



ERAWATCH COUNTRY REPORTS 2012: Bulgaria

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The Country Report 2012 builds on and updates the 2011 edition. The report identifies the structural challenges of the national research and innovation system and assesses the match between the national priorities and the structural challenges, highlighting the latest developments, their dynamics and impact in the overall national context.

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EXECUTIVE SUMMARY

Bulgaria is one of the countries with the lowest R&D intensity in the EU and ranks the lowest in the EU on private R&D investment as a share of GDP. The GERD per inhabitant for 2011 is € 29.3 (Eurostat, provisional), and is the lowest in the EC 27, where the average GERD per inhabitant for 2011 is € 510.5 (Eurostat, estimated). In this respect the latest R&I policy development in the country is connected with Government decision of 9th of January 2013 for separate operational programme (OP) during the next programming period, 2014-2020, called “Science and Education for Smart Growth 2014-2020”. The new operational program is seen as an important contribution to reviving the decapitalised and poorly funded Bulgarian science and education, which has been left behind in the 2007 – 2013 programming period.

Some of the tangible goals laid down in the new operational programme include: a gradual increase of R&D spending in Bulgaria up from the current level of 0.6% to 1.5% of GDP by 2020, a decrease in the rate of schools dropouts to 11%, and an increase of the number of people with a university degree in the age group 24-30 up to 36%.

The envisaged five priority axes of the OP and their associated more concrete measures are:

1. Scientific research and technological development

- Modernization of scientific equipment
- Supply of modern ICT technologies for digitalization of scientific and educational content, data storage, and maintenance of electronic portals for scientific results publication

2. Education for employment, mobility and entrepreneurship

- Strengthening of linkages between university education and business sector
- Support for qualification and mobility of the human resources employed in the educational sector

3. Educational environment for social inclusion

- Improved access to pre-school and school education
- Integration of children from ethnic minorities and reintegration of children dropping out of the educational system
- support for children with special educational needs

4. Encouragement of education, qualification and life-long learning

- Improved quality of and access to university education
- Improved quality of and access to pre-school and school education
- Improved conditions for life-long learning

5. Educational infrastructures

- Construction, reconstruction and renovation of educational infrastructure different to activities falling under Operational Programme “Urban Development”
- Introduction of unified ICT systems and equipment in the field of conventional and professional education

Development of the research policy in 2012 is connected with implementation of the revision of the Law for BAS (2011). For the first time the National Assembly of the Republic of Bulgaria (Parliament) discussed and accepted the BAS research output annual report. Also the first decisions from the Advisory board, dominated by external for Academy staff took place.

The challenges of the national research and innovation system are defined by further dynamics of the structure of R&D funding and performing. The most notable change in Bulgaria’s R&D funding’ structure in 2010 and 2011 is the increase of the investments from abroad. They have been in the range of 5-8% of total R&D funding for the period 2000-2009. However, due to the inflow of EU Cohesion and Structural Funds in 2010 and 2011 they respectively reached 39.4% and 43.9% of all R&D funding. This structural change in funding has led to increasing of

R&D performed by the Business Enterprise sector from 30.0% of GERD in 2009 to 53.2% in 2011. It also has led to domination of the public competitive funding (from national and mostly European sources) in the main funding streams.

A Smart National and/or Regional specialisation strategy is expected to be presented by the team of the World Bank in August, 2013 according to a service agreement, signed by the Bulgarian Government and the World Bank to provide advisory services in development of the “Smart Specialization Strategy” for Innovation in June 2012. Before an interesting concept similar to some nationally based ideas for SSS, was presented. This concept suggests smart specialization in pulp and paper, engineering, agro-foods, tourism (See: Dominique Foray, May11-12,2012).

The *structural challenges* to research and innovation system and policy that the country has to overcome on this stage could be presented in six groups. On the first place is *overcoming low R&D intensity*. The national R&D spending goal of 1.5 % of GDP by 2020 is not on-track and out of reach, as R&D intensity has to perform at least +1.6% annual growths since 2000 comparatively to real level not higher than 0.6%. R&D expenditure in the public sector as % of GDP is 0.29, which is more than twice below the efforts of EU27 average – 0.76. The low R&D intensity accelerates decreasing attractiveness of the research career. The second one concerns *subordination of funding priorities*. There is many policy documents with different priorities recommended, but not subordinated. National thematic and sectoral priorities for public R&D funding at EU, national and regional level are not subordinated with policies for increasing domestic and foreign demand for nationally based research output. There is no subordination between science, technology and innovation policy as appropriate innovation strategy is still not elaborated. On the third place an important problem is *reducing fragmentation of R&I administration*. Its solution will contribute to improvement of its efficiency. The fourth challenge concerns *strengthening R&I in universities and public research organizations*. The problem is that on one hand, strengthening universities and developing a strategy to engage higher education institutions in innovation activities appears in several policy documents, but their big number is an obstacle to concentrate national efforts and reach significant results. Strengthening R&D in public research organizations concerns overcoming decapitalisation of existing national R&D centers along with increasing attractiveness of scientific carrier. Overcoming this challenge will lead to decreasing brain drain. Establishment of “Sofia-tech” technology park as a core R&I hub for the whole country and set the conditions to attract leading international and local scientists is another side of the strengthening R&I in the country. The sixth challenge is *intensifying links between education, research and business and avoiding bottlenecks for start-up companies and innovative SMEs*. The links between education, research and business are sporadic and weak, and thus the human potential is not effectively used for achieving social and economic objectives. Along with this public financial instruments and guarantees for young and innovative enterprises are still in the early stage of implementation and their effect is expected to be seen. The links between education, research and business are sporadic and weak and thus the human potential is not effectively used for achieving social and economic objectives. Public financial instruments and guarantees for young and innovative enterprises are still in the early stage of implementation and their effect is expected to be seen.

During the period 2010-2012 the Bulgarian government undertook some actions to update the strategic framework and address structural challenges. National Reform Programme (2011) set the national R&D spending goal at 1.5% of GDP by 2020. During the period 2010-2012 the Bulgarian government undertook some actions to update the strategic framework and address structural challenges. National Reform Programme (2011) set the national R&D spending goal at 1.5% of GDP by 2020. The National Strategy of Scientific Research to 2020 (adopted by Parliament in 2011) listed *five priority areas* for the development of research in Bulgaria. They are: energy, energy efficiency and transport; development of green and eco -technologies;

biotechnologies and bio-foods; new materials and technologies; cultural and historical heritage; development of fundamental research on programme and competitive principles to reach 15% of the total public expenditures on science. The information and communication technologies have been listed as a horizontal topic.

Nevertheless the national R&D budgets in 2012 and 2013 are neither concentrated in the priorities, defined by the various strategic documents produced in the past, nor the newly set priorities of the National Strategy of Scientific Research to 2020. The Government depends heavily on the available EU funding for reaching the national targets. Moreover, instead of applying strategic approach, based on analysis of the national needs, the policy measures often follow the EU financing priorities without adaptation to national priorities. In this respect it could be concluded that there is no clear match between the national priorities and the structural challenges.

The policy mix taking place in the R&D policy domain in the country could be defined as predominantly generic with declining public discretionary institutional funding and increasing competitive public funding for R&D projects. Now the public competitive R&D project grants, support for R&D infrastructures, structural reform of public research institute sector are important characteristic of the national policy. In the private sector the generic policy mix is characterised with discretionary institutional funding for R&D to firms and competitive R&D project grants. Many necessary strategic documents and measures however are still under preparation. The most of the identified challenges still remain without measures or budgets for practical solution, in spite of several policy actions have already been implemented. The sectoral policies are not well developed which is a barrier to better addressing the challenges. The same is valid for R&D/Innovation policies, like linkages between research and business and IRP policies. The policy mix in the finance domain is non R&D specific, and oriented towards macroeconomic stability. In the human capital domain the policy mix is characterised with non R&D specific educational and employment policy.

The innovation domain could be defined as predominantly generic. The same is valid for the industry, trade, defence, consumer protection, health and safety, environment, regional development, competition and other policies.

In conclusion it could be summarised that there is no clear enough match between the national priorities and the structural challenges. That is why the policy mix taking place in the R&D&I policy domain in the country could be defined as supply-side oriented and predominantly generic. Many necessary strategic documents and measures however are still under preparation. Despite the fact, that most of the challenges still remain without measures or budgets for practical solutions, several policy actions have already been implemented. It could be recommended on long term the policy mix to address increasing foreign and domestic demand for domestic R&D output, and from other side – increasing the domestic potential for such demand. Along with this effective allocation of scarce R&D funding requires its clear prioritisation.

TABLE OF CONTENTS

EXECUTIVE SUMMARY.....	3
1 INTRODUCTION.....	7
2 RECENT DEVELOPMENTS OF THE RESEARCH AND INNOVATION POLICY AND SYSTEM.....	11
2.1 National economic and political context.....	11
2.2 Funding trends	11
2.3 New policy	12
2.4 Recent policy documents.....	13
2.5 Research and innovation system changes	14
2.6 Regional and/or National Research and Innovation Strategies on Smart Specialisation (RIS3)	14
2.7 Evaluations, consultations.....	14
2.8 Policy developments related to Council Country Specific Recommendations	15
3 STRUCTURAL CHALLENGES FACING THE NATIONAL SYSTEM	16
4 ASSESSMENT OF THE NATIONAL INNOVATION STRATEGY.....	20
4.1 National research and innovation priorities.....	20
4.2 Evolution and analysis of the policy mixes.....	22
4.3 Assessment of the policy mix	25
5 NATIONAL POLICY AND THE EUROPEAN PERSPECTIVE.....	28
REFERENCES.....	31
LIST OF ABBREVIATIONS.....	33

1 INTRODUCTION

Bulgaria is a small country with a population of 7,327,224 on January 1, 2012 (Eurostat, 1.12.2012), or 1.45% of the EU-27 population (503678862 -2012 Eurostat forecast data). Its GDP per capita in Purchasing Power Standards is 46% of the EU-27 average (Eurostat, 2011). In 2009-2011 the economic activity, measured as GDP growth, has increased up to 1.7%, and the forecast for 2012 is 0.8%, which is above the EU-27 average (See Table 1.) The high-technology sectors (mainly ICT), remain one of the leading drivers of economic growth. But the share of innovative enterprises that utilise new technological knowledge is increasing mainly due to expanding market share and standardisation requirements.

In the last decade the country's intramural R&D expenditure (GERD) has remained at stably low level. The data for the 2010 shows R&D expenditures of 0.6% of GDP, and 0.57 % for 2011 (Eurostat, provisional). The level of R&D expenditures as a share of GDP is almost 4 times lower than the EU-27 average, estimated by Eurostat for 2011 as 2.03%. Provisional GERD for 2011 is €219,637 m. Bulgaria's business enterprise R&D expenditure (BERD) is €116.93 m in 2011 (Eurostat,p), or 0.3% of GDP, far behind the EU average of 1.26% of GDP (2010,2011,Eurostat, s). The R&D funded by the Government sector for 2010 was €93.045m, and in 2011 - €78.711 m (Eurostat p), respectively - 0.22%, and 0.2% (p) of GDP, which is close to, but less than EU average – 0.26% (s). BERD in Bulgaria as share of the total GERD (, 29.23% in 2009, 50.54 % in 2010, and 53.2% in 2011p according to Eurostat) is lower, but becoming closer to the EU average (62.35% in 2011p, Eurostat).

Research input versus output

The human resources in science and technology as a share of the economically active population in the age group 25-64 are almost stable: 32.2% in 2009, 31.6% in 2010, and 32.5% in 2011 (b, Eurostat). This level is lower than EU 27, which is slowly increasing from 40.1% in 2009 to 42,3% in 2011 (p).The R&D personnel however has remained at a level of about 0.51% share of the total employment in full time equivalent for 2011(Eurostat provisional), less than half of the 1.08% EU average (Eurostat estimate).

The research infrastructure of the country is formed by public research organizations, along with the research organisations in HEI, business and NGO sector. Their activities have been substantially scaled down since 1989. Governmental business research organisations were closed in 1996-97. The rest public research organisations have still accounted for 52% of the full-time equivalent employment of R&D personnel (NSI; BAS: Annual reports).The main research organisations in the public sector are the BAS and the Agricultural Academy. There are also other public research institutes but they are much less prominent in the Bulgarian research sector, such as the National Centre of Public Health Protection. The BAS is the largest national scientific research centre with the largest Ph.D. school in the country. It covers fields of the natural, engineering, social, medical and agro-biological sciences and the humanities and social sciences. It conducts scientific research aimed at the creation and acquisition of new knowledge, facilitates the development of scientific careers, develops interdisciplinary research, cooperates with universities, high schools, scientific organisations, and state, governmental and non-governmental organisations. 20,64% of researchers of the country are employed by the BAS (2011). More than a half of the scientific articles and patents in Bulgaria are produced by employed by BAS. The scientists of the Academy have worked on about half of the EU framework programmes and 70% of the NATO project grants for Bulgaria. (BAS: Annual report).

In the higher education sector there are seven in-house R&D units (2010) in 51 higher schools,

according to the Registry of Accredited Higher Educational Institutions in Bulgaria, maintained by the Ministry of Education, Youth and Science. The HEI employed 30.70% of the full-time equivalent R&D personnel in Bulgaria in 2011 (NSI, 2011).

The business enterprise sector in Bulgaria, according to the National Statistical Institute in 2011, employs 14.35% of the full-time equivalent R&D personnel. The employed researchers constitute 1747 of all employed R&D personnel in the business enterprise sector 2970 (NSI, 2011p).

Research input versus output shows some *imbalances in scientific input and output*. The shares of GERD for HEI and the main performer of the Government research system in GERD are similar: 10.24% of GERD (Eurostat, 2011p) is performed by the HEI, the share of the BAS is 13,78 % (2011), while the output is different – only one research organisation in the country – BAS, produced more than a half of the country's research output. Scientific publications by Bulgarian scientists in 2011, available in Scopus were 3 177. 20,64% of researchers of the country, employed by BAS produced 2938 publications in refereed journals, of which 1823 were the scientific publications in journals with impact factor (BAS, Annual report 2011). The latter is 56% of total scientific publications of Bulgarians. The same conclusion follows from the CR 2011 figures: according to data from the *Essential Science Indicators* (cited in a Report on the scientific publications by Dr. Georgi Angelov, Centre for Science Studies and History of Science, BAS), HEI has produced 27 'top papers' by April 2009, BAS has produced 40, the university hospitals and other public health institutions have produced 12. The available data by the *Science Citation Index* (SCI) (presented in *The Science in Bulgaria at the Beginning of XXI Century, 2009, BAS*) shows that the Bulgarian universities have published 45.98% of all the 22,170 scientific articles for the period 1999-2008, while BAS has produced the other 54.02%. The SCI and data from the Ministry of Education and Science also shows that BAS has the highest productivity in respect to production of scientific articles with its average 1319 articles per year for the 2005-2009 periods, while this rate varies in the different Bulgarian universities between 1.2 and 390.

Balance between sectors in technological output appears only in official statistics for patents. According to data calculated by eng. Rumiana Georgieva, based on the Bulgarian Patent Bulletin, for the period 2001- 2011, the business sector has held 23.3% (252) the HEI sector has held 1.6% (or 17), the Governmental sector (performed mainly by BAS) held 6.8% (74), and the individuals held 68.3% (738) of the patents with Bulgarian owner. But a precise look at the owners of the patents, registered by individuals (more than 50% of total) shows mainly names of persons, employed by BAS. In terms of outputs, there were only 9 Bulgarian patent applications with the European Patent Office in 2010 (17 in 2009, 15 in 2008), submitted mainly by large companies.

According to IUS *relative strengths* are in Human resources, Intellectual assets and Economics effects. High growth is observed for Community trademarks and R&D expenditure in the business sector. A relatively strong decline is observed for Non-R&D innovation expenditures and Venture capital investments. Growth *relative weaknesses* are in Open, excellent and attractive research systems, Finance and support, Firm investments, Linkages & entrepreneurship and Innovators.

Scientific, technological and economic specialisation of the country

3177 scientific publications by Bulgarian scientists are available in SCOPUS database in 2011, which is of decrease of almost 7% (237 articles) on the previous year. The total number of scientific publications to which Bulgarian scientists made contribution for the period 2001- 2011 was 47,263. According to the scientific fields, maintained in SCOPUS, the *scientific specialisation and respective potential knowledge demand* could be grouped in following categories (Innovation.bg 2012): group of high publishing activity includes *physics and astronomy* (16% of all publications with Bulgarian Participation for the period 2001-2011), *medicine* (11%), *chemistry* (10%), material

science (9%), biochemistry, genetics and molecular biology (9%) and engineering sciences (8%). In the second group with moderate publishing are the following scientific fields – agricultural and biological science (5%), mathematics (5%), chemical engineering (4%), computer science (4%), pharmacology, toxicology and pharmaceuticals (3%) earth and space (3%). The third group includes all other fields.

Technological specialization and respective potential knowledge demand could be characterised by patents, issued in Bulgaria and nationally owned in the period 2001-2011. The majority of the Bulgarian patent owners hold patents in the *human necessities* (227), followed by performing operations, transporting (202), mechanics, lighting, engines and pumps, guns and ammunition (176), chemistry or metallurgy (163), electricity (126), construction (98), physics (87), textiles and paper (2)(BPO, Innovation.bg 2012).

The *economic specialisation and respective explicit knowledge demand* could be characterised by different criteria¹. The sectors with most value added to the GDP According to 2011 NSI data, are the *manufacturing, mining and quarrying, electricity and gas supply*, as well as wholesale and retail trade, as well as repair of motor vehicles and transportation. The export is the major driver for GDP growth. In this respect its specialisation is important signal for knowledge driven development as there is evidence the export oriented firms are better R&D performed. According to BNB the export specialisation of Bulgaria by commodity groups is mainly in *base metals and their products* (21% of total for 2011), machines, transport facilities, appliances and tools (19.3%), animal and vegetable products, food, drinks and tobacco products (16.2%), mineral products and fuel (15.2%), textile and leather materials, clothing, footwear and other consumer goods(14,4%), chemical products, plastics and rubber (9.5%). The trade balance (FOB-CIF) for 2011 shows that the country is a *net exporter of manufactured articles, manufactured goods, food and live animals*, as well as beverages and tobacco (NSI). The country also exports machinery and transport equipment; however it imports almost double the amount of the same type of goods from the EU.

Most of the FDI in Bulgaria have been focused in real estate and related financial services, which have been related to pre-crisis credit lending boom and hence have not been conducive to knowledge demand and/ or supply. Accordingly, the Bulgarian economy has not been associated with technological innovation and respective international specialisation, but rather marketing and organisational innovation. Thus the explicit demand for knowledge is low.

The structure of the national research and innovation system and its governance

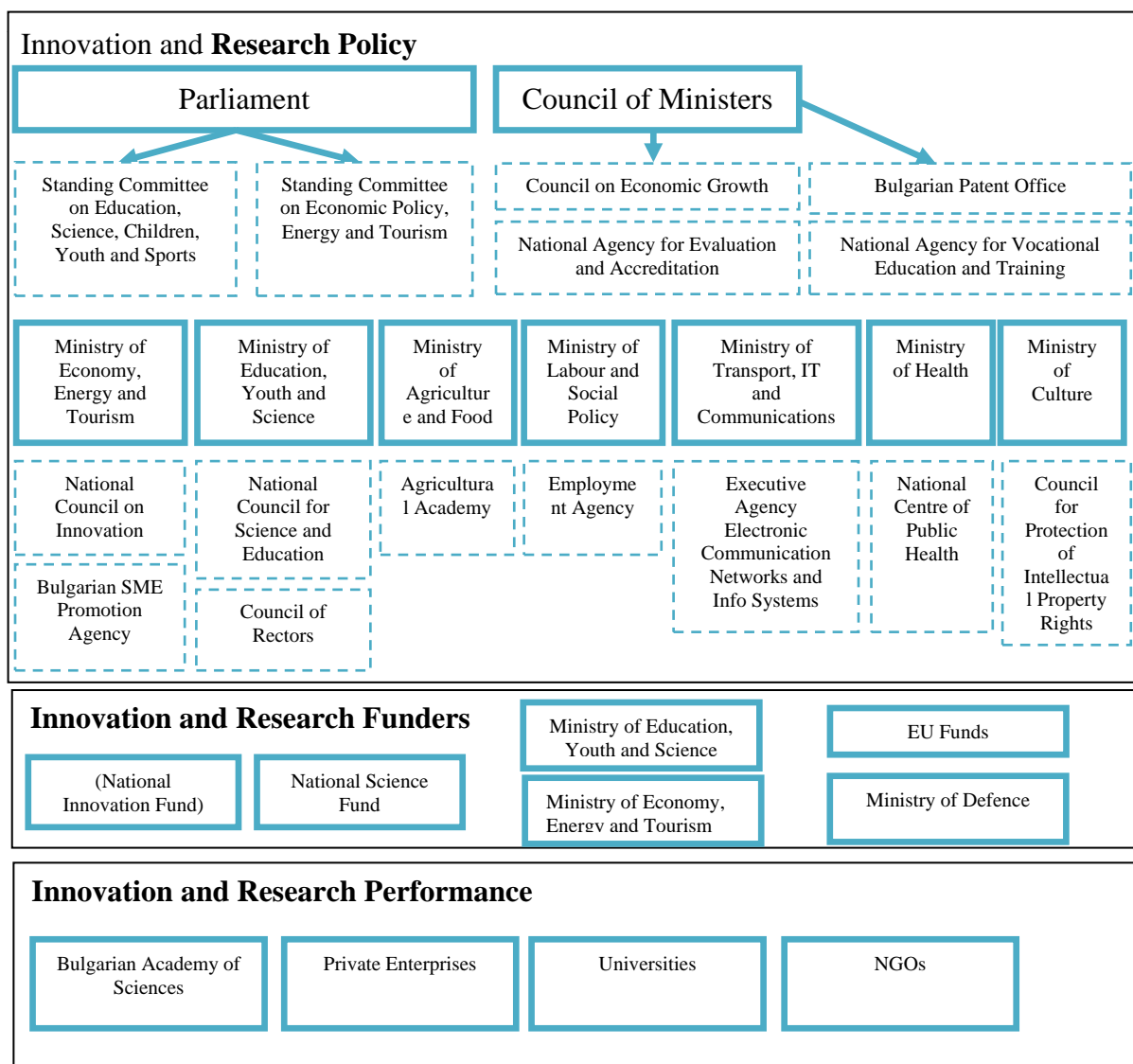
The Bulgarian research and innovation system is characterized by overall decline. The recent trends in its development are defined by funding from abroad, mainly from European funds (43.3% for 2011). A tendency of decentralization of the research system in terms of sectors financed has appeared, but still not in terms of research output. The government sector's share in funding research and development (R&D) decreased from 58.3% in 2008 to 36.6% in 2011. Nevertheless more than 60% of the Bulgarian scientific publications have come from only one research organization of this sector.

The Bulgarian research system has undergone considerable changes since the country started its

¹ According to an academic study (Innovativeness of a national economy) economic specialisation of the country is in the areas, which form relative comparative advantages (RCA) in the international trade of the country (primary sector, resource based productions, and low technological productions); increase the RCA (production of electrical equipment); form RCA in the international trade of the country before and has potential for gaining back positions (branches forming predominant export of high technological product groups like electrical machines, optical instruments, rotating electrical power stations, energy machines); have highest contribution to the economic growth (service sector, processing industry).

transition to a market economy in 1989. The R&D funding has withered quickly. R&D expenditure from 2.39% in 1990 levelled off at an annual average of just below 0.5% of GDP in the period 2003-2012, which is less than one fourth of the average EU-27 value. During the period 1990-1997, when the privatization and loose the former foreign markets took place, the separate research organizations (about 37), funded by the Ministry of economy and working for state owned big business complexes, as well as R&D offices inside business enterprises, were closed. During this period the business R&D expenditures was decreased from more than 90% to about 20% of total. This change has been affecting the Bulgarian research system up to now.

The recent structure of the national research and innovation systems is presented in Figure 1. The major *RDI policy making bodies* in the Government are the Ministry of Education, Youth and Science which defines and implements national research policy and the Ministry of Economy, Energy and Tourism which is responsible for the national innovation policy. Along with the Parliament, adopting the R&D state budget the National Science Fund (NSF) and the National Innovation Fund (NIF) are the main public research funding bodies. The National Science Fund programmes are open to all public and private research performers, including private enterprises. The National Innovation Fund programmes were open to enterprises only (by 2008 when its activity was discontinued). Public R&D institutes, most notably the Bulgarian Academy of Sciences (BAS), are the *major performers of R&D*. There are no big research performers from the private sector.



2 RECENT DEVELOPMENTS OF THE RESEARCH AND INNOVATION POLICY AND SYSTEM

2.1 National economic and political context

The National Strategy for Scientific Research to 2020 (2011) is aimed to facilitate the development of the Bulgarian Science by making it a factor for economic development based on knowledge and innovation. The newly set national goal for R&D investments to reach 1.5% of GDP by 2020 is a testimony for some change in priority setting by attributing a growing priority to innovation. This Strategy for the first time officially introduced a set of priorities for the development of science in Bulgaria. Their origins are in June 2010, when the Bulgarian government adopted an ambitious GERD target of 1.5-2% of GDP, stated in its position on the Strategy Europe 2020. The position also presents economic sectors for structural specialisation of the Bulgarian economy, pointing out that the export oriented and high technology sectors are expected to draw the attention of foreign investors. The research policy goals are strongly connected with implementation of the Europe 2020 Strategy, presented in elaborated by the Ministry of Finance Draft of the National Reform Programme 2010-2013 in November 2010. The Bulgarian goals for Europe 2020 include: 76% rate of employment for the population aged 20-64; 1.5% of GDP investments in R&D; 16% share of renewable energy sources in the total end-consumption of energy and increase of energy effectiveness with 25%; decreasing the drop-out rate from the educational system to 11% and increase the share of the people aged 30-34 with completed higher education to 36%; decreasing the number of people living in poverty to under 260,000. The latest development in the R&I policy in Bulgaria is connected with Government decision of 9th of January 2013 for separate operational programme (OP) during the next programming period, 2014-2020, called “Science and Education for Smart Growth 2014-2020”.

2.2 Funding trends

The GERD as a share of GDP – 0, 57 % is not changing, showing lack of clear policy to reach the target of 1.5% in 2020. The GERD per inhabitant is € 29.3 (2011, Eurostat, p), and is the lowest in the EU 27, where the average GERD per inhabitant for 2011 is € 510.5 (Eurostat, s).

The most notable change in Bulgaria’s R&D funding’ structure in 2010 and 2011 is the increase of the investments from abroad. They have been in the range of 5-8% of total R&D funding for the period 2000-2009. However, due to the inflow of EU Cohesion and Structural Funds in 2010 and 2011 they respectively reached 39.4% and 43.9% of all R&D funding. This change in funding has led to increasing of R&D performed by the Business Enterprise sector from 30.0% of GERD in 2009 to 53.2% in 2011. The Government sector has historically been the main research funder and performer in Bulgaria. Now its role is changed. Government budget appropriations or outlays on R&D (GBAORD) have declined in last three years. R&D performed by the Governmental sector is declining sharply – from 55.2% of GERD in 2009 in 2011 it is 35.8%. R&D funded by Business Enterprise sector is increasing from 0.16 % in 2009 to 0.3% in 2010 and is keeping this level in 2011, which level is seven times less than EU27average, which is 1.26. R&D performed by HEIs (% of GERD) is very low – 14.09% in 2009, and is declining to 10.2%. The latter is more than twice less EU 27, which is 24% (2011). R&D performed by PROs in the country (% of GERD) could be neglected.

Table 1. Recent developments of research and innovation

	2009	2010	2011	EU 27
GDP growth rate in %	-5.5	0.4	1.7	-0.3(2012)
GERD as % of GDP	0.53	0.6	0.57p	2.03s(2011)
GERD (euro per capita)	24.3	28.5	29.3p	510.5s(2011)
GBAORD – total R&D appropriations (€ million)	117.8	99.7	96.4	91,277.1 (EU27total2011)
R&D funded by business Enterprise sector as % of GDP	0.16	0.3	0.3p	1.26(2011)
R&D performed by HEIs (% of GERD)	14.09%	11.6%	10.2%	24%(2011)
R&D performed by Government sector (% of GERD)	55.2%	37.3%	35.8%	12.7% (2011)
R&D performed by Business Enterprise sector(% of GERD)	30.0%	50.3%	53.2%	62.4 (2011)
Share of competitive vs institutional public funding for R&D	50%*	60%*	78%*	n/a

Legend: f- forecast; p- provisional; s –Eurostat estimate, * - own estimate

Source: Eurostat 28.3.2013

The *main competitive national public R&D funding instruments* are the National Innovation Fund (NIF) and the National Science Fund (NSF). Due to considerations of overlapping with EU funding programmes, NIF has not distributed any funds since 2008, when it reached a budget of €10.3m. NSF's budget peaked in 2009 (€51.1m), but Government cuts in 2010 have substantially restricted it to €13m. In addition to the two funds, direct budget subsidies to public research organisations are provided by the Government. The *inflow of EU Cohesion and Structural Funds* in 2010 and 2011 has *increased the share of competitive public funding* for R&D considerably. The allocated ERDF and Cohesion Fund support for the 2007-2013 period amount to €310.6m for RTDI and linked activities and €292m for Support for innovation in SMEs (DG Regional Policy data; Country Report on achievements of Cohesion Policy: Bulgaria, 2011). Tax incentives for R&D expenditures have been limited and have not attracted private enterprises.

In conclusion it could be summarized that the main funding mechanisms, assessed as a balance between the main funding streams, are dominated by public competitive funding (from national and mostly European sources). Collaborative funding is a mechanism incorporated in the majority of projects with EU funding. About half of national funding distributed by NSF, and more than two third by BAS has thematic focus. NSI data for the period 2000 – 2011 shows that R&D spending in real and in growth terms has been highest in technical sciences and natural sciences, followed by the agricultural sciences. In 2010 and 2011 however the medicine and health science received the most R&D funding. Government spending dominates the natural sciences, therefore, of primary importance in R&D spending growth. In contrast, R&D expenditures of the business enterprise sector in technical sciences are greater than those in the public sector. For example the GBAORD by socio-economic objectives favors the agriculture (15.3%), and education (12%), followed by the general advancement of knowledge in the universities (10.4% of the GBAORD), (NSI, 2011).

2.3 New policy measures

The latest development in the R&I policy in Bulgaria is connected with Government decision of 9th of January 2013 for a separate operational programme (OP) during the next programming period, 2014-2020, called “Science and Education for Smart Growth 2014-2020”. This OP is seen as an important contribution to reviving the decapitalised and poorly funded Bulgarian science and education, which has been left behind in the 2007 – 2013 programming period.

OP Competitiveness continues to increase its contracting rate for the support of innovation and technology projects. For the period May-October 2012, it contracted a total of BGN 420 million (€ 215 million). At the end of October 2012, 85 SMEs were awarded contracts for technological modernisation for the total amount of BGN 60 million (€ 30.6 million).

In October 2012, the National Innovation Fund (managed by the Executive Agency for Small and Medium-Sized Enterprises) opened a new call for R&D projects with a total budget of BGN 5 million (€2.55 million). This is the first open call for new projects since 2008. Research and development, and feasibility projects are eligible to participate in the competition. For the R&D projects the maximum grant is BGN 500,000 (€ 255,623) for a period of 12-36 months. For the feasibility projects the maximum subsidy is BGN 50,000 (€ 25,562) for projects with duration of up to one year. For both types of projects the established ceilings may increase depending on the category and the availability of effective collaboration with a research organisation and / or other enterprise. Bulgarian organisations involved in international projects under “Eureka” can also apply in the competition.

2.4 Recent policy documents

In 2010-2012 the Bulgarian government undertook some actions to update the regulatory framework, set new rules, procedures and priorities, as well as create coherence and synergies between the previously numerous strategic documents. The Strategy of Scientific Research by 2020 (2011) listed the main science priority areas. The National Reform Programme (2011) set the national R&D spending aim of 1.5% of GDP by 2020. The Roadmap for Research Infrastructure was also adopted in 2010. The amended Law on Scientific Research Promotion (October 2010) introduced the idea for independent assessment on public research funds' spending and better accountability to society. The government's position on the Strategy Europe 2020 (2010) focuses on the support for export oriented and high technology industries. Many necessary strategic documents and measures however are still under preparation: new Higher Education and Science Law (to update the current Higher Education Act); new Law on Innovation, which will reinstitute the National Innovation Fund, the activities of the National Council on Innovations, and most probably will introduce new tax and research public procurement incentives; update of the university rating system. Despite the fact, that most of the challenges still remain without measures or budgets for practical solution, several policy actions have already been implemented. The Law on the Development of the Academic Staff (May 2010) decentralised the academic career promotion and lead to increased autonomy of the universities. Other recent developments include provision of state co-financing of FP7 projects, and introduction of university rating system (November 2010).

The major Laws affecting the research policy mix are the State Budget of the Republic of Bulgaria Acts. They set the BAS, Ministries and HE's annual R&D funding. The state R&D budgets for 2010, 2011, 2012 have not clearly reflected the priorities, defined in strategic documents. The changes of the Law for the BAS (2011) introduce advisory board to the governance structure of the BAS, as well as annual reporting the results of R&D activities to the Parliament. These changes are implemented, and in 2012 the BAS reported its research output.

An overview of the most important policy documents provides guidance as to the potential *thematic focus* of the Bulgarian research policy, once financing becomes more readily available. The National Strategy for Scientific Research for the Period 2005-2013 gives preference to applied research as opposed to basic research, as do more general policy documents such as the National Strategic Reference Framework. All these documents are careful to spell out that the distinction between applied and basic research is rather blurred. The National Strategy for Scientific

Research for the Period 2005-2013 outlines the following priority thematic areas: national identity and Bulgarian cultural heritage; information technologies; new materials and technologies; agro- and biomedical research and technologies.

Among national policy documents related to *sectoral policies* are: The National Programme for Reforms 2007-2009 has come up with a long list of priorities: *ICT, genetics, medicine, biotechnologies, machine building, energy-saving technologies, and nanotechnologies*. The next National Program for Reforms 2008-2010 focuses on the improvement of the legislation and financing mechanisms in the research and science area. The government's position on the Europe 2020 Strategy (June 2010), based on analysis of the Ministry of the Economy, Energy and Tourism, includes some economic sectors for *structural specialisation of the Bulgarian economy*, such as *information technologies, electronic components, machine-building, medicinal and optical equipment production, etc.*

There are not enough effective policies to strengthen the links between public R&D institutions and industry. Bulgaria does not have any specific tax, public procurement or other public policy measures to stimulate private R&D spending. The main driving factors are expanding market share and standardisation requirements. The Bulgarian economy continues to have a low technology profile; however the existing high-technology sectors, including ICT, remain one of the leading drivers of economic growth.

The BAS, in its capacity of National research centre promotes own policy toward definition of thematic RD priorities. Its research agenda is developed according to the goals and priorities, defined in "Strategic Goals and Priorities of the Bulgarian Academy of Sciences Scientific Policy in the 2009 - 2013 Period", adopted by its General Assembly. (<http://www.bas.bg/fce/001/0268/files/MicrosoftWord-StrategicFieldsandPrioritiesoftheBulgarianAcademyofSciencesScientificPolicyinthe2009.pdf>). The document defines tree policy areas addressing challenges to country development: Science as the main driving force in the development of knowledge based national society and economy; Scientific potential and research infrastructure as a part of the European Research Area; and National identity and cultural diversity in Europe and in the world. According to these policies thematic priorities of the research agenda of Scientific councils at autonomous BAS institutes are defined. The achieved results are reported to the Parliament.

2.5 Research and innovation system changes

The most notable change in Bulgaria's R&D expenditures' structure in 2010 and 2011 is the increase of the investments from abroad. They have been in the range of 5-8% of total R&D expenditures for the period 2000-2009. However, due to the inflow of EU Cohesion and Structural Funds in 2010 and 2011 they reached 39.4% and respectively 43.9% of all R&D expenditures (NSI). Now the Government is less important for funding and performing R&D&I. The EU funding has become the most important for national R&I system. The Enterprise Business sector has become prevailing in R&D performance.

At the level of R&D performers a significant change was occurred after the change of the Law for BAS on 12 of April, 2011. An Advisory board was established at the BAS governing structure, which allows public influence to its research agenda. With the same change of the Law a significant change occurred at political level with obligation the Annual reports of BAS to be discussed and accepted by the Parliament. For the first time in 2012 the Parliament discussed and accepted the research outputs of the Academy. (the Law for BAS <http://www.bas.bg/fce/001/0266/files/NewLaw-BAS14042011.pdf>).

During 2012 other significant changes were discussed (as Law on Innovation, etc.), but didn't take place.

2.6 Regional and/ or National Research and Innovation Strategies on Smart Specialisation (RIS3)

Smart National and/or Regional specialisation strategy has not been introduced in the country yet. It is expected to be presented by the team of the World Bank in August, 2013.

The Bulgarian Government has signed service agreement with the World Bank to provide advisory services in development of the “Smart Specialization Strategy” for Innovation in June 2012. Before an interesting concept similar to some nationally based ideas for SSS, was presented. This concepts suggests smart specialization in pulp and paper, engineering, agro-foods, tourism (See: Dominique Foray, May11-12,2012).

2.7 Evaluations, consultations

The only international evaluation and consultation of research organisation was undertaken by the BAS. This evaluation is important as the reform, taking place in the BAS during the period 2010-2012, were based on the results, presented in the report: “Research at the Bulgarian Academy of Sciences. A Report by the 2009 Science Review Committee” (See: [http://www.bas.bg/fce/001/0149/files/BAS_Eval_RMC_Report_Vol_1_\(27Nov09\).pdf](http://www.bas.bg/fce/001/0149/files/BAS_Eval_RMC_Report_Vol_1_(27Nov09).pdf)) . The Review Committee has come to the unambiguous conclusion that the majority of BAS Institutes perform valuable research as judged by international standards; some research groups operate at the forefront worldwide. The overall evaluation is that research in the BAS is an impressive achievement, considering the particularly difficult circumstances for research in Bulgaria. Institutes that perform remarkably well in international comparison, produce research of the highest societal relevance for Bulgaria and the wider region. However, that this relatively good performance results largely from investments in the past and cannot be sustained without a considerable effort on the part of both BAS and the Bulgarian government. The effort required is primarily a matter of providing better funding to BAS. As it was not the case and further drastic reorganisation aimed at matching the ambitions and the scope of the research at BAS with the financial resources available has taken place. The change after evaluation (2011) was directed towards programme oriented organization of research activities (see: http://www.bas.bg/fce/001/0342/files/KATALOG_NAUKA_ENG_curves.pdf) .

2.8 Policy developments related to Council Country Specific Recommendations

Bulgaria has a low level of investments in research and innovation (R&I) and several good recommendation were given by the Commission in this respect. But there are not enough strong developments related to the country specific recommendations, adopted by the Council of the European Union on 06.07.2012. More concretely no success is available in declared efforts the R&I investment to be raised in order to reach a national target of 1,5 % of GDP by 2020. This target is not on-track and out of reach, as R&D intensity has to perform at least +1.6% annual growth since 2000 comparatively to real level not higher than 0.6%. The appropriate innovation strategy is still not elaborated. The R&I administration in Bulgaria is fragmented and there are no attempts to overcome this barrier to improved its efficiency. Bulgaria needs to strengthen its universities and develop a strategy to engage higher education institutions in innovation activities, but their big number is an obstacle to concentrate national efforts and reach significant results. Nevertheless frameworks fostering collaboration between universities and the private sector are further developed, and funding is allocated in a competitive way. Attempts to avoid bottlenecks for start-up companies and innovative small and medium-sized enterprises (SMEs) seeking finance are undertaken. In October 2012, the National Innovation Fund (managed by the Executive Agency for Small and Medium-Sized Enterprises) opened a new call for R&D

projects with a total budget of BGN 5 million (€2.55 million). Public financial instruments and guarantees for young and innovative enterprises are still in the early stage of implementation and their effect is expected to be seen.

Table 2. COUNCIL RECOMMENDATION on the National Reform Programme 2012 of Bulgaria and delivering a Council opinion on the Convergence Programme of Bulgaria, 2012-2015 facing the national system, Brussels, 6 July 2012

Member State	CSR on research & innovation	National target	R&D intensity
BG	CSR4: Speed up the reform of relevant legal acts on schools and higher education and of accompanying measures by focusing on modernising curricula, improving teacher training, and ensuring access to education for disadvantaged groups. <u>Improve the access to finance for start-ups and SMEs, in particular those involved in innovative activities.</u>	1.50% Not on-track Out of reach	0.60% (2010) Average annual growth: <u>+1.6% since 2000</u> Average annual growth required: <u>+9.7% till 2020</u>

3 STRUCTURAL CHALLENGES FACING THE NATIONAL SYSTEM

Bulgaria is one of the countries with the lowest R&D intensity in the EU and ranks the lowest in the EU on private R&D investment as a share of GDP. Based on the Summary Innovation Index, it falls into the group of the modest innovators. Bulgaria again ranks bottom in the European Union's 2013 scoreboard of innovation performance, having been at or near the lowest ranking every year since 2008. Bulgaria now has ranked last in the 2008, 2012 and 2013 scoreboard, placing second-bottom in 2009 and fourth from last in 2010 and 2011.

Table 3. Basic characteristics of the research and innovation in the country

HUMAN RESOURCES	
New doctorate graduates (ISCED 6) per 1000 population aged 25-34	0.5
Percentage population aged 25-64 having completed tertiary education	27.3
Open, excellent and attractive research systems	
International scientific co-publications per million population	205
Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country	2,62
Finance and support	
R&D expenditure in the public sector as % of GDP	0.26
FIRM ACTIVITIES	
R&D expenditure in the business sector as % of GDP	0.30
Linkages & entrepreneurship	
Public-private co-publications per million population	4.10
Intellectual assets	
PCT patents applications per billion GDP (in PPSE)	0.34
PCT patents applications in societal challenges per billion GDP (in PPSE) (climate change mitigation; health)	0.12
OUTPUTS	
Economic effects	
Contribution of medium and high-tech product exports to trade balance	-4.78
Knowledge-intensive services exports as % total service exports	26.84
License and patent revenues from abroad as % of GDP	0.03

Source: Innovation Union Scoreboard 2013

According to IUS 2013 national *human resources are insufficient*. New doctorate graduates (ISCED 6) per 1000 population aged 25-34 are 0.5, which is 3 times below EU27. Percentage of population aged 25-64 having completed tertiary education is 27.3, which is below EU27 (34.6). There are problems with *openness and attractiveness of research system*. The international scientific co-publications per million population is 205, which is two third of the EU 27. Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country is 2,62, which is less than performed in IUS 2011 (3.59). It is far below EU27- 10.9. *Finance and support*, measured as R&D expenditure in the public sector as % of GDP is 0.26, which is three times below EU27. *Firm activities*, estimated as R&D expenditure in the business sector as % of GDP, are 0.30 which is four times below EU27 (1.27). *Linkages in IUS 2013*, measured as Public-private co-publications per million population, are 4.10, almost twice more than in IUS 2011, but thirteen times less than EU27 (52.8). *Intellectual assets*, measured as PCT patents applications per billion GDP (in PPS€), are 0.34, ten times less than EU 27 (3.9). PCT patents applications in societal challenges per billion GDP (in PPS€) (climate change mitigation; health) are 0.12, while for EU27 they are 0.96. The outputs - economic effects, are also insufficient comparatively to EU 27. Contribution of medium and high-tech product exports to trade balance is -4.78, while in EU27 is 1.28. Knowledge-intensive services exports as % total service exports is 26.84, while in EU27 is 45.14. License and patent revenues from abroad as % of GDP are 0.03, and in EU27 – 0.58.

The National Strategy of Scientific Research to 2020 strategy reviews the state of the national R&I system and *lists nine top challenges*. Among them are: Sustainability and predictability of R&D investments in pursuance of the national R&D target for 2020; Rigidity of the institutional structure of the public scientific system; The aging structure of scientific personnel deteriorates further as the structure and incentives in place do not stimulate new entrants to the system; The disproportionally small share of competitive funding in public budgets for scientific research; Lack of mobility schemes in the public and the private sector; The absence of competitive funding of doctoral studies and need of introduction of project financing of the doctoral studies under projects of interest for the hosting institution; Lack of coherence between the education, science and innovation policies; Underdeveloped innovation infrastructure; Limited instruments at national level in support of innovation.

The main structural challenges in the area of innovation and science that Bulgaria could be summarised on the base of above analyse of IUS, and of the National scientific strategy and other national policy documents, on Council opinion on the Convergence Programme of Bulgaria, 2012-2015 facing the national system, Brussels, 6 July 2012, as well using benchmarking the performance against EU average, and available economic analysis in the country. The greatest among them are:

1. Overcoming low R&D intensity and increasing human resources. According to the policy documents the R&I investment has to be raised in order to reach a national target of 1,5 % of GDP by 2020. This target is not on-track and out of reach, as R&D intensity has to perform at least +1.6% annual growth since 2000 comparatively to real level not higher than 0.6%. R&D expenditure in the public sector as % of GDP is 0.29 (twice less than the efforts of EU27 average – 0.76), and in private sector - 0.3. The Innovation Union Competitiveness Report 2011 (IUC) sees the structural reason for this worrying performance in the “sectoral specialisation in low technology sectors and the ... scarcity of medium and high technology firms in the economy”.

2. Subordinating funding priorities. Subordinating national thematic and sectoral priorities for public R&D funding at EU, national and regional level coordinated with a policy for increasing domestic and foreign demand for national research output is a grand challenge facing the national system structure. Insufficient integration of S&T, R&D, innovation and

macroeconomic policy has appeared in policy documents with different priorities recommended are not implemented. The appropriate innovation strategy is still not elaborated. This state of the art is connected to the chaotic nature of the changes in public policy, inconsistency in the funding of individual scientific fields, as well as the weak institutionalisation of policy measures. A positive sign in the respect of developing research priorities is the R&D programming for 2010-2013 period practice, taking place in the BAS.

As EU funding becomes more and more available for R&I infrastructure reform, national efforts should be focused on streamlining policy formulation and coordination and on leveraging very limited public funds to attract higher private R&D investment. The latest available data shows that the crisis has exacerbated existing structural challenges in research and innovation in Bulgaria. The reduction in national public R&D in Bulgaria contradicted the general EU trend of increasing R&D funding to compensate for private sector cuts during the crisis (IUC Report, 2011 and 2.2). These developments put at considerable doubt the attainment of the national R&D goal by 2020.

3. Fragmentation of R&I administration. The R&I administration in Bulgaria is fragmented and there are no attempts to overcome this barrier to improve its efficiency in concentration of scarce resources for better results in R&I. There are signs however that some strategic decisions could be taken. Good example in this respect is the Government decision of 9th of January 2013 for a new separate operational programme (OP) during the next programming period, 2014-2020, called “Science and Education for Smart Growth 2014-2020”. The new operational program is seen as an important contribution to reviving the decapitalised and poorly funded Bulgarian science and education, which has been left behind in the 2007 – 2013 programming period.

4. Strengthening R&I in universities and public research organizations. Another structural challenge facing the national system is strengthening universities and developing a strategy to engage higher education institutions in innovation activities, but their big number is an obstacle to concentrate national efforts and reach significant results.

The institutional fragmentation affects intellectual assets appreciation. PCT patents applications per billion GDP (in PPS€) are 0.32, which is well below the EU27 average – 3.78. It also affects introduction of an efficient system for *R&D evaluation* as a component of each modern research, technology and innovation policy. Despite the measures envisaged in various strategic documents, as well as in the implementation of EU Funds, however, a comprehensive evaluation system has not yet been established in Bulgaria, which is one of the reasons for insufficient efforts for publications: international scientific co-publications per million population are 206, while in EU 27 average they are 301, and scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country are 2.59, well below EU 27 average- 10.73. There is one good example for international evaluation of BAS in 2009², after which from 2012 evaluation of results of the Academy is provided on an annual base by the Parliament. Evaluation instruments have not yet been regularly implemented in practice in other research organisations. For example, the National Innovation Strategy, which foresees the Minister of Economy, Energy and Tourism’s submission to the National Innovation Council, and to the Council of Ministers, of an annual report on the status and development of the innovation policy in Bulgaria. By the end of 2011, the Ministry of Economy, Energy and Tourism had issued two such reports on the innovation policy in Bulgaria – for the years 2006 and 2007. Despite the good start, such reports need to be regularly updated.

² European Science foundation and ALLEA (2009) Research at the Bulgarian Academy of Sciences. A Report by the 2009 Science Review Committee
[http://www.bas.bg/fce/001/0149/files/BAS_Eval_RMC_Report_Vol_1_\(27Nov09\).pdf](http://www.bas.bg/fce/001/0149/files/BAS_Eval_RMC_Report_Vol_1_(27Nov09).pdf)

Another example relates to the National Strategy of Scientific Research to 2020. It foresees, but has not actually implemented, activities such as: carrying out impact assessment of the application of new solutions and measures in the field of science and innovation; introduction of compulsory, regular international evaluation of the organisations providing financing to and carrying out scientific research, R&D and innovation; regulation of long-term objective evaluation and monitoring criteria of scientific programmes and results; and definition of a system for regular internal evaluation of scientific organisations with clear long-term criteria.³

Strengthening R&I in public research organizations suggests overcoming decapitalisation of national R&D centres and increasing attractiveness of scientific carrier.

Overcoming decapitalisation of national research centres, well performed in R&D output is another challenge facing the national system. Public funding for the BAS and the Agricultural academy, best performed in R&D productivity, is rather small. This leads to their decapitalisation and brain drain. New doctorate graduates (ISCED 6) per 1000 population aged 25-34 are 0.6 for 2010, which is twice less than EU27 average (1.5). One of the reasons is that the percentage population aged 25-64 having completed tertiary education is 27.7, which is also below EU 27 average (33.6). Another reason is that the current levels of research personnel salaries, and the outdated material base and equipment do not attract young researchers, resulting in brain drain and aging R&D staff. There is also lack of stimuli for attracting leading researchers from abroad.

5. Intensifying links between education, research and business and avoiding bottlenecks for start-up companies and innovative SMEs. The policy governance of higher education, research and innovation is departmentalised. In the frame of the Ministry of education, youth and science's project „Science-Business” 5 sessions for competitive selection of post-graduate students and young scientists for month training in high-tech research complexes and infrastructures were conducted. Nevertheless in total Bulgarian firms do not collaborate enough with public research institutions on their innovation projects citing prohibitive costs and minimal benefits from producing knowledge-intensive products for an unsophisticated consumer base with low demand pull potential. R&D expenditure in the business sector as % of GDP are 0.30, which is more than four times below the efforts of EU27 average – 1,23. As a result of the weak link between research, business and education the economic effects of research and innovation system are insufficient: medium and high-tech product exports as % total product exports are 25.66 , while the EU27 average are 48.23; knowledge-intensive services exports as % total service exports are 23.48, while the EU27 average are 48.13; License and patent revenues from abroad as % of GDP are 0.09, while in EU-27 average – 0.51. There is one good example of a strong link between research and education: the BAS, along with being the largest national research centre is among larger accredited Ph.D. educational centres in the country with 572 Ph.D. students by the end of 2011. The link between the research and business and other organisations appears in the share of own income in the budget of BAS. This share is 40% (BGN 60.278m or €30.91m)⁴. Nevertheless the public-private co-publications per million population in the country is 2.3, rather below the EU 27 average – 36.2. Bottlenecks for start-up companies and innovative small and medium-sized enterprises (SMEs) seeking finance are another challenge facing the national system. Public financial instruments and guarantees for young and innovative enterprises are still in the early stage of implementation and their effect is expected to be seen. In October 2012, the National Innovation Fund (managed by the Executive Agency for Small and Medium-Sized Enterprises) opened a new call for R&D projects with a total budget of BGN 5 million (€2.55 million).

³ National Strategy of Scientific Research to 2020

http://mon.bg/opencms/export/sites/mon/en/top_menu/science/national_research_strategy-2020.pdf

⁴ Annual Report of the BAS 2011, accepted by the Parliament

http://www.bas.bg/fce/001/0003/files/OTCET_BAN_2011.pdf

4 ASSESSMENT OF THE NATIONAL INNOVATION STRATEGY

4.1 National research and innovation priorities

The National Strategy for Scientific Research to 2020 (2011), is the key policy document, is aimed to facilitate the development of the Bulgarian Science by making it a factor for economic development based on knowledge and innovation. The newly set national goal for R&D investments to reach 1.5% of GDP by 2020 is a testimony for some change in priority setting by attributing a growing priority to innovation. To that end, the latest National Strategy of Scientific Research to 2020 contains innovation goals and measures, which aim to achieve the newly set goal for investments in R&D and innovation. The National Strategy of Scientific Research set for the first time the five specifically listed priority areas for the development of research in Bulgaria. They are: energy, energy efficiency and transport; development of green and eco - technologies; biotechnologies and bio-foods; new materials and technologies; cultural and historical heritage; development of fundamental research on programme and competitive principles to reach 15% of the total public expenditures on science. The information and communication technologies have been listed as a horizontal topic. The Strategy envisages that over 60% of the public R&D financing will be concentrated in the prioritise areas by 2020. The support for scientific activity will be continued through institutional financing based on developed scientific programmes and plans in order to maintain the level of scientific knowledge and specialists relevant for the state, needed in various fields of economy and governance, as well as creation of innovative solutions (National Strategy of Scientific Research to 2020, Bulgarian Ministry of Education, Youth and Science, 2010)

The Government claimed that it specified the newly set priority scientific areas taking into account the national economic interests, the priorities of the Bulgarian government defined in the National Reform Programme, analysis of the scientific activity and export potential in Bulgaria, as well as the EU scientific priorities. They are also accounting for the leading market initiative, analysis of the Esko Aho Group regarding the measures for creation of Innovative Europe, the foreign direct investment data, the priority areas of the Seventh Framework Programme and the need of promotion of applied research. Still no tangible results have been observed. There are no notable changes in the established framework for developing the innovation capacity in the country between 2010 and 2012. There is a visible split between bodies responsible for research and education policies, and those in charge of innovation. This split is evident throughout the system and is a major cause for the lack of coordination.

Other emerging topics in the national policy discussions in the last three years have been the restructuring of the Bulgarian Academy of Sciences, the re-launching of the National Innovation Fund activities and the need of new Law on Innovation, the possibilities for countering the brain-drain and the lack of interest towards research in the young people, as well as the need of providing incentives for the technology intensive sectors. The latest public discussions also focus on the energy efficiency, necessity of support of green and social innovations, as well as developing rules for promoting the pre-commercial procurement.

The National Strategy of Scientific Research to 2020 specifically addresses some challenges through its measures. However it should be stated that within the interpretation of the Strategy the term “social challenge” implies issues such as promotion of the scientific community and social and economic status of the researches. The Strategy does not concerns itself with the conventional meaning of societal challenges (e.g. climate change, aging population, etc.), though

the latter are indirectly addressed by programmes such as “Natura 2000”. The term societal (or social) challenges is used in the context of measures, such as introduction of targeted programmes supporting scientific activity in SMEs and creation of managerial culture for collaboration with scientific institutions; introduction of financing model stimulating competition, development and application of scientific results in society and economy and increase of the funds for research and innovation; and strengthening the social dimensions of science by introduction of a programme for promotion of scientific activity of students at schools and universities, scientific activity awards and “science shops”. The rationale for such measures is that the quality of the performed scientific research depends mainly on the human potential - highly qualified and motivated researchers. The idea is to follow a more efficient policy toward raising the scientists’ economic and social status and creating attractive conditions for scientific activity that will give them sufficient professional self-confidence. The state encourages the return of highly qualified Bulgarian scientists working at foreign institutions abroad. Support is also to be provided to the collaboration between the Bulgarian diaspora and the scientific organisations in Bulgaria through introduction of specialised schemes.

There are no regular evaluations implemented in regards to the achievements of the research and innovation policies conducted, nor the functioning of the NSF and NIF. There is also no formal evaluation of Bulgaria’s participation in EU’s Framework Programmes, and the operational programmes. According to the National Innovation Strategy (2004), the Minister of Economy, Energy and Tourism should submit to the National Innovation Council and to the Council of Ministers an annual report on the status and development of the innovation policy in Bulgaria. By the end of 2011 however, the Ministry has issued only two reports on the Bulgarian National Innovation Policy – for 2006 and 2007. Analyses are prepared ad hoc and sporadically. For example, in 2010 the Ministry of Education, Youth and Science elaborated an Analysis of the Scientific Activity in Bulgaria, which once again confirms the challenges in from of and the shortcomings of the national innovation system. The trends and developments of the innovation and research policy are analysed by the civil society (for example the Innovation.bg report, issued by ARC Fund), as well as by the EC through the platforms ERAWATCH, TrendChart, Regional Innovation Monitor, etc. Additional challenge to the measuring of innovation trends provides the fact that the National Statistical Institute (NSI) presents data with a few years lag.

The National Strategy of Scientific Research to 2020 sets new rules and indicators for monitoring the achievements and implementation of the Strategy. It also calls for the introduction of a system for evaluation of the national research activity. The implementation effectiveness of the set targets and measures in the Strategy are to be evaluated by independent external experts every three years.

The Council of Ministers, the Ministry of Economy, Energy and Tourism and the Ministry of Education, Youth and Science are the primary public bodies to implement and monitor the Strategy. Some of the monitoring indicators and corresponding targets include: Increasing the percentage of public resources for science used in priority scientific areas up to 60% by 2020; 5 modern research infrastructure constructed per priority scientific areas by 2020; Increasing from 6 to 10 the number of projects with Bulgarian participation in the framework of the European Roadmap for Research Infrastructure by 2020; 3 institutional / long-term research programmes under the priority areas by 2020; 2 joint research centres; Increasing the number of established national research networks from 25 to 115 by 2020, etc.

The business enterprise R&D expenditure (BERD) in Bulgaria has been gradually increasing as a share of GDP and as a proportion of the total R&D expenditures from 2000 to 2009; it however dropped due to the economic crisis in 2010 and slowly increased in 2011. Yet, the share of the government financing is still predominant. There is a need of establishing new innovation and research financing instruments, especially since the discontinuation of the National Innovation

Fund and the low absorption rates of the EU-funded operational programmes. According to the National Strategy of Scientific Research to 2020 examples of such instruments are the JEREMIE Initiative (launched in 2011) and other guarantee funds, sectoral research programmes (still not established), specialised national programmes in a specific scientific field, national programmes for support of scientific infrastructure, and for the implementation of the National Roadmap for Scientific Infrastructure, etc.

In conclusion it could be summarised, that state priorities are not consistent enough with structural challenges identified in the previous chapter, which make national policy not effective enough.

4.2 Evolution and analysis of the policy mixes

There have not been any notable changes in the innovation policy mix, programmes and measures in Bulgaria between 2010 and 2012. After the introduction of the Currency Board in the country in 1997, Bulgaria has relied primarily on public expenditures to promote research and innovation. There is a general reluctance with respect to introducing tax relief for R&D and innovation in Bulgaria. There has been no funding allocated for the National Innovation Fund since 2008, except for BGN5m (€2.5m) secured in 2011 to cover payments due for the completion of already approved projects. Some universities become more active in promoting scientific and innovative activities, including research projects, knowledge exchange between universities, organisation of scientific conferences. The budget of the National Science Fund was reduced in 2011 to BGN35m (€17.8m) resulting in downsizing or discontinuation of support schemes and individual projects (Mini-TrendChart Report Bulgaria, 2011).

The main factors that present weaknesses and threats, but also opportunities for future improving the innovation and research environment, include:

Governance structure

The institutional fragmentation presents a challenge to the policy implementation. The research and innovation policies remain within the authorities of two different ministries that have different policy-making mechanisms and policy implementation structures. There are indications for collaboration between the Ministry of Economy, Energy and Tourism and the Ministry of Education, Youth and Science, for example the joint consultation during the elaboration of the National Strategy of Scientific Research to 2020. The strategy for the first time incorporates important science, technology and innovation policy guidelines in one document. Still, the cooperation needs to be spread to more policy areas and policy instruments, including laws, regulations, and elaboration of specific measures (Mini-TrendChart Report Bulgaria, 2011).

The Ministry of Finance is also active in the processes of policy formulation and discussion in the area of RDI. Representatives from the Ministry have taken part in various expert groups and committees, both on national and EU level, concerned with innovation policy. Experts for the Ministry of Finance are also participating in the monitoring and evaluation process of the National Innovation Strategy's implementation. The ministry is also hosting and coordinating an information system for management and monitoring of the EU's structural instruments in Bulgaria. The system operates as a project, funded by OP Technical Assistance, and provides detailed, publicly available information on the implementation of the various Operational Programmes in Bulgaria.

Multi-annual strategy

The National Strategy of Scientific Research to 2020 was adopted in 2011. It puts in place conditions and defines prospects for attaining the targets set forth in the Europe 2020 Strategy.

There is also foreseen adoption of new Law on Innovation (to re-place the law from 2004), as well as new Higher Education and Science Law. Still, the chaotic changes in public policy and inconsistency of funding towards the individual scientific areas create uncertainty both in the publicly financed research institutes and the business. In order for both the national and Europe 2020 objectives to be achieved the strategy documents, as well as implementation measures, should be harmonised and jointly elaborated between all stakeholders. These should also include standardisation, public procurement rules, regulations, etc. The coordinated policy-making process should aim to achieve increased coherence between the education, science and innovation policies. Moreover, the foreseen measures in the strategies should be adequately financed, efficiently implemented and regularly monitored, assessed and updated.

Adequacy of public funding and budgetary prioritisation

Since the transition to a market economy started in 1989, the predominant public research and development (R&D) funding has withered quickly. R&D expenditure levelled off at an annual average of just below 0.5% of GDP in the period 2003–2012, which is less than one fourth of the average EU–27 value. The national financial recourses need to be adequately planned and increased. This would bring stability to the business environment and provide more incentives for the currently low private research and innovation activities.

Another challenge is that currently the national budget funding is neither concentrated in the priorities, defined by the various strategic documents produced in the past, nor the newly set priorities of the National Strategy of Scientific Research to 2020. The government depends heavily on the available EU funding for reaching the national targets. Moreover, instead of applying strategic approach, based on analysis of the national needs, the policy measures often follow the EU financing priorities. The absorption level of EU funds and in particular the operational programmes is rather low due to delay in the start of the programme, lack of experience and administrative capacity. Cohesion policy instruments should be used more adequately.

The above speaks for the fact that Bulgarian RDI politics is currently very much dependent on external, EU, guidance, both financially and strategically. This creates unsustainable innovation environment, which results in Bulgaria inadequately addressing its internal innovation challenges. Giving priority to EU-wide financing priorities is also among the reasons for the considerable delays in the implementation of the various strategies in the field of RDI. To be continuously competitive and to successfully attract EU funding, the research base must at least be kept in a good state through adequate domestic funding and through a properly carried out prioritisation process.

Reaching the national R&D financing goal of 1.5% of GDP by 2020 would require both increasing the national funding, as well as providing new and regularly updated and effectively financed support measures for promoting the private sector investments in R&D activities. The 2010 budgets of most of the research and innovation policy measures and schemes in Bulgaria have not been updated with appropriate funding for 2011, 2012 and 2013 (for more information see Annex A of the Mini-TrendChart Report Bulgaria, 2011, and the Low for State Budget 2012 & 2013).

Monitoring system; Evaluation of institutions and policies

The lack of up to date statistical and qualitative data on the implementation of the research and innovation policy and measures is a weakness for Bulgaria. Evaluation is performed ad hoc and irregularly. A good example was the international evaluation of research activities in the BAS in 2009, followed by a reform, taking place up to now. Statistical data is produced with a lag of

several years. A positive step is the newly introduced university rating system (launched in 2010), which is intended to serve as a tool for discretionary state funding according to universities' achievements. Still, there is need of establishment of evaluation system and rules for initiating policy and structural changes in all innovation and research-related institutions based on the recommendations from the evaluations. The National Strategy of Scientific Research to 2020 foresees as one of its measures the introduction of scientific activity evaluation of the research organisations, which will help the state to design better policy measures. The strategy also sets new rules and indicators for monitoring the achievements and implementation of all its measures. It is expected that monitoring and control procedures will be also introduced with the future new Law on Innovation and the new Higher Education and Science Law.

Research careers; Attraction of world talent and countering the brain-drain

The country experiences a shortage of qualified human resources, as reflected in the fact that Bulgaria scores lower than the EU average on the availability of a highly qualified and educated workforce. In order to overcome these challenges, Bulgaria needs to develop more effective mechanisms for attracting the young people, as well as leading researchers from abroad. Pre-conditions for increasing the attractiveness of the research career are the improvement of the business environment, updating the research infrastructure and equipment, increasing researchers' salaries, ensuring effective collaboration between the research institutes, the education and the business.

Link between education and research; Partnerships at all levels and between all actors

Generally R&D institutions and universities do not actively cooperate with companies. There are no specific policy measures aimed at promoting public-private knowledge transfer or spin-offs. The mobility of research staff between the public and the private sector is rare and it is not supported by any specialised programmes for fostering inter-sectoral mobility. The majority of Bulgarian business enterprises do not have research units, thus not attracting research staff from the public sector. Collaboration between research institutions and SMEs often remains "hidden" as a result of lacking tax and other incentives (Mini-TrendChart Report Bulgaria, 2011). To ensure enhanced partnerships at all levels and between all actors, the state should not only put in place the necessary support measures and implement institutional restructuring, but also guarantee accountability to society on funds spent, and build mutual trust between the science, the private sector and the society.

Business environment promoting private investments

Due to the lack of specific measures for promoting private investments in R&D, the discontinuation of the National Innovation Fund and the effects of the global crisis, the businesses are reluctant to invest in research and innovation.

Tax incentives for R&D expenditures are very limited in scope and have failed to attract private enterprises. They do not favour in-house R&D, and tax breaks' effects are significantly delayed in time. Moreover, while there is an increase in absolute terms in the R&D funding from higher education and enterprises, the share of the latter in total R&D expenditure in Bulgaria remains half that of the EU average. This implies that the capacity of Bulgarian enterprises to support research infrastructure and staff is limited (Mini-TrendChart Report Bulgaria, 2011).

In order to promote private investments in research and science, the state should define its sectoral priorities and provide new instruments in support of innovation such as start-up funding schemes, support to clusters, technology centres, commercialisation of patents. The new financial engineering instruments, guarantees and venture capital funds should be further enhanced and more broadly used.

4.3 Assessment of the policy mix

In 2010-2012 the Bulgarian government undertook some actions to update the regulatory framework, set new rules, procedures and priorities, as well as create coherence and synergies between the previously numerous strategic documents. The Strategy of Scientific Research by 2020 (2011) listed the main science priority areas. The National Reform Programme (2011) set the national R&D spending aim of 1.5% of GDP by 2020. The Roadmap for Research Infrastructure was also adopted in 2010. The amended Law on Scientific Research Promotion (October 2010) introduced the idea for independent assessment on public research funds' spending and better accountability to society. The government's position⁵ on the Strategy Europe 2020 (2010) focuses on the support for export oriented and high technology industries. Many necessary strategic documents and measures however are still under preparation: new Higher Education and Science Law (to update the current Higher Education Act); new Law on Innovation, which will reinstitute the National Innovation Fund, the activities of the National Council on Innovations, and most probably will introduce new tax and research public procurement incentives; update of the university rating system. These changes address and are expected to tackle the challenges, discussed in Chapter 3. Still, an extensive effort from all stakeholders is needed to implement the foreseen measures. Despite the fact, that most of the challenges still remain without measures or budgets for practical solution, several policy actions have already been implemented. The Law on the Development of the Academic Staff (May 2010) decentralised the academic career promotion and lead to increased autonomy of the universities. Other recent developments include provision of state co-financing of FP7 projects, and introduction of university rating system (November 2010), restructuring the Bulgarian Academy of Sciences. The changes of the Law on the BAS (2011) introduce advisory board to the governance structure of the BAS, as well as annual reporting the results of activities to the Parliament, started in 2012.

Table 4. Assessment of the policy mix⁶

Challenges	Policy measures/actions	Assessment in terms of appropriateness, efficiency and effectiveness
Overcoming low R&D intensity and increasing R&D human potential.	Accepted Acts for Annual state budget 2012 & 2013.	Decreased public funding in nominal terms and trend towards increased utilisation of EU funds for innovation support at the end of the programme period could lead only to furthering changes in the R&D structure of the national system, but not to overcoming low R&D intensity. Appropriateness and effectiveness of state budgets require clear prioritisation and coordination between different sources of public R&D funding, and measures for increasing foreign and domestic market demand for national research product.
Introducing subordination of funding priorities.	Joint preparation and collaboration in the formulation of priorities and measures for new OP "Science and Education for Smart Growth 2014-2020". The changes of the Law on the BAS (2011)	National thematic and sectoral priorities for public R&D funding at EU, national and regional level are neither well defined, nor subordinated with a policy for increasing domestic and foreign demand for national research output. Introduced advisory board to the governance structure of the BAS, which allows influencing its research programme, as well as annual reporting the results of activities to the Parliament, which ensure their appropriateness.
Overcoming fragmentation of R&I administration.	No measures.	The efficiency of activities of R&I administration is not changes.

⁵ The government's position on the Strategy Europe 2020, <http://www.minfin.bg/document/8030:1>

⁶ Changes in the legislation and other initiatives not necessarily related with funding are also included.

Challenges	Policy measures/actions	Assessment in terms of appropriateness, efficiency and effectiveness
<p>Strengthening R&I in universities and public research organizations</p>	<p>Evaluation measures set in the new National Strategy of Scientific Research to 2020 (2011) Introduced university rating system (2010) Change of the Law for BAS (2011).. Availability of EU-financed operational programmes to develop human resources. Adopted new Law on the Development of the Academic Staff (May 2010). Push for increasing the national budget financing of education. Availability of EU-financed operational programmes to develop human resources.</p>	<p>The evaluation of research in university sector is still performed irregularly. The regular annual assessment of the scientific results of BAS as a public research organisation with the greatest potential for development by the Parliament is implemented in 2012, after international evaluation in 2009. The university rating system (2010) serves as an effective tool for discretionary state funding according to universities' achievements, including research activities (up to 25% more financing than the allocated subsidy can be received). No any consolidations of R&I in universities took place. The low level of salaries for researchers, more concretely in the main research organisation – BAS, affects increasing the brain drain. Strengthening R&I in public research organizations concerns also overcoming decapitalisation of existing national R&D centres and increasing the salaries of R&D employed, along with establishment of “Sofia-tech” technology park as a core R&I hub for the whole country and set the conditions to attract leading international and local scientists. The new Law on the Development of the Academic Staff (2010) abolished the Supreme Attestation Commission. This decentralised the academic, as well as research career promotion and lead to increased autonomy of the universities to grant academic titles. In some cases however this put barriers to the mobility of the academic staff between universities. There is need of elaboration of common criteria and rules for granting academic titles so that they can be recognised by all institutions.</p>
<p>Intensifying links between education, research and business and avoiding bottlenecks for start-up companies and innovative SMEs.</p>	<p>NSF 2010 competition-based scheme “Stimulating scientific research in the state universities” OP Competitiveness. Launch of JEREMIE and JESSICA funds (2010). Adopted National Reform Programme of the Republic of Bulgaria 2011-2015. New call of the National Innovation fund, October, 2012 for R&D projects with a total budget of 2.55 m. euro</p>	<p>The Bulgarian managing authorities of operational p Only the National Science Fund (NSF) allows for the communication between the industry, educational institutions, and public research centres. There is need on new support measures in this area. Focus in OP Competitiveness is strongly placed on the infrastructure and much less on the services, which might result in under-use of the available funds. Despite the successful launch of JEREMIE and JESSICA funds, there is still need of more venture capital. Bulgaria is about to lose its competitive advantages due to the decreased quality of education and brain-drain. The Bulgarian economy continues to have a low technology profile. The funding to intermediary organisations for technology transfer is still neglected. The lack of long-term budget financing plans for specific research priorities results in insecurity in the private sector and its investment decisions. The National Reform Programme of the Republic of Bulgaria 2011-2015 promotes the clusters, technology transfer offices and technology parks, however its effects are yet to be seen.</p>

In conclusion it could be summarised that the policy mix taking place in the R&D policy domain in the country could be defined as generic with declining public discretionary institutional funding for R&D projects. Now the public competitive R&D project grants, support for R&D infrastructures, structural reform of public research institute sector are important characteristic of the national policy. In the private sector the generic policy mix is characterised with discretionary institutional funding for R&D to firms and competitive R&D project grants. Many necessary strategic documents and measures however are still under preparation. The most of the identified challenges still remain without measures or budgets for practical solution, in spite

of several policy actions have already been implemented. The sectoral policies are not well developed which is a barrier to better addressing the challenges. The same is valid for R&D/Innovation policies, like linkages between research and business and IRP policies. The policy mix in the finance domain is non R&D specific, and oriented towards macroeconomic stability. In the human capital domain the policy mix is characterised with non R&D specific educational and employment policy.

The innovation domain could be defined as predominantly generic. The same is valid for the industry, trade, defence, consumer protection, health and safety, environment, regional development, competition and other policies.

5 NATIONAL POLICY AND THE EUROPEAN PERSPECTIVE

Bulgaria's national RTDI policy is supply side one. In order to achieve the objectives of the ERA pillars the country needs to focus on demand side, setting more precise guidelines for cross-border collaboration, as well as elaborate and implement effectively a number of support measures. The Innovation Union Competitiveness report 2011 for Bulgaria notes that there can be potential to raise the quality of the scientific production, should the necessary reforms be adopted. Still, currently there are no common promotion procedures for researchers that could ensure career stability. The education curricula should also be improved to focus on creativity and critical thinking, and it should be based on analysis of the labour market. Although the state budget 2012 foresees some increase of the subsidy for the universities, the financial support in general has remained too weak to bring about a qualitative change in the universities' research activities. From other side the big number of universities for country like Bulgaria is additional barrier to improving universities' research activities. In this respect the question why to keep a reduced budget subsidy for the BAS, where human and technical potential are still concentrated and effective, is still open. The National Roadmap for Research Infrastructure was adopted in 2010 and Bulgaria is included in several European research infrastructure projects. Still, Bulgaria lacks financial, industrial and human potential for the construction and maintenance of big research infrastructures. The available research material base remains obsolete. There also is need of further regulations and incentives in regard to the cross-border cooperation, jointly funded activities, as well as common foresight. The main national measures supporting cross-border cooperation include the bi-lateral scientific and education agreements with other countries. More national collaborative support schemes are needed to raise the joint research activities, as well as the number of co-publications and co-patenting. The weak links between R&D institutions and industry remain a major challenge. There is also a lack of strong institutional policies in the field of intellectual property. The technology transfer offices are in the process of establishing. As participant in the FP7, among the EU-27, Bulgaria ranks 20th in terms of number of applicants and requested EC contribution (Innovation Union Competitiveness report 2011for Bulgaria). Despite Bulgaria's participation in the FP7, ESF, COST, ERA NET+ and other EU-programmes, there is no real concentration of public resources in priority scientific areas.

In European Research Area Communication adopted by the Commission on 17 July 2012⁷ one of identified Thematic Objectives to be implemented is strengthening research, technological development and innovation. The Country Specific Recommendation n°4 concerns improvement of the access to finance for start-ups and SMEs, in particular those involved in innovative activities. Implementations of the EC recommendations are connected with four tasks. Firstly, to strengthen private research and innovation investments by increasing the research and innovation capacities of firms and creating research jobs; support cooperation initiatives where local Bulgarian and foreign R&D are brought together to build a knowledge base in Bulgaria; creating synergies between research, higher education and businesses focusing on developing joint excellence and competence centres and promoting knowledge transfer and facilitating networking for innovation with researchers, academics and entrepreneurs from other European countries. The next task concerns supporting the design and operational implementation of the "Sofia-tech" technology park pilot project as a core R&I hub for the whole country and set the conditions to attract leading international and local scientists, establishing world-class working conditions and human resource development opportunities, in technology parks, centres of excellence, clusters and incubators. On the third place, strengthening the R&D&I in the country needs reduction of the red tape and timespan for

⁷ COM(2012) 392 final

patenting and improve the management of intellectual property rights (IPR) of Bulgarian innovators, including through applying the 2008 Commission recommendation and Code of practice. The last recommendation concerns cooperation in R&I among Danube Member States, States associated to Horizon 2020 and Neighbourhood countries to support a Danube Research Area. Assuring performance of investments by CSF Funds under this thematic objective requires meeting the relevant ex-ante conditionalities in advance of 2014. The general considerations which would improve governance and delivery concern preparation of research and innovation strategies for smart specialisation, prioritising national fields of excellence and comparative advantages set up an evaluation and monitoring system on innovation and research policy Implementation, establishment of regional or national partner facilities for European Strategy Forum on Research Infrastructure Roadmap Projects, aligning the research and innovation strategy on energy with the Strategic Energy Technology Plan (Strategic Energy Technologies Plan), reviewing the existing framework conditions for the development of bio-based products and technologies, supporting joint innovative activities in the food and agriculture industries It is expected to take action to harness the innovation potential of the sea and coasts in line with the Blue Growth Initiative, in particular in areas such as blue energy, aquaculture, maritime and coastal tourism, marine mineral resources, and blue biotechnology.

Precondition for a sustainable and effective national policy in the European perspective in the respect of the above recommendations is connected with definition, subordination and implementation of national thematic and sectoral priorities for public R&D funding at EU, national and regional level coordinated with a policy for increasing domestic and foreign demand for national research output. In this respect the recent national policies in great extent support the strategic ERA objectives (see Table 5).

Table 5. Assessment of the national policies/measures supporting the strategic ERA objectives (derived from ERA 2020 Vision)

	ERA dimension	Main challenges at national level	Recent policy changes
1	Labour Market for Researchers	Low number of researchers compared to EU. Ageing of the research staff. Decreased domestic and foreign market demand for R&D products of the country. Further enhancement of the secondary and the higher education systems in needed. Need of adequate financing for research and increased absorption of the EU Funds in support to PhDs and human resources development. Need of promotion procedures for researchers and financial incentives. The education curricula should focus on creativity and critical thinking and be based on analysis of the labour market.	Adopted new Law on the Development of the Academic Staff (2010). No measures. Adopted university rating system. New Higher Education and Science Law is foreseen.
2	Cross-border cooperation	Need of strategic guidelines for participation in European coordination and integration of research funding. Need of further regulations and incentives in regard to the cross-border cooperation, jointly funded activities, as well as common foresight. Need of more effective mechanisms to support the preparation of European projects under the EU Framework Programmes. Re-institutionalising of the Bulgarian Council on Innovation and its advisory functions on issues such as international cooperation, envisaged in the forthcoming Law on Innovation.	No changes. Foreseen new Law on Innovation, re-institutionalising of the Bulgarian Council on Innovation.

	ERA dimension	Main challenges at national level	Recent policy changes
3	World class research infrastructure	<p>Fragmented RI in HE sector. Reduced Government funding for the most productive PRO with concentrated research potential and well developed research infrastructure (partly obsolated). Distribution of the limited public budget R&D resources among a large number of HE institutions. Attraction of foreign researchers and knowledge. Update of the research material base is needed. Uneven spatial and thematic distribution of scientific infrastructure. Lack of adequate information, communication and e-services. Lack of foreign and internal market demand from the business.</p>	<p>Amendments of the Law on Scientific Research Promotion (on 22 October 2010). Adopted National Roadmap for Research Infrastructure (2011). Adopted national target for R&D expenditure of 1,5% of GDP by 2020.</p>
4	Research institutions	<p>Fragmented RI in HE sector. Distribution of the limited public budget resources among a large number of institutions. The financial support in general remained too weak to bring about a qualitative change in the universities' research activities. Complexity of own revenue generation. Lack of management experience. The criteria for granting scientific titles should be unified to ensure recognition of titles from all institutions.</p>	<p>Adopted new National Research Strategy by 2020 (2011). Launched new university rating system (November 2010), allowing up to 25% more financing than the state subsidy. The draft state budget 2012 foresees increase of the universities' subsidies. Adopted Law on Student and Postgraduate Loans (January 2010).</p>
5	Public-private partnerships	<p>No effective national policies to strengthen the links between R&D institutions and industry. Private funding in research is scarce, hindering researchers mobility. Technology transfer offices are still in the process of been established. There are no centres for commercialisation of patents and intellectual property. Inactive innovation mediators - clusters, technology centres; technology transfer offices; centres for commercialisation of patents and intellectual property, etc. (according the National Strategy of Scientific Research to 2020). Impossibility of the organisations to develop mobility schemes – internal and interinstitutional, as well as inter-sectoral, for which there are also normative obstacles (according the National Strategy of Scientific Research to 2020).</p>	<p>Launched scheme for creation of technology transfer offices under OP Competitiveness (January 2011). Foreseen new Law on Innovation and re-institutionalising of the National Innovation Fund.</p>
6	Knowledge circulation across Europe	<p>Lack of effective national measures supporting cross-border cooperation and knowledge circulation. Low FP7 success rate (financial contribution and number of applicants) compared to the EU average. The number of co-publications between Bulgarian researchers and researchers from other ERA countries is one of the lowest in Europe. Low co-patenting activity. Research outputs are usually not freely available to the public.</p>	<p>The National Science Fund implements the bi-lateral scientific agreements.</p>

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LIST OF ABBREVIATIONS

ARC	Applied Research and Communications
BAS	Bulgarian Academy of Sciences
BERD	Business Expenditures for Research and Development
BGN	Bulgarian Lev New
BNB	Bulgarian National Bank
BPO	Bulgarian Patent Office
BulCRIS	Bulgarian Current Research Information System
CERN	European Organisation for Nuclear Research
CIF	Cost, Insurance, Freight
COST	European Cooperation in Science and Technology
CR	Country Report
EC	European Commission
EMBO	European Molecular Biology Organisation
ERA	European Research Area
ERA-NET	European Research Area Network
ERDF	European Regional Development Fund
ERIC	European Research Infrastructure Consortium
ERP Fund	European Recovery Programme Fund
ESA	European Space Agency
ESF	European Science Foundation
ESFRI	European Strategy Forum on Research Infrastructures
EU	European Union
EU27	European Union including 27 Member States
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FDI	Foreign Direct Investments
FOB	Free on Board
FP	European Framework Programme for Research and Technology Development
FP7	7th Framework Programme
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D

GOVERD	Government Intramural Expenditure on R&D
GUF	General University Funds
HEI	Higher education institutions
HERD	Higher Education Expenditure on R&D
HES	Higher education sector
HRST	Human Resources in Science and Technology
ITER	International Thermonuclear Experimental Reactor
IP	Intellectual Property
IUC	Innovation Union Competitiveness
IUS	Innovation Union Scoreboard
MEYS	Ministry of Education, Youth and Science
MF	Ministry of Finance
NIF	National Innovation Fund
NRP	National Reform Programme
NSI	National Statistical Institute
NSF	National Science Fund
OECD	Organisation for Economic Co-operation and Development
OP	Operational Programme
OPHRD	Operational programme “Human Resources Development”
PRO	Public Research Organisations
R&D	Research and development
R&I	Research and Innovation
RI	Research Infrastructures
RIS	Regional Innovation Strategies
RTDI	Research Technological Development and Innovation
S&T	Science and Technology
SF	Structural Funds
SME	Small and Medium Sized Enterprise
SSS	Smart Specialization Strategy
VC	Venture Capital