher education institutions compared to 4.9% in Romania and 14.7% in Croatia. Even less – 2.8% of the innovative companies cooperate with government, public or private research institutes (compared to 7.6% in Romania and 10.2% in Croatia).

Cooperation: Technology Transfer Offices (TTOs), incubators and technological parks

The foundations of a system of technological centres, business incubators and technology transfer offices (TTOs) were established during 2011-2014 under the Operational Programme "Development of the Competitiveness of the Bulgarian Economy" 2007-2013 (OPC), where the Ministry of the Economy successfully financed 33 organisational establishments, including: 4 technology centres for the value of €3.9m (20% implementation from the budget of €20m); 12 business incubators with a total value of €5.4m (30% implementation); 16 technology transfer offices (with a total value of €1.0 m (38% implementation); and the new Science and Technology Park in Sofia (Table 27).

Table 27: Technology Transfer Infrastructure under the OP Competiveness 2012-2013

	Technology Transfer Offices	Science and Technology Park	Technological centers	Business Incubators
Contracts (stared)	16	1	4	12
Total value in € m	1.905	42.685	3.917	5.425
% of implementation	38%	85%	20%	30%

Source: RIO Country Report 2014: Bulgaria

The Bulgarian Academy of Sciences (BAS) serves as an example for the development of TTOs. Three TTOs were established in 2007 to realise knowledge transfer as a continuation of the technology transfer policy, which started with the establishment of "GIS - Transfer Centre Foundation"¹⁸³. GIS is an independent non-profit organisation co-founded by BAS in 2000. Since December 2010, BAS, in collaboration with the Bulgarian Industrial Association, has established six "knowledge regions" as an infrastructure for effective KT. In 2009, BAS adopted new guidelines for IP management and KT as well as guidelines for the establishment of spin-offs.¹⁸⁴

Another case is the TTO at the University of Sofia. It was established in 2008 (Phare Project) and has been part of the Scientific and Research Centre at Sofia University since 2009. Since then two patent applications and two cases of technology transfer have taken place. In total 400 researchers and students have been trained in commercialisation of scientific results. Moreover, 60 contacts with industry have been realised and 15 technologies suitable for transfer to the industry have been identified. There are regulations for technology transfer and IP protection. The TTO of Sofia University is a member of the CERN TTOs network.¹⁸⁵

One of the key projects in this framework is Sofia Tech Park. The managing authority for this project is directly the Ministry of the Economy, and it is established with the aim to strengthen the competitiveness of science and entrepreneurship in Bulgaria, to improve the exchange of knowledge between academia and the business community, to become a platform for the development of start-up companies, and to accelerate the process of commercialization of research. The techno park has already established a broad consortium for its implementation including leading universities, the Bulgarian Academy of Sciences, business clusters, large international companies, the Sofia Municipality, the Ministry of Education and Science, the Ministry of Labour and Social Policy, NGOs and others institutions.¹⁸⁶

¹⁸³ www.gis-tc.org

¹⁸⁴ Dobrev, Bojil. 2012 Knowledge Transfer and IP Management at Universities and Public Research Organisations in Bulgaria, Knowledge Transfer Study 2010-2012, Northern Balkans Expert Workshop, <http://knowledge-transfer-study.eu/workshops/northern-balkans>

¹⁸⁵ Ibid.

¹⁸⁶ RIO Country Report 2014: Bulgaria.

Cooperation: share of public-private co-publications

Figure 34 Co-publications by field 2003-2013 in Bulgaria. Scopus database

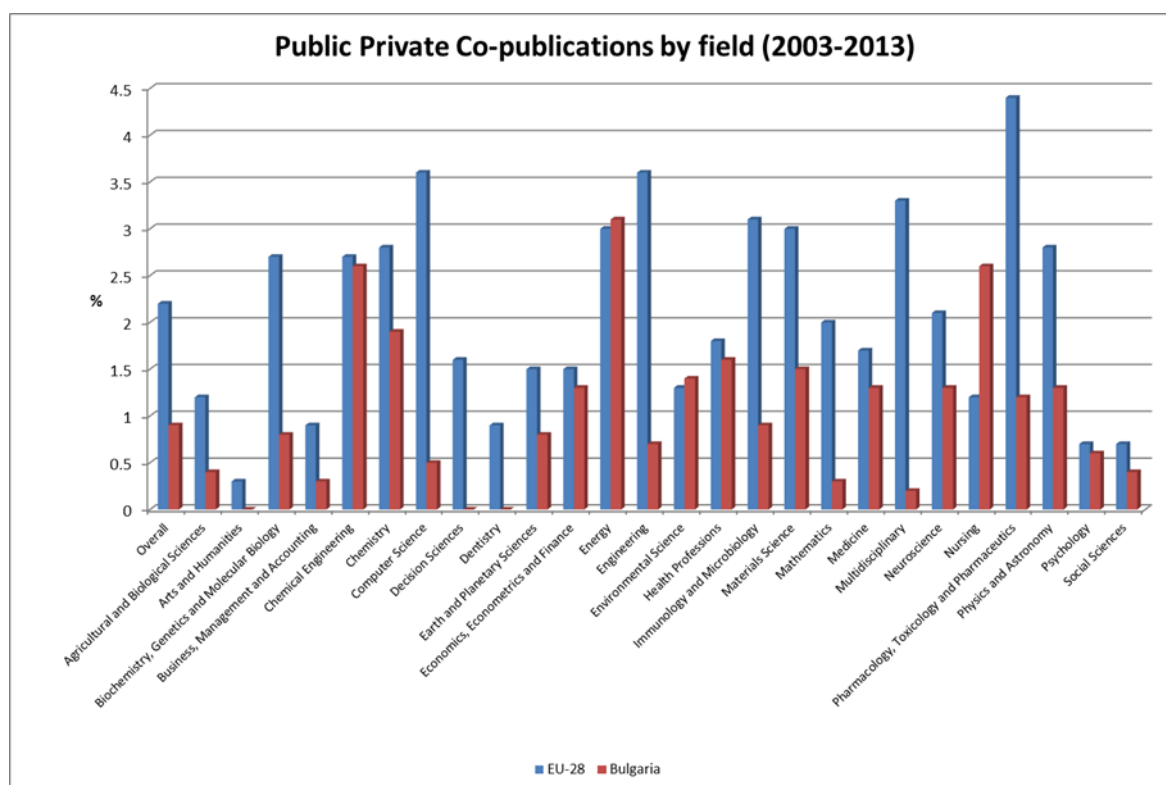


Figure 34 shows the 2003-2013 average percentages of academia-industry co-publications by field in Bulgaria, compared to the European average. Scopus data indicate also that the percentage of co-publications has fluctuated in the last ten years (2003-2013). In 2003 it was 0.6% and then doubled for the period 2004-2007 (being slightly above 1%). In 2008 the percentage of co-publications dropped to 0.9% and stayed a little bit below 1% until 2011. In 2012 it increased to 1.1% and then decreased to 0.8% in 2013. In 2013 Bulgaria had only 4.4 public-private co-publications per million of population compared to 29 for the EU-28 (and 3.9 for Romania, and 9.9 for Croatia).¹⁸⁷ The domains with the highest percentage of academia-industry co-publications are energy, chemical engineering, nursing, chemistry, the health related professions, and the materials science.

¹⁸⁷ Source: JRC IPTS RIO elaboration on Scopus data collected by Sciencematrix in a study for the European Commission DG RTD (Campbell, 2013). The share of public-private co-publications is derived from the Scival platform and is also based on Scopus data (September 2015). SciVal® is a registered trademark of Elsevier Properties S.A., used under license. The data on public-private co-publications is not fully compatible with the data included in the IUS, due to differences in the methodology and the publication database adopted.

5.7.2 Policy Measures

One of the initial measures managed by the Ministry of Education and Science (MES) is the project Science and Business (started in 2011), which aimed to improve the environment for science and business interaction. Specific activities financed within this project have been: improving the communication "science-business" through networking across sectors; promotion of research results and new scientific developments; presentation of successful research products for society and business; improving the qualifications of researchers, including young researchers, to meet the needs of the labour market. The programme had a budget of €2.6m, but MES has not released yet the evaluation of the outcomes. Among the target activities under this programme was the development of an interactive national platform to integrate three existing systems – the National Research Registry, information from the Bulgarian Patent Office, and information from the National Information and Documentation Office on the PhD dissertations.

During the period 2012-2014 a new centralised system for practical education and placements in industry was developed and tested. The capacity of the system will allow university education to offer 60 000 placements with 14 000 employers.

Among the measures aiming to improve the R&D performance is the early programme managed by the Ministry of Education and Science (MES) and the Bulgarian Academy of Sciences (BAS) to disburse €42 000 (from €102 000 contracted) between 2009 and 2014 as grants for doctoral students undertaking PhD research at a national company. This programme was implemented through the Scientific Research Fund (SRF) and aimed to renovate the scientific potential by attracting young people to engage in research, and to build an effective link between science and industry through the active participation of enterprises in the development of a doctoral dissertation.

For the period 2008-2011 one of the earliest financial schemes of the Ministry of the Economy for knowledge transfer was to disburse knowledge transfer vouchers to micro, small and medium enterprises. The scheme supported the transfer of knowledge to businesses from universities and research organizations as "knowledge providers", and enabled businesses to solve certain problems of applied nature through the acquisition of knowledge related to the innovation of products, processes and services.

For the period 2011-2014, the Bulgarian SMEs Promotion Agency (BSMEPA), the Operational Programme "Development of the Competitiveness of the Bulgarian Economy" 2007-2013 (OPC), and the Ministry of the Economy supported 65 contracts (out of 78 approved contracts) and disbursed €9 738m (from a budget of €30m) to support R&D activities at firm level. The recipients of the grants were partnerships between private firms and research organizations or universities from Bulgaria and EU countries. The outputs from the scheme were measured by the funding agency through the following indicators: number of R&D jobs created; number of researchers employed by enterprises; application for industrial designs, utility models, trademarks, patents; registration of industrial designs, utility models, trademarks, patents; individual indicators for each project.

The National Innovation Fund (NIF) itself funds two types of projects - industrial R&D and experimental development, and technical feasibility projects. For the last two rounds the fund disbursed €4.66m to 36 projects (2012) and €5.10m, absorbed in 52 projects (2014). The aim of the projects has been to acquire new or improved products, processes or services designed to raise the economic efficiency, to improve the innovative potential and technological level of the enterprises, to increase the private investment and to enhance the dynamics of innovative processes. The monitoring of the Fund highlights that the instrument has produced a profound impact on firm activities such as: 38.5% of the firms increased the level of employment, 79% of the firms introduced a new product to the market, 66% of the firms have entered new markets, 71% have improved sales and revenue.

One of the latest initiatives of the Ministry of the Economy is the Technostart Programme (started in 2014) with a budget of 205 thousand Euro. It aims at encouraging the innovation activity of young entrepreneurs in Bulgaria – students, PhD students and graduates in the earliest stage of the entrepreneurial cycle – to submit and work on a new business idea. Under this programme 169 candidates received a grant of €10 000 towards the cost of fixed assets (including equipment, computers and hardware), and the cost of intangible assets (including software, registration of new products / services, patents, licenses, trademarks, utility models or industrial design).

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Both the National Strategy for Promotion of Small and Medium Size Enterprises 2014-2020 and the Innovation Strategy for Smart Specialisation 2014-2020 explicitly describe the need to create synergy across the support measures for innovation and for entrepreneurship. RIS3 also highlights the fact that Bulgaria has established the economic foundations for entrepreneurship, offering the lowest income tax for individuals (10%), the lowest corporate tax (10%), and is among the countries with the lowest VAT (20%).

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The lack of entrepreneurial education in professional schools and the HEI sector is recognised as the main obstacle to growth of entrepreneurship in the technology and innovation sector. Therefore, RIS3 emphasizes that the main challenge for innovation entrepreneurship is its integration in pan-European value-chains and international scientific research partnerships. The new OPIC also puts strong emphasis on applied research oriented towards the business sector, as well as the enhancement of science-business intermediaries, such as Sofia Tech Park, and strengthening of the network of technological centres, thematic laboratories and technology transfer offices. Cluster support is planned to happen on the next level – after clusters have been established, the financing will focus on innovation activities and enlarged opportunities for training, commercialization of knowledge and skill acquisition.

5.8 Regulation and innovation

In 2012 the attempt to introduce and adopt a Law on Innovation proved unsuccessful. Partially the environment was unprepared for the novel concept, and partially the draft legal act failed to present an ambitious agenda. The draft act regulated only the content of the innovation activity of economic entities and institutionalised already existing institutional structures – the National Innovation Council and the National Innovation Fund, without prescribing the proper mechanisms for their effective functioning. Given the unenviable position of the country in the international rankings of innovation and the inefficient use of financial and human resources for innovation, such a law should introduce at least a number of the measures that have long-existed in the global innovation management practice, and which have been omitted from the version proposed for public discussion:

1. Tax incentives to encourage innovative enterprises. These could include: waiving social security contributions when opening up highly qualified job positions; allowing for tax deductible expenses for innovation incurred by the company or commissioned to another entity, research institute or higher educational establishment; creating a status of 'innovative' enterprise, which is granted under certain conditions and on the basis of which companies get the right to a package of tax breaks and other incentives and an easier access to public funding; allowing duty-free import of scientific instruments and apparatus imported for scientific purposes or training by organisations for which research and teaching are not their main activity; giving back to higher education institutions, research institutes and enterprises 50% of the tax revenues generated by them from research and innovative activity and sale of intellectual property rights; tax holidays for scientists, researchers and highly qualified personnel who return to work in Bulgaria. The application of tax incentives to promote company innovation activity is a successful practice in many EU countries, including Belgium, UK, Denmark, Germany, Estonia, Ireland, Spain, Latvia, Poland, Finland, etc. Their introduction aims at bringing to light the company's hidden costs for R&D.
2. Introducing pre-commercial procurement and mandating legislative and executive authorities at the national, regional and local levels to use the tools of pre-commercial procurement.
3. Clear pathways for public-private partnerships, treatment of IPR and commercialization options.
4. Promotion of academic entrepreneurship. Public universities should obtain title to properties which could be part of an innovation/business incubator or a technological park and research and academic staff in universities, scientific research units and enterprises should be allowed sabbaticals of up to three years (paid leave up to a year and unpaid leave up to two years) in order to establish a high-tech enterprise. Without such bold initiatives the draft Law on Innovation will not allow for the realisation of the full innovation potential of the Bulgarian economy or for the adequate involvement of Bulgarian enterprises and science in the development and implementation of new European and international technology solutions.

5.9 Assessment of the framework conditions for business R&I

In 2015, the Bulgarian government continues with its efforts focused on improving the business environment and reducing the administrative burden, with the idea also to enhance the business climate. In addition, a number of improvements in the statutory framework were drafted to enhance budget revenue collection, to accelerate the absorption of EU funds, to support ongoing optimisation of the administration, and to focus on e-governance. New Law on EU funds entered into force in December 2015, consolidating the legal basis in the area. The new Operational Programme Good Governance 2014-2020, approved by EC in February 2015, combines OP Technical Assistance and OP Administrative Capacity. The program is worth over €335m. Measures in key areas, such as administrative reform and e-Governance, e-Justice and judicial reform will be funded through the programme. The main priorities of the programme include improving services and completing the administrative reform. The main focus is providing citizens and business with easier access to services, including through further development of e-governance. The judiciary reform will continue to be a priority so that its quality, transparency and efficiency are improved.

6. Conclusions

Bulgaria ranks among the poorer research performers in the EU, categorized as 'modest' innovators by IUS 2015. The Bulgarian research and innovation system has been characterized by a significant underfunding, varying around 0.5-0.6% of GDP, rising to 0.8% in 2014. In June 2010, the Bulgarian government adopted a national R&D investment target of 1.5% of GDP by 2020, but having in mind that such a target would require dramatic increase of the R&D expenditure over the next five years, the Horizon 2020 PSF panel discusses the possibility of setting a more realistic target of at least 1% of GDP. The recent trends in the R&I structural developments are characterized by growing private R&D expenditure and in particular by increasing foreign R&D investments. As a result of the implemented EU operational programmes and instruments, the R&D performed by the business sector (as percentage of GERD) increased from 30% in 2009, to 50% in 2010, followed by 61% in 2013 (close to the EU28 average of 64%).¹⁸⁸ However, the growth in BERD concentrated practically solely in R&D services.

Simply increasing investment in size however cannot be expected to lead to competitive results, unless more focus is placed on incentives for excellence and internationalisation, in particular through a substantial increase in the part of public funding which is allocated competitively, transparently and based on merit, ideally on a project basis. According to the World Bank Report "Input for Bulgaria's Research and Innovation Strategies for Smart Specialization" (February 2013), 'the current funding environment does not encourage sufficiently researchers and research organisations to increase the quality and impact of their research'. The PSF panel concludes that the fragmented and dispersed Bulgarian higher education and research system would profit from a progressively higher concentration of resources based on the allocation of public funding to institutions using measures rewarding high quality such as performance-based funding schemes or performance contracts. The present model for funding Bulgarian higher education and research organisations that perform research is clearly inadequate when it comes to encouraging the building-up of high-level research environments. The model also leads to brain drain, given the low salaries and the unattractive career prospects and gradually undermines Bulgaria's performance in the Framework Programmes/H2020.

The Bulgarian R&I system is characterized by insufficiently coordinated priorities and on-going concerns with regard to project funding. There is no obvious horizontal coordination in the system. The governance is divided between the Ministry of Education and Science (MES) responsible for the public research performing organisations and the Ministry of the Economy whose intention is to promote innovation within SMEs, to invest in innovation infrastructure (e.g. Sofia Tech Park) and to attract the research activities of foreign firms.

The R&I system is fragmented mainly due to the overall governance and institutional system, which not only divides public and private segments, but also stimulates whole institutions to compete against each other for institutional budgets, instead of competing within themes to support excellence and quality research results on a project basis. The aspects of the system with competitive allocation of resources are relatively recent and funding for research and innovation remains fragmented and unpredictable. Bulgarian participation in international consortia could be put at risk. The Scientific Research Fund (SRF) sponsors basic and applied research activity and training of the public sector. The National Innovation Fund (NIF) finances applied research, development and innovation activities, including technology transfer.

¹⁸⁸ RIO Country Report for Bulgaria, 2014

The two (limited resource) funds are managed independently and have autonomous objectives and targets, without any mechanism in place for coordination. The very limited resources are dispersed in a large number of projects without clear reference to impact for society and the economy.

There is no multi-annual planning capacity. In addition, accusations of malpractice against the SRF and the lack of transparency in the two funds have seriously damaged trust in both the national and international communities.

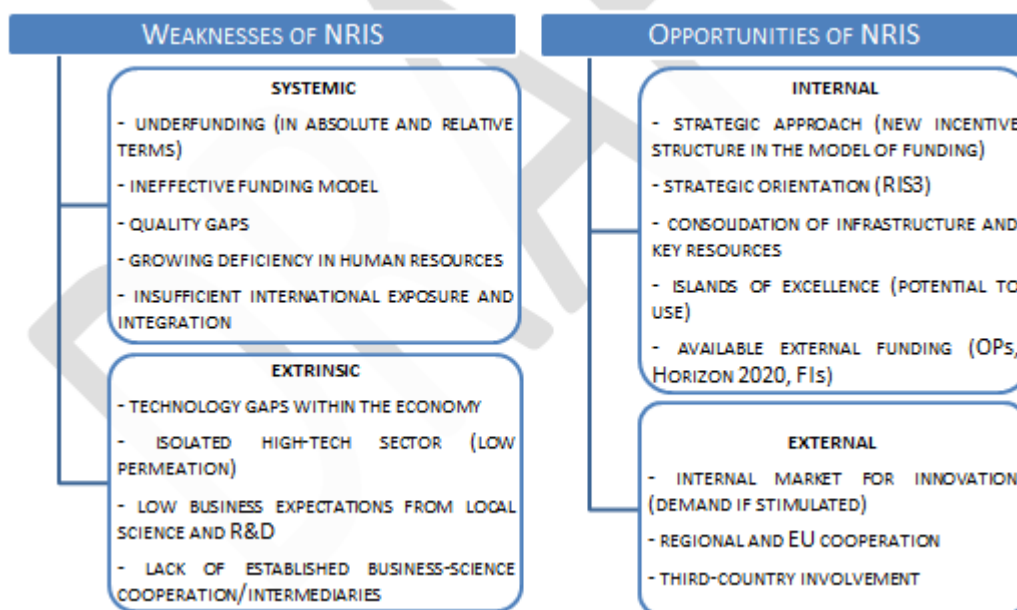
Up to the present moment Bulgarian funding schemes neither complement nor prepare for the effective participation of Bulgarian scientists and innovation entrepreneurs in EU research and innovation programmes or in activities funded through the ESIF. The PSF panel recommends that Bulgaria strengthens its EU funding capacities by establishing a Sciences/ EU Funding Liaison Office in Brussels and a full-time professional National Contact Point (NCP) Network. Both actions will contribute to reinforcing the capacities of national researchers and teams to successfully take part in EU funding programmes.

The Bulgarian National Research and Innovation System (NRIS) is characterized by a separation of the publically funded “research and development segment” on the one hand, and the private sector “innovation segment” on the other. The lack of complementarity between the activities of the beneficiaries and stakeholders of the two segments is one of the main challenges of the innovation system. The low level of R&D spending, in particular in the enterprise sector, along with the quality gaps and almost non-existent linkages between research and the needs of the productive sector are key reasons for Bulgaria’s comparatively poor record of innovation. The private sector is dominated by SMEs (the largest share of which in trade), and they are at difficulty to allocate funds to R&D, do not have their own technologies and capabilities to develop innovations, which are crucial for individual industries or group of industries.

Bulgaria is gradually increasing entrepreneurial activity in the Public Research Organisations (PROs). PROs such as the Bulgarian Academy of Sciences (BAS) and the public universities are by definition ‘non-profit organisations’. As they are increasingly encouraged to embrace a model of entrepreneurship¹⁸⁹ and become partners in the Open Innovation system, PROs find themselves acting more as commercial entities – licensing their research results to the private sector for money bearing royalties, starting and taking an ownership stake in commercial spin-off companies, negotiating and signing contract agreement to provide research services. Public private cooperation and enforced legislation to protect and transfer research results and IP rights could have a positive effect on the commercialisation of research in Bulgaria and higher overall innovation status.

¹⁸⁹ forthcoming change in 2016

Figure 35 Weaknesses and Opportunities of NRIS



Source: Authors' Own Data

The future of the Bulgarian National Research and Innovation System depends on the realization of long-term investment and reform policy to increase quality and efficiency. Four of the PSF "Ten Policy Messages directly advise on the course of action", using international experience and expertise, directly show the way forward in this respect:

#4. Improve the processes for the evaluation and funding of project proposals, and bring those processes to international standards.

#5. Increasingly concentrate funding for institutions that perform research, so as to reward high performance.

#6. Encourage the participation of Bulgarian scientists and innovation entrepreneurs in European programmes.

#7. Take rapid action to rebuild incentives for research careers at all stages and to retain and attract young talent from Bulgaria and from abroad into science and innovation.

Fortunately, consolidation and excellence are mutually reinforcing mechanisms, i.e. the national system is capable of overcoming the current gap between the publically funded "research and development segment" on the one hand, and the private sector "innovation segment" on the other. This public-private gap can be closed by further development of:

1. cooperation tools and frameworks (e.g. public private partnerships);
2. consolidation mechanisms and intermediaries (such as clusters, technology parks, etc.); and
3. undubious legislation to protect and transfer knowledge, research results and IP rights.

The regional and EU-wide cooperation, as well as third-country collaboration, present additional opportunities yet to be explored.

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Abbreviations

ABBREVIATION	FULL NAME IN ENGLISH	FULL NAME IN BULGARIAN
BSG	Research for Benefit of Specific Groups	(Научни) изследвания в полза на специфични групи
BSMEPA	Bulgarian SME Promotion Agency	Изпълнителна агенция за насърчаване на МСП
CBC	Cross Border Cooperation	Трансгранично сътрудничество
CP	Cohesion Policy	Кохезионна политика
CSA	Coordination and Support Action	Действия за координация и подкрепа
CSR	Country Specific Recommendations	Специфични препоръки за страната
DG	Directorate General	Генерална дирекция
DG R&I	Directorate General Research and Innovation	ГД Изследвания и иновации
DG Regio	Directorate General Regional and Urban Policy	ГД Регионална и урбанистична политика
EC	European Commission	Европейска комисия
EIF	European Investment Fund	Европейски инвестиционен фонд
ERC	Support for Frontier Research	Подкрепа за върхови изследвания
ESF	European Social Fund	Европейски социален фонд
ESFRI	European Strategy Forum on Research Infrastructures	European Strategy Forum on Research Infrastructures
ETC	European Territorial Cooperation	Европейско териториално сътрудничество
EU	European Union	Европейски съюз
FDI	Foreign Direct Investments	Преки чуждестранни инвестиции
FP	Framework Programme	Рамкова програма
GBAORD	Government Budget Appropriations or Outlays for Research and Development	Публичните бюджетни средства или разходи за научноизследователска и развойна дейност
GDP	Gross Domestic Product	Брутен вътрешен продукт
ICT	Information and Communication Technologies	Информационни и комуникационни технологии
IPRs	Intellectual Property Rights	Информационни и комуникационни технологии
JEREMIE	Joint European Resources for Micro to Medium Enterprises	Съвместни европейски ресурси за микро-, малки и средни предприятия
KET	Key Enabling Technologies	Ключови (базови) технологии
MC	Marie Curie Actions	Действия Мария Кюри

MoE	Ministry of Economy	Министерство на икономиката
MES	Ministry of Education and Science	Министерство на образованието и науката
MIP	Macroeconomic Imbalance Procedure	Процедура за макроикономически дисбаланси
MoF	Ministry of Finance	Министерство на финансите
NEC	National Economic Council	Национален икономически съвет
NCP	National Contact Point	Национална контактна точка
NCSI	National Council for Science and Innovations	Национален съвет за наука и иновации
NIF	National Innovation Fund	Национален иновационен фонд
NIS	National Innovation System	Национална иновационна система
NSI	National Statistical Institute	Национален статистически институт
OP	Operational Programme	Оперативна програма
R&D	Research and Development	Научни изследвания и развитие
R&I	Research and Innovation	Научни изследвания и иновации
R&TD	Research and Technology Development	Научни изследвания и технологично развитие
RI	Research Infrastructures	Инфраструктура за научни изследвания
RIS3	Research and Innovation Strategy for Smart Specialisation	Иновационна стратегия за интелигентна специализация
RTDI	Research, Technological Development and Innovation	Научни изследвания, технологично развитие и иновации
S3	Smart Specialisation	Интелигентна специализация
SMEs	Small and Medium-sized Enterprises	Малки и средни предприятия
SRF	Scientific Research Fund	Фонд Научни изследвания
TTOs	Technology Transfer Offices	Офиси за технологичен трансфер
UMIS	Information System for Management and Monitoring of the Structural Instruments of the EU in Bulgaria	Информационна система за управление и мониторинг на структурните инструменти на ЕС в България

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Annex 1 – List of the main research performers

Name	Number of Participations	EC Contribution (in million euro)
SOFIA UNIVERSITY "ST. KLIMENT OHRIDSKI"	45	9.02
INSTITUTE OF INFORMATION AND COMMUNICATION TECHNOLOGIES (IICT) – BULGARIAN ACADEMY OF SCIENCES	35	6.86
ONTOTEXT AD	15	5.00
INSTITUTE OF SOLID STATE PHYSICS – BULGARIAN ACADEMY OF SCIENCES	3	4.50
UNIVERSITY OF PLOVDIV	11	2.75
INSTITUTE OF OCEANOLOGY – BULGARIAN ACADEMY OF SCIENCES	21	2.33
INSTITUTE OF POLYMERS – BULGARIAN ACADEMY OF SCIENCES	2	2.23
PENSOFT PUBLISHERS LTD (PENSOFT)	8	1.81
TECHNICAL UNIVERSITY OF SOFIA	22	1.77
NEW BULGARIAN UNIVERSITY	2	1.59

Annex 2: List of the main funding programmes (Списък на програмите)

Наименование на програмата	ЕСИФ	Общо	2014	2015	2016	2017	2018	2019	2020
Оперативна програма Региони в растеж	ЕФРР	1 311 704 793		209 709 553	210 682 571	208 196 124	215 574 110	252 777 169	214 765 266
Оперативна програма Развитие на човешките ресурси	ЕСФ	883 476 570	109 904 260	115 533 697	121 695 693	126 756 317	131 725 635	136 577 132	141 283 836
Оперативна програма Развитие на човешките ресурси	ИМЗ	55 188 745	31 004 913	24 183 832					
Оперативна програма Наука и образование за интелигентен растеж	ЕСФ	352 619 543	43 865 781	46 112 642	48 572 063	50 591 896	52 575 286	54 511 647	56 390 228
Оперативна програма Наука и образование за интелигентен растеж	ЕФРР	243 381 138	30 276 551	31 827 355	33 524 869	34 918 976	36 287 929	37 624 422	38 921 036
Оперативна програма Иновации и конкурентоспособност	ЕФРР	1 079 615 516	146 992 661	177 521 817	132 763 251	149 531 640	156 177 908	132 666 597	183 961 642
ОП Инициатива за МСП	ЕФРР	102 000 000		102 000 000					
Оперативна програма Транспорт и транспортна инфраструктура	КФ	1 144 687 261	141 914 934	149 571 203	157 874 873	164 533 779	170 787 093	177 211 502	182 793 877
Оперативна програма Транспорт и транспортна инфраструктура	ЕФРР	459 761 907	57 194 263	76 699 952	79 906 659	54 913 334	57 499 375	60 024 099	73 524 225
Оперативна програма Околна среда	КФ	1 133 619 883		288 667 920	156 348 458	162 942 993	169 135 837	175 498 142	181 026 533
Оперативна програма Околна среда	ЕФРР	371 204 258		78 144 588	34 555 915	64 309 078	66 396 998	68 435 421	59 362 258
Оперативна програма Добро управление	ЕСФ	285 531 663	35 520 065	37 339 449	39 330 951	40 966 499	42 572 537	44 140 497	45 661 665
Програмата за морско дело и рибарство	ЕФМДР	88 066 622		24 296 787	12 337 253	12 537 214	12 828 942	12 916 663	13 149 763
Програма за развитие на селските райони	ЕЗФРСР	2 366 716 966		502 807 341	505 020 057	340 409 994	339 966 052	339 523 306	338 990 216
	Общо	9 877 574 865	596 673 428	1 864 416 136	1 532 612 613	1 410 607 844	1 451 527 702	1 491 906 597	1 529 830 545

Source: Partnership Agreement 2014-2020, October 2015 update (<http://www.eufunds.bg/>)

Annex 3: Evaluations, consultations, foresight exercises

List of Documents
- Final Report under public procurement contract N° 319/01.06.2011 with a subject: "Mid-term evaluation of the implementation of grant schemes under Priority Axis 1 "Development of a Knowledge-based Economy and Innovation Activities" and Priority Axis 2 "Increasing the efficiency of enterprises and promoting a supportive business environment" of Operational Programme "Development of the Competitiveness of the Bulgarian Economy" 2007-2013"
- Final Ex Ante Evaluation of the Partnership Agreement 2014-2020 Report under Project (OPTA 2007-2013) No 0094-CCU-1.1 Supporting the process of elaboration of the Partnership Agreement of the Republic of Bulgaria for the programming period 2014-2020
- Final Ex Ante Evaluation of the Operational Programme Innovation and Competitiveness 2014-2020 Report under Project No BG161PO003-5.0.01-0003 Effective Management of Operational Programme "Development of the Competitiveness of the Bulgarian Economy
- Final Ex-ante Evaluation of Operational Programme Science and Education for Smart Growth 2014-2020 Report under Project No BG051PO001-8.1-01-0001 "Support for General Directorate "Structural Funds and International Educational Programmes" of the Ministry of Education and Science to manage successfully priority axes 3 and 4 of Operational Programme Human Resources Development"
- Report Input for Bulgaria's Research and Innovation Strategies for Smart Specialization, World Bank, February 2013
- Project 0114-CA-1.2 "Raising the Operational Efficiency of the Certifying Authority in Certifying 2013-2015 Expenditures" Reports: "Preparation of an ex-ante assessment and a strategy for the effective implementation of financial instruments under the Operational Programme Environment 2014-2020"; "Preparation of an ex-ante assessment and a strategy for the effective implementation of financial instruments under the Operational Programme Regions in Growth 2014-2020"; "Preparation of an ex-ante assessment and a strategy for the effective implementation of financial instruments under the Operational Programme Innovation and Competitiveness"; and "Preparation of an ex-ante assessment and a strategy for the effective implementation of financial instruments under the Operational Programme Human Resources Development 2014-2020"
- Ex ante Assessment of the EU SME Initiative
- Report Research and Innovation Strategies for Smart Specialization (RIS3 or 3S) Assessment of the case of Bulgaria, prepared by Slavo Radosevic & George Stroglyopoulos, Study financed by the European Commission DG Regio, 30 October, 2012
- Report on the Smart Specialization Strategy of Bulgaria (2013), prepared by Daniela Mineva and Lisa Cowey within the context of DG RTD Expert Groups advising on development of Smart Specialization in EU12 plus Greece, Portugal and Spain
- Reer Review Report on Bulgaria's RIS3, produced in the context of the Peer Review Workshop in Dublin, July 2014 (JRC Smart Specialisation Platform)
- Stairway to Excellence Project (Fact&Figures and Country Report, Bulgaria)
- Final Report Horizon 2020 Policy Support Facility Peer Review of the Bulgarian Research and Innovation system (October 2015)

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