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An assessment of research system and policies

Bulgaria

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Executive Summary

Research-related policies aimed at increasing investment in knowledge and strengthening the innovation capacity of the EU economy is at the heart of the Lisbon Strategy. The strategy reflects this in guideline No. 7 of the Integrated Guidelines for Growth and Jobs which aims to increase and improve investment in research and development, in particular in the private sector. The report aims at supporting the mutual learning process and the monitoring of Member States efforts. The main objective is to characterise and assess the performance of the national research system of Bulgaria and related policies in a structured manner that is comparable across countries. In order to do so, the system analysis focuses on key processes relevant for system performance. Four policy-relevant domains of the research system are distinguished, namely resource mobilisation, knowledge demand, knowledge production and knowledge circulation. This report is based on a synthesis of information from the ERAWATCH Research Inventory and other important available information sources.

The analysis of the Bulgarian research system has shown that it has stagnated in recent years following a prolonged period of downsizing, facing a lot of restructuring challenges, as well as very low investment in R&D in the 1990s. The country's EU accession has promoted the process of setting up modern governance institutions though often their existence remains mostly "on paper" with little effect on R&D policy implementation. A particularly persistent weakness of the Bulgarian R&D system remains the very low participation of the private sector in R&D expenditures. Bulgaria faces challenges in all four domains presented in this report, including in the coordination and coherence between them, but low R&D expenditures coupled with the increasing deficit of qualified R&D personnel are probably the biggest and hardest of them.

Domain	Challenge	Assessment of strengths and weaknesses
Resource mobilisation	Justifying resource provision for research activities.	Resource provision for research is well justified in Bulgaria, including in the Law on Scientific Research Promotion. However, due to lack of coordination and subordination between policy documents in 2006 Government Budget Appropriations and Outlays for R&D as a share of GDP were twice lower in Bulgaria than in EU-27.
	Securing long term investment in research.	Well-established research funding instruments – the National Science Fund and the National Innovation Fund - which provide competitive programme and project-based funding. Still public funding of research remains ineffective as most of it is channelled through direct institutional grants to public research organisations. Long term research funding is to a high extent dependent on European funding, notably EU Structural Fund's support. Income from international programmes, including EU FPs, is increasing.
	Dealing with barriers to private R&D investment.	BERD is one of the lowest in the European Union which indicates that local business does not compete on innovation.
	Providing qualified human resources.	Traditionally high tertiary education attainment in Bulgaria is affected strongly by deteriorating quality, intensifying brain drain, aging academia and low attractiveness of science careers.

Domain	Challenge	Assessment of strengths and weaknesses
Knowledge demand	Identifying the drivers of knowledge demand.	Knowledge demand "locked" primarily in the public research sector targeting mostly basic research. Business and financial services and information technology services lead the business demand for R&D though the lack of foresight and/or technology assessment precludes better analyses of areas of demand.
	Co-ordination and channelling knowledge demands.	The National Science Fund and the National innovation Fund attract increasing number of companies though there is a persistent lack of coordination between research and innovation policy.
	Monitoring of demand fulfilment.	There is an increasing abundance of monitoring instruments in the public and the private sector, as well as at EU level, though with varying quality.
Knowledge production	Ensuring quality and excellence of knowledge production.	Tradition in knowledge production and international cooperation in basic and applied research in mathematics, physics, chemistry, engineering sciences, etc. Research capacity is still concentrated in the Bulgarian Academy of Sciences while it is still limited in universities. Research performance is fragmented among various fields and units under the conditions of limited funding. International peer review is used in the National Science Fund evaluations.
	Ensuring exploitability of knowledge.	Low level of commercialisation of R&D results and lower levels of patent applications compared to the New Member States and EU-27 averages.
Knowledge circulation	Facilitating circulation between university, PRO and business sectors.	Existing good contacts between PROs and universities with the industry and services sector based on research contracts. Still knowledge circulation between PROs, universities and the business sector remain limited.
	Profiting from international knowledge.	Universities and PROs have increasingly better access to international knowledge through long-term agreements with European counterparts and the Framework programmes.
	Enhancing absorptive capacity of knowledge users.	Low knowledge absorptive capacity of Bulgarian industry and small number of innovative enterprises coupled with lack of qualified personnel.

The analysis of the recent policy responses in the four domains summarised in the table below shows that research and related policies are consistent with the main strengths and weaknesses identified in the preceding analysis. Most notably the Bulgarian government has continued increasing public expenditure on R&D through project and programme-based instruments. However, the main opportunities for a revival of the Bulgarian R&D system are associated with the country's EU accession and the provided opportunities for access to EU technical and financial resources. The lack of policy and strategy coherence across and within domains, e.g. combining knowledge production and knowledge demand tools and reforming PROs to increase their efficiency, remains the main policy-related threat that will continue to hamper R&D in Bulgaria.

Domain	Main policy opportunities	Main policy-related risks
Resource mobilisation	The Bulgarian prime minister has recently announced a drive towards strengthening the Law on Scientific Research Promotion, updating the draft National Innovation Strategy and integrating it with the National Strategy for Scientific Research for the Period 2005 – 2013, modernising science career promotion through changes in legislation as well as increasing competitive public funding for R&D. Accordingly, the NSF annual budget for 2008 has more than tripled to roughly €32m.	Public policies still fail to provide incentives for the mobilisation of private investments in R&D. There are no public reform plans in place to address the rigidities in the public research sector and the quality of human capital for research.
Knowledge demand	The government has started to move away from institutional towards competitive research funding. Changes in the investment promotion act indicate a desire to move away from capital intensive towards knowledge intensive industries.	No overall evidence based policy towards upgrading the Bulgarian economy towards more knowledge intensive industries. Lack of coherence between policy initiatives. The lack of in-depth foresight and technology demand studies might hamper the translation of increased public spending into more business demand on R&D.
Knowledge production	The Ministry of Education and Science has announced commitment towards developing more research capacity in universities through launching specific calls for university research capacity under the National Science Fund. The fund also supports specific calls in traditionally strong sectors of Bulgarian science, such as chemistry, mathematics, and physics.	Persisting inadequate environment for the encouragement of company R&D, including weak IPR enforcement. Pressure, but no clear plans, on restructuring the Bulgarian Academy of Sciences and the Agricultural Academy, without existing long-term strategy for developing PROs and university research capacity, which might perpetuate fragmentation in knowledge production in the public sector.
Knowledge circulation	Awareness of the governmental institutions of the need for pro-active measures to stimulate knowledge circulation. EU Cohesion and Structural Funds provide substantial financial support for various aspects of knowledge circulation and absorption capacity improvement - developing human capital skills, networking, etc.	Coordination problems of policy measures initiated by different governmental institutions create threats of doubling or diluting resource allocation thus reducing their compound impact. Research has discovered that companies are not well prepared to submit and implement projects for improvement of their innovation capacity under the EU programmes and funds.

Bulgaria faces most of the challenges described in the Green Paper “The European Research Area: New Perspectives”. The country has taken steps to align national programming with EU research priorities, e.g. by opening in 2006/2007 for the first time a facility with the National Science Fund to support the preparation of framework programme projects by Bulgarian researchers, as well as to co-fund Bulgarian participation in FP7 projects. As a result of the ERA initiative a number of research and technology oriented institutions (“soft” infrastructure) were formed in Bulgaria: centres of excellence, the Innovation Relay Centre – Bulgaria, the International Association of Science Parks – Bulgaria, the national network of Euro Info Centres (Innovation Relay Centre (IRC)-Bulgaria and the Euro Info Centres are currently members of the Enterprise Europe Network in Bulgaria). However, the Bulgarian government has so far failed to ensure adequate national support and/or integration of the activities of

these organisations in the national policies of the country. Bulgaria is a member of the SEE-ERA.NET project, which coordinates research policies in South-East Europe between Member States and the countries of the Western Balkans. The impact of the ERA dimension on major research system characteristics such as the low investment in R&D remains unclear. For the period 2000 – 2006 almost no major goal of the first Bulgarian position paper on ERA from 2001 has been realised in practice. Most notably there was no increase in R&D expenditures.

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1 - Introduction and overview of analytical framework

1.1 Scope and methodology of the report in the context of the renewed Lisbon Strategy and the European Research Area

As highlighted by the Lisbon Strategy, knowledge accumulated through investment in R&D, innovation and education is a key driver of long-term growth. Research-related policies aimed at increasing investment in knowledge and strengthening the innovation capacity of the EU economy are at the heart of the Lisbon Strategy. The strategy reflects this in guideline No 7 of the Integrated Guidelines for Growth and Jobs (IGL). This aims to increase and improve investment in research and development (R&D), with a particular focus on the private sector. One task within ERAWATCH is to produce analytical country reports to support the mutual learning process and the monitoring of Member States' efforts.

The main objective is to analyse the performance of national research systems and related policies in a comparable manner. The desired result is an evidence-based and horizontally comparable assessment of strengths and weaknesses and policy-related opportunities and threats. A particular consideration in the analysis is given to elements of Europeanisation in the governance of national research systems in the framework of the European Research Area, re-launched with the ERA Green Paper of the Commission in April 2007.

To ensure comparability across countries, a dual level analytical framework has been developed. On the *first level*, the analysis focuses on key processes relevant to system performance in four policy-relevant domains of the research system:

1. Resource mobilisation: the actors and institutions of the research system have to ensure and justify that adequate public and private financial and human resources are most appropriately mobilised for the operation of the system.
2. Knowledge demand: needs for knowledge have to be identified and governance mechanisms have to determine how these requirements can be met, setting priorities for the use of resources.
3. Knowledge production: the creation and development of scientific and technological knowledge is clearly the fundamental role of a research system.
4. Knowledge circulation: ensuring appropriate flows and distribution of knowledge between actors is vital for its further use in economy and society or as the basis for subsequent advances in knowledge production.

These four domains differ in terms of the scope they offer for governance and policy intervention. Governance issues are therefore treated not as a separate domain but as an integral part of each domain analysis.

Figure 1: Domains and generic challenges of research systems

Resource mobilisation	Knowledge demand	Knowledge production	Knowledge circulation
• Justifying resource provision • Long term research investment • Barriers to private R&D funding • Qualified human resources	• Identification of knowledge demand drivers • Co-ordination of knowledge demands • Monitoring of demand fulfilment	• Quality and excellence of knowledge production • Exploitability of knowledge production	• Knowledge circulation between university, PRO and business sectors • International knowledge access • Absorptive capacity

On the *second* level, the analysis within each domain is guided by a set of generic "challenges" common to all research systems that reflect conceptions of possible bottlenecks, system failures and market failures (see figure 1). The way in which a specific research system responds to these generic challenges is an important guide for government action. The analytical focus on processes instead of structures is conducive to a dynamic perspective, helps to deal with the considerable institutional diversity observed, and eases the transition from analysis to assessment. Actors, institutions and the interplay between them enter the analysis in terms of how they contribute to system performance in the four domains.

Based on this framework, analysis in each domain proceeds in the following five steps. The first step is to analyse the current situation of the research system with regard to the challenges. The second step in the analysis aims at an evidence-based assessment of the strengths and weaknesses with regard to the challenges. The third step is to analyse recent changes in policy and governance in perspective of the results of the strengths and weaknesses part of the analysis. The fourth step focuses on an evidence-based assessment of policy-related risks and opportunities with respect to the analysis under 3) and in the light of Integrated Guideline 7; and finally the fifth step aims at a brief analysis of the role of the ERA dimension.

This report is based on a synthesis of information from the European Commission's ERAWATCH Research Inventory[1] and other important publicly available information sources. In order to enable a proper understanding of the research system, the approach taken is mainly qualitative. Quantitative information and indicators are used, where appropriate, to support the analysis.

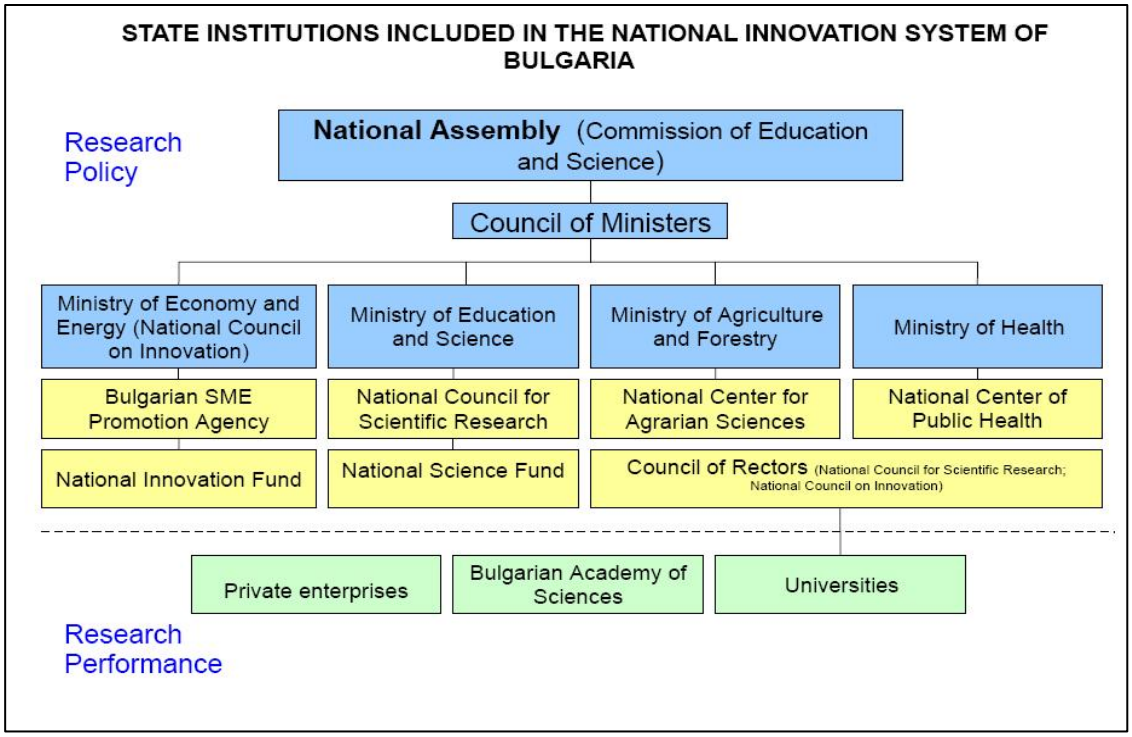
After an introductory overview of the structure of the national research system and its governance, chapter 2 analyses resource mobilisation for R&D. Chapter 3 looks at knowledge demand. Chapter 4 focuses on knowledge production and chapter 5 deals with knowledge circulation. Each of these chapters contains five main subsections in correspondence with the five steps of the analysis. The report concludes in chapter 6 with an overall assessment of strengths and weaknesses of the research system and governance and policy dynamics, opportunities and threats across all four domains in the light of the Lisbon Strategy's goals.

[1] ERAWATCH is a cooperative undertaking between DG Research and DG Joint Research Centre and is implemented by the IPTS. The ERAWATCH Research Inventory is accessible at http://cordis.europa.eu/erawatch/index.cfm?fuseaction=ri.home. Other sources are explicitly referenced.

1.2 Overview of the structure of the national research system and its governance

Bulgaria is one of the smallest EU-27 economies. In 2007 it produced a GDP of €28.9b which equalled 0.24% of the EU-27 GDP[2]. Its GDP per capita in Purchasing Power Standards was 38.2% of EU-27 average[3]. Bulgaria is among the four countries of the Union with lowest R&D intensity, spending 0.48% of GDP on R&D in 2006 - almost 4 times less than the EU-27 average. During the last three years the country has registered a decrease in the total intramural gross expenditure on R&D (GERD) – 0.5% of GDP in 2004, 0.49% of GDP in 2005, and 0.48% of GDP in 2006[4]. However, this relative decrease was counterbalanced by a high rate of real annual GDP growth - 6.6% in 2004, 6.3% in 2005 and 6.2% in 2006. Hence, GERD registered an increase in absolute terms: €99.32m in 2004, €106.42m in 2005 and €121.20m in 2006[5].

Figure 2: State institutions included in the national innovation system of Bulgaria



Source: ERAWATCH Research Inventory, 2008
http://cordis.europa.eu/erawatch/index.cfm?fuseaction=ri.content&topicID=35&countryCode=BG&parentID=34

The Bulgarian research system and governance are nationally centred. The regional dimension of R&D policy is not yet developed. The highest policy-making body in research in Bulgaria is the Commission of Education and Science at the Bulgarian Parliament – the National Assembly. The Council of Ministers endorses the most impor-

[2] Source: Eurostat, Table - main aggregates (annual data), date of extraction: Sun, 13 Apr 08.
[3] Source: Eurostat, Table - general economic background, date of extraction: Sun, 13 Apr 08.
[4] Source: Eurostat, Table - total intramural R&D expenditure (GERD) by sectors of performance, unit – pc_gdp, date of extraction: Sun, 13 Apr 08.
[5] Source: Eurostat, Table - total intramural R&D expenditure (GERD) by sectors of performance, unit – mio_eur, date of extraction: Sun, 13 Apr 08.

tant strategic documents in Bulgaria's research policy. However, the political responsibility for designing and implementing the national R&D policy is with two ministries: the Ministry of Education and Science (MES) and the Ministry of Economy and Energy. Other ministries, which oversee sectoral government research organisations, also participate in research policy setting and implementation in their respective domains – Ministry of Agriculture and Food[6], Ministry of Healthcare, etc.

The main public instrument for funding research of both public and private research performers is the National Science Fund (NSF), which is overseen by the National Council for Scientific Research at MES. The responsibilities of NSF encompass: implementation of the national research policy, and of the European research policy in Bulgaria; provision of international expertise during the evaluation of project proposals, based on which the subsequent funding is allocated; working out specific schemes to support the national research potential (such as support to young researchers, research infrastructure, and preparation of research projects). The budget of NSF for 2008 has quadrupled in comparison to the previous year, and the total amount earmarked for its programmes is approximately €30.68m (BGN60m), which enhances the importance of the NSF for strengthening the national R&D system. The NSF budget for 2008 represents ~25.3% of GERD for 2006 (€121.20m).

The main government instrument for direct financial support for business R&D is the National Innovation Fund (NIF). NIF supports projects, which include applied research and/or experimentation, encourages the joint project implementation by industry and research organisations (research institutes and universities). NIF is administered by the Bulgarian Small and Medium Enterprises Promotion Agency at the Ministry of Economy and Energy. Its budget for 2008 is approximately €10.23m (BGN20m). The financing of the Fund from the budget increased steadily from approximately €2.81m in 2005 (BGN5.5m), the first year of its operation. The Fund requires that businesses provide 50% co-financing to the projects it supports, which has resulted in the funding of projects worth €25.60m (BGN50m) over the period 2005 - 2007.

The Council of Rectors participates in the formulation of the state policy on higher education and scientific research in Bulgarian universities. It protects the higher education institutions' interests and represents them at national and international level. It facilitates the organisation and implementation of joint initiatives with other university and non-university organisations, working to the advantage of academics and students. It also participates in national and international events on issues related to the higher education and scientific research.

The government sector is the main research performer in Bulgaria. In 2006 the Government sector performed R&D worth 0.31% of GDP (or 65% of GERD). The Business enterprise sector accounted for 0.12% of GDP (25% of GERD), while the Higher Education Sector – for 0.05% of GDP (10% of GERD). The share of the Private non-profit sector was statistically insignificant[7]. The main research performers in the country are: the Bulgarian Academy of Sciences, an autonomous budget funded public research organisation with 69 research institutes, laboratories, centres, and specialised units; the Agricultural Academy, a government research organisation part

[6] The name of the ministry was changed from Ministry of Agriculture and Forestry to Ministry of Agriculture and Food in 2008.
[7] Source: Eurostat, Table - total intramural R&D expenditure (GERD) by sectors of performance, unit – pc_gdp, date of extraction: Sun, 13 Apr 08.

of the Ministry of Agriculture and Food, which encompasses 21 research institutes, 13 regional service centres for applied science, as well as 1 national agrobiology park, a Centre for Scientific and Engineering Information and the National Agricultural Museum; higher education institutions - 51 universities, higher education schools and colleges. There are no major private research performers.

2 - Resource mobilisation

The purpose of this chapter is to analyse and assess how challenges related to the provision of inputs for research activities are addressed by the national research system. Its actors have to ensure and justify that adequate financial and human resources are most appropriately mobilised for the operation of the system. A central issue in this domain is the long time horizon required until the effects of the mobilisation become visible. Increasing system performance in this domain is a focal point of the Lisbon Strategy, with the Barcelona EU overall objective of a R&D investment of 3% of GDP and an appropriate public/private split as orientation, but also highlighting the need for a sufficient supply of qualified researchers.

Four different challenges in the domain of resource mobilisation for research which need to be addressed appropriately by the research system can be distinguished:

- Justifying resource provision for research activities;
- Securing long term investment in research;
- Dealing with uncertain returns and other barriers to private R&D investment; and
- Providing qualified human resources.

2.1 Analysis of system characteristics

2.1.1 Justifying resource provision for research activities

The Law on Scientific Research Promotion is the main legal document in Bulgaria that spells out the need, policy goals, instruments and mechanisms for stimulating the supply of resources for R&D in the country. The National Strategy for Scientific Research for the Period 2005 – 2013, which is the main policy implementation instrument envisaged in the Law on Scientific Research Promotion has not yet been adopted[8] by the National Assembly of Bulgaria though its draft has been approved by the Council of Ministers already in 2005. The delay in the adoption of the strategy flags a considerable governance problem for the Bulgarian research system, which might impede resource provision for R&D both in the public and the private sector. Total Government Budget Appropriations and Outlays for R&D (GBAORD) as a share of total general government expenditure in Bulgaria in 2006 was 0.81% compared to 1.58% for EU-27[9].

A central role in justifying the resource provision for research activities is played by the National Council for Scientific Research. The Council approves all major research

[8] As of April 2008.
[9] Source: Eurostat, Table - total GBAORD as a % of total general government expenditure, date of extraction: Sun, 13 Apr 08.

policy documents, as well as the funding priorities of the National Science Fund. The Council is chaired by the Minister of Education and Science, and involves 19 members representing the Ministry of Economy and Energy, the Ministry of Finance, universities, the Council of University Rectors, the Bulgarian Academy of Sciences, the Ministry of Agriculture and Food, the Executive Council of the National Science Fund, the Bulgarian Federation of Scientific and Technical Unions. Its diversified membership structure provides grounds for working out a balanced national consensus on research policy decisions and for alleviating to a certain degree the lack of a national research strategy.

The National Innovation Strategy, adopted by the Council of Ministers in 2004, though not based on a law, fills in some of the vacuum left behind by the lack of a national research strategy and provides justification for the provision of more resources for R&D. The strategy validates the increasing role of research for developing a knowledge-based economy and for addressing specific needs of society as a whole, and spells out the need for increased support to private R&D and development of the research potential of enterprises. It sets a national R&D target – GERD of 1.15% of GDP by 2013. The annual innovation performance assessment report of the Bulgarian economy Innovation.bg 2007, notes that actual total R&D outlays in Bulgaria as of 2007 fall considerably short of the GERD targets set in the strategy (ARC Fund, 2007, p.66).

A number of EU-membership-related documents, such as the National Reform Programme (2007 – 2009), the National Strategic Reference Framework (2007 – 2013) and its seven Operational Programmes[10], contain analysis of the status of research and innovation activities in the country and provide justification for the need for increasing the resources for research and development in both the public and private sectors. The National Reform Programme (2007 – 2009) describes and justifies the policy measures in response to the four priority actions agreed at the 2006 Spring European Council. It focuses on improvement of the overall framework for R&D and innovative activities, development and improvement of the intellectual property protection, providing for increased resources to R&D through the National Science Fund, the National Innovation Fund and the budget of the Ministry of Economy and Energy. The National Strategic Reference Framework (2007 – 2013) provides the vision for Bulgaria's development as a member of the European Union, namely "By 2015 Bulgaria to become a competitive EU country with high quality of life, incomes and social awareness". The Framework envisages that research activities in the years until 2013 be supported under two Operational Programmes, complementing the funding under the National Innovation Fund and the National Science Fund: OP Competitiveness for developing the research infrastructure and business R&D capacity and OP Human Resources for increasing the research potential.

The need for increased resources for research has been justified as well in the Annual Reports on the Bulgarian National Innovation Policy for 2006 and 2007 of the Ministry of Economy and Energy, as well as in the *Innovation.bg* reports for 2005, 2006, 2007 and 2008 of the Applied Research and Communications Fund, a Sofia-based think-tank in innovation policy research and strategic analysis. All reports conclude that the low-technology orientation of the Bulgarian companies and the economy as a whole is still pervasive, and the current (year 2007) low level of funding for

[10] Source: Bulgarian Ministry of Finance, http://www.eufunds.bg.

R&D cannot reverse the negative trends. The impact of the increased funding earmarked for 2008 is to be seen after 2009.

The difficulties in the process of justifying resources for research in Bulgaria stem from the lack of coordination and subordination between priorities, and legal and strategic documents in research and innovation. This translates into a lack of coordination between the Ministry of Education and Science and the Ministry of Economy and Energy in implementing the national research and innovation policies respectively. Coordination is missing as well between the funding arms of the two ministries – NSF and NIF, which impedes the achievement of complementarity in the mobilisation of resources for research, e.g. both funds supported voucher schemes for the transfer of knowledge between enterprises and research organisations. The lack of coordination also creates confusion in the research policy debate, e.g. in the DG Research publication Key Figures 2007 Bulgaria is branded as the only Member State, which does not have a target for research intensity, although the National Innovation Strategy spells out such a target (European Commission, 2007c, p.8).

2.1.2 Securing long term investment in research

The funding for research activities in Bulgaria comes through: direct budgetary aid, indirect budgetary aid, financial support by the Cohesion and Structural Funds, European programmes and private R&D spending.

- **Direct budgetary aid** – (i) institutional funding, supporting the Bulgarian Academy of Sciences and the accredited universities (through direct subsidies to the budgets of the public research organisations), (ii) subsidies to the budgets of the ministries, which have research performing organisations within their structures, e.g. the Agricultural Academy at the Ministry of Agriculture and Food and the National Centre of Public Health Protection at the Ministry of Healthcare, as well as (iii) budget subsidies to the Ministry of Education and Science for developing programme-oriented financing (National Science Fund, which finances multi-annual projects with duration of 2 to 3 years) and to the Ministry of Economy and Energy for developing project-based financing (National Innovation Fund) through grants. Both funds support research projects through competitive calls. NSF programmes are open to all public and private research performers, while NIF, which targets the business sector, supports research institutes and universities only through collaboration in joint research projects with private companies. The financial commitments for the direct budgetary aid are undertaken on an annual basis with the adoption of the Law on the State Budget for the respective year. Since 2008 all Bulgarian ministries present to the National Assembly three-year programme budgets, within the framework of the annual state budget preparation cycle. The programme budgets of the Ministry of Education and Science and the Ministry of Economy and Energy outline the long-term investment framework in research.
- **Indirect budgetary aid** in the form of membership fees for access to participation in international programmes, e.g. the framework programmes for research, technology development and demonstration activities of the EU, the Competitiveness and Innovation Programme, etc.
- **Financial support by the Cohesion and Structural Funds –** there is no national operational programme on research, the development of the Bulgarian research system will be supported by the Cohesion and Structural Funds

through two operational programmes, which will provide project-based financing for developing the research infrastructure (OP Competitiveness) and for strengthening the research potential (OP Development of Human Resources). Both programmes launched their first competitive calls in the second semester of 2007. Their impact on the Bulgarian research system is still to be seen in the forthcoming years.

- **International programmes for research and technology development,** notably the EC-supported programmes, are also accessible for the Bulgarian public and private research performers. According to data provided to CORDIS by the Ministry of Education and Science and the European Commission, the receipts under FP6 programme have reached €31.40m for the 4-year period of the programme, which is comparable to the amounts disbursed by the two national budget funds for the same period. This is indicative of the importance of the framework programmes for the development of the Bulgarian research system.
- **Private R&D spending**, for co-funding of the research projects financed under the National Innovation Fund and the framework programmes for research and technology development, for conducting own research, etc.

The share of direct budgetary aid in the recent years was about 2/3 of the total R&D spending in the country. The country has a reversed structure of R&D spending compared to the EU. According to its R&D intensity, Bulgaria is among "the group of trailers", for which both R&D intensity and its annual average growth rate are below the EU-27 average and the existing gaps can be expected to increase (Eurostat, 2008). Until 2008 the Bulgarian research system has mainly been supported by the national budget through direct subsidies, most of which for institutional funding. Given the highly fragmented institutional environment – more than 160 education and research entities - of the country, any further increase in the volume of public institutional funding will not have a strong impact on the overall research performance before reforming the Bulgarian Academy of Sciences and the higher education institutions, introducing more efficient mechanisms for distribution of the scarce funds for research and improving the legislation.

In 2008 the public and private research performers will have access to an increased pool of resources for research and innovation activities, research infrastructure and for developing the research potential. In addition to the earmarked institutional funding, both the National Innovation Fund and the National Science Fund enjoy much higher budgets than in the previous years, and the support to be provided under OP Competitiveness and OP Human Resources will complement this funding. The indicative amount earmarked under the operational programmes for 2008 for developing education and science is approximately €91.06m (BGN178.1m). The education will receive the highest increase in the funding for 2008. The outcomes of the competitive calls for proposals will provide the grounds for an in-depth analysis of the research activity in the beginning of 2009.

In conclusion, public funding is still the main source for long-term investments in research (publicly funded R&D intensity – publicly funded GERD as percentage of GDP in 2002 was 0.34%, and in the following two years (2003 and 2004) the figure was 0.33%)[11]. The two financial instruments for supporting R&D – the National Science

[11] Source: Eurostat, Table – Publicly funded GERD as % of GDP, date of extraction: Sun, 13 Apr 08.

Fund and the National Innovation Fund – proved to be successful in the recent years, as well as the approach for programme-oriented and project-based financing of research. While the funding schemes of the National Science Fund are more diversified and address both public and private performers, the funding schemes of the National Innovation Fund are still quite limited in number and focused on enterprises only. Both funds do not provide support to intermediary organisations in research and innovation, which in general is a structural deficiency of the national innovation system, and considered to be among the reasons for the low levels of commercialisation of RTD results (especially the lack of transfer mechanisms from research to industry). The major challenges faced by the national research system can be summarised as follows:

- The mobilisation of private R&D funding to complement the public funding can be considered as the most challenging in the medium-to-long run.
- The direct budgetary aid for institutional funding still prevails over the programme-oriented and project-based financial support and there is an urgent need for restructuring the funding model, as well as for reforming the Bulgarian Academy of Sciences and the higher education institutions (the public funding distributed among the HEI is not enough to reverse the negative trends, given the very low levels of payment to the lecturers and the research staff). The launch of national mechanisms for supporting the Bulgarian participation in FP7 (two measures have been launched – to support the proposal development and to co-fund contracted FP7 projects if necessary) is expected to strengthen the national research performance. Similar mechanisms to support the participation of Bulgarian entities in CIP, Life-long Learning Programme, and other EU programmes of relevance will further increase the level of participation and thus will improve the research capacity of the country.
- In the short-to-medium run the development of inter-ministerial coordination mechanism in regard to the coordinated implementation of the measures of OP Competitiveness and OP Human Resources focused on research, will facilitate the research performance of the country, the ministries in focus are the Ministry of Education and Science, the Ministry of Economy and Energy and the Ministry of Labour and Social Policy. Coordination is needed as well in monitoring the performance of the country in the EC-supported programmes (FP7, CIP, etc.) to achieve optimisation of resources.
- At the present moment the lack of a coherent national research and innovation strategy, respectively the lack of research priorities, and the general profile of the national research system do not allow a more focused approach in targeting long-term investments in research and research infrastructure.

2.1.3 Dealing with uncertain returns and other barriers to business R&D investment

ERAWATCH Research Inventory states that the low share of business R&D expenditure is a major issue and challenge for the development of a knowledge-based economy in Bulgaria. According to EUROSTAT data GERD funded by business in 2003 was 0.13% of GDP, and the figure for 2004 was 0.14%[12]. Further, BERD funded by

[12] Source: Eurostat, Table – GERD funded by business as % of GDP.

government is very low as well – the figures for 2003 and 2004 were respectively 0.20% and 0.30%[13] of total BERD.

Based on interviews with the managers of three multinational companies (MNC) present in Bulgaria (ARC Fund, 2008b) one can conclude that their role is important for the overall development of the local economies as the MNCs increase the quality of local human resources through formal and non-formal forms of training, and transferring specific technological knowledge to the local staff. Another major contribution of MNCs is the introduction of high-quality products on the local market. In regard to research, their contribution at the moment is non-existent as the MNCs have their own research centres at their headquarters in Western Europe and have no strategies in place to internationalise their R&D activities in Bulgaria. They are open for collaboration with universities, but this is limited to the selection of graduate students as employees of the companies. The interviewed MNCs are not interested in developing joint research and innovation projects with Bulgarian research organisations and HEI, as the company collaborates strongly with the universities of the country of origin, where the headquarters are based.

According to ERAWATCH Research Inventory there is no data on the type and number of R&D performers in the business sector, but indirect evidence (i.e. hiring ads) shows that these are mostly mid-sized and big international and domestic companies. Sectorally, the most R&D intensive performers seem to be in the information technology (IT) services.

The above is confirmed by the EU Industrial and R&D Investment Scoreboard, where no Bulgarian company is presented.

Risk capital is still new for Bulgaria, and has no considerable contribution in R&D. The ERAWATCH Research Inventory reads that there are currently no risk capital schemes for supporting R&D, Bulgaria has not yet attracted any risk investors and Bulgarian innovative firms have still not shown an interest in this type of financing.

According to a survey carried out under the Innovation Coach[14] project supported under FP6 the gap in regard to the risk capital in Bulgaria is identified to be in the pre-seed, prior the company creation, and in the start up phases of the company. It has been pointed out that SMEs claim difficulties in accessing early stage finance, mainly knowledge based companies which are not always considered appealing by traditional financing operators and in the meantime interviewed financial operators state that there is a lack of investor-ready knowledge based projects (the number of knowledge based companies founded yearly is still small). Until now, a structured and holistic pre-seed policy for supporting the valorisation of research results and a real seed capital are still missing, even if some actions have been already implemented. Filling in this gap will help to improve the attractiveness of early stage segments, encouraging current operators to address their focus at this stage.

The ERAWATCH Research Inventory notes that the only existing R&D tax relief measures in Bulgaria were discontinued in 2007. The Bulgarian government has decided to lower the overall business taxes while discontinuing any forms of tax relief and relying on expenditure instruments to implement R&D and innovation policies.

[13] Source: Eurostat, Table – BERD funded by government.
[14] Innovation Coach: Support action for innovation mainstreaming within the Enlarged Europe, South Central Region of Bulgaria Final Report: Financial Schemes for Knowledge-based Companies. www.innovationcoach.net.

2.1.4 Providing qualified human resources

"Bulgarian entrepreneurs have been warning for several years now that the system of higher education does not provide qualifications that respond to the needs of the companies" (Ministry of Economy and Energy, 2007).

Development of human capital and improvements of education are among the top policy priorities of Bulgaria. Though the country managed to achieve economic stabilisation in the recent years, the number of employed in R&D tends to decrease. In the period 2000-2005 employment in R&D decreased by an average of 2% per annum, resulting in a drop in the overall number by almost 2,000 persons. The decline is not the same for the different sectors. Most worrying are the figures for the technical, medical and agricultural sciences, which are of primary importance for innovation. The number of scientists in the domain of technical sciences decreased by 5% on average per annum in the period 2000 – 2005, for the same period the number of scientists in the agricultural sciences decreased by 15.4%, and in the medical sciences this percentage was 12.6% (National Statistical Institute, 2006). As a percentage of all employed R&D personnel in 2004 was 0.62% in Bulgaria (the corresponding share for EU-27 was 1.44%), of which 0.09% were employed by the business enterprise sector, against 0.63% for the EU-27. The sectoral break-down for 2004 is the following: total employed – 0.62%, business sector – 0.09%, government – 0.38% and higher education sector - 0.15%.

The reasons for these negative trends are quite complex, among them the following are worth to be mentioned: insufficient number of students as well as the large number of young people leaving the country to study in the USA and Europe. Another serious problem is the ageing academic staff. Whether the increased levels of funding for R&D will change this situation is still to be seen.

The educational level indicates the quality of human resources. In terms of share of university graduates as a percentage of the population (in the age group 25-64) in Bulgaria the level of education does not significantly differ from the EU average value (21.7% for Bulgaria against 21.9% for EU-25 in 2004 for instance). At the same time there is the worrying trend of decreasing the quality of higher education in the country, as well as of decreasing the number of people at the HEI. For instance the number of graduates in 2004 was 2% less compared to the year 2000, which is in contrast with the trends in the New Member States. For the same two years, the number of graduates in EU-15 Member States has increased by 22%, and the corresponding increase for the New Member States is 38%. These figures clearly indicate that in the recent years the Bulgarian education is in crisis, both in terms of numbers and quality, and its inability to meet the demand of the national economy for highly educated workforce due to obsolete educational and research infrastructure, low salaries of the lecturing staff, no inflow of young people in the system, and outdated curricula of the HEI not corresponding to the recent trends in technology development (Ministry of Economy and Energy, 2007b).

At the same time we cannot speak about decline in the demand for higher education among the young people. There is a fast growth in the number of Bulgarian students studying and developing PhDs abroad. According to data provided by UNESCO Institute of Statistics, in 2001 the Bulgarian students studying abroad (12,644 students) represented 5% of all students in the country, while in 2004 this share grew to 10% or 22,936 students (for comparison the Romanian students abroad during 2004 were 15,926). These figures clearly spell out that the Bulgarian higher education is losing

its attractiveness and there is a pressing need for reforms in the Bulgarian educational system, as well as in the legislation.

2.2 Assessment of strengths and weaknesses

The strengths of the national research system provide a good basis for the formulation and implementation of coherent research and innovation policy. The introduction of the programme-oriented and project-based funding in research and innovation is expected to increase the competitiveness of the national research performers and improve the responsiveness of the research system to knowledge demands of society and economy. What is still missing is the policy and priority coordination, which could improve the overall level of resource mobilisation. The prevailing institutional funding over the programme-oriented and project-based funding does not favour the quality and excellence of research activities in the country. The institutional fragmentation of the research system is not favourable for allocating resources towards specific priorities.

Main strengths	Main weaknesses
• The main institutions which can ensure the effective operation of the national research system are in place • The need for increased resource mobilisation for research is well justified in policy documents • Well established funding instruments – the National Science Fund and the National Innovation Fund • Long-term research funding secured through the national budget and the operational programmes • Programme-orientedand project-based funding • Good performance in FP6 and growing income from international research projects in public research is growing	• Lack of policy and priority coordination • Low levels of private R&D spending • The model of public financing of research in Bulgaria is not efficient for ensuring exploitability of research results. • Bulgarian higher educational system is in crisis and Bulgarian education is losing attractiveness • Weakening of the national research potential • Institutional fragmentation of the research system – over 160 entities, most of which are financed through direct budgetary aid, which does not allow for efficient distribution of scarce funds for research. • Lack of interministerial coordination in the provision of support to research and innovation • Insufficient level of investment in research and innovation by businesses and poor IPR activities of companies

2.3 Analysis of recent policy changes

Since January 1st 2007, Bulgaria is a full member of the European Union. In the past year the Government elaborated several important strategic documents, formulating the main social and economic priorities of the country for the 2007 – 2013 programming period, as well as outlining the action lines to achieve these priorities. These documents form the strategic framework for undertaking specific measures with a view to reinforcing and stimulating the interaction among the elements of the national research and innovation systems: the National Reform Programme (2007 - 2009), the National Development Plan (2007 - 2013), the National Strategic Reference Framework for 2007 – 2013 and 7 operational programmes laying down the main

priorities and guidelines for the implementation of the Cohesion Policy and for dealing with the Cohesion and Structural Funds.

The Bulgarian education and science will be supported mainly through the OP Competitiveness for building research infrastructure, through OP Human Resources for strengthening the research potential and through OP Regional Development for rehabilitation of the social infrastructure (for the universities – libraries, laboratories, training facilities, etc.).

In the beginning of 2008 the Fourth National Innovation Forum was organised. The Forum was opened by the Prime Minister of Bulgaria. In his keynote speech, the Prime Minister Sergey Stanishev shared that his personal commitment is for research and innovation to be at the top of the Bulgarian government's priorities. Mr. Stanishev further announced two important policy initiatives of the Bulgarian government:

- Updating the National Innovation Strategy of 2004, and
- Revising the Law on Stimulating Research, which was adopted in October 2003. The Law provided for working out a National Research Strategy within 6 months after its adoption, which was not achieved.

The Prime Minister tasked the Forum participants to come up with ideas and recommendations, which can be taken up by the government to improve Bulgaria's research and innovation potential[15].

The legal framework for attracting foreign investment to research and development was worked out in 2007. One of the objectives of the latest amendments to the Investment Promotion Act (IPA)[16] and the Implementing Regulation of the Investment Promotion Act adopted in September is to enhance the competitiveness of the Bulgarian economy through increased investment in the technological development of industries and services with high added value. The Investment Promotion Act envisages the promotion of business operations in computer technologies, R&D activities, education and human health. The law creates opportunities for government support to investments in the development of organisations, businesses, enterprises and other entities performing "high-tech activities in computer technologies, research and development" (Art. 12). The effects of the application of the law are to be seen in the future.

[15] http://cordis.europa.eu/wire/index.cfm?fuseaction=article.Detail&rcn=17201.
[16] Promulgated in the State Gazette No. 42 of 2007, effective as of 30 August 2007

Challenges	Main policy changes
• Justifying resource provision for research activities;	• The resource provision for research activities has been well justified in a number of strategic documents worked out in 2007: the National Reform Programme (2007 - 2009), the National Development Plan (2007 - 2013), the National Strategic Reference Framework for 2007 – 2013 and 7 operational programmes laying down the main priorities and guidelines for the implementation of the Cohesion Policy and for dealing with the Cohesion and Structural Funds. Resource provision is as well justified in the National Innovation Strategy and in the draft of the National Strategy for Scientific Research for 2005 – 2013. The Bulgarian science will be supported through OP Competitiveness for building research infrastructure, OP Regional Development for rehabilitation of social infrastructure.
• Securing long term investment in research	• Introduction of the programme-oriented and project-based funding through the National Science Fund and the National Innovation Fund. • Legal framework for attracting foreign investments to research and development worked out in 2007.
• Providing qualified human resources	• OP Human Resources will provide support for strengthening the research potential

2.4 Assessment of policy opportunities and risks

Though the Government has been increasing public funding for R&D in line with GDP growth in recent years, its positive effects will most probably only be felt in the next three to five years. Most public debates on science in 2007 and 2008, however, have pointed out that such increases in public R&D spending will fail to produce sizable change in Bulgaria's overall poor performance until the public R&D system is reformed and restructured towards more specialisation and commercialisation. Most independent experts have noted that the main opportunities for the future development of the Bulgarian R&D system are associated with the EU Membership of the country, which is expected to bring more and better targeted R&D programmes and instruments and opportunities for more European cooperation. Public policies still fail to provide incentives for the mobilisation of private investments in R&D, which remains one of the lowest in the European Union though recent changes in the Investment Promotion Act create opportunities for government support to investments in the development of organisations, businesses, enterprises and other entities performing "high-tech activities in computer technologies, research and development" (Art. 12). Additionally, at the 2008 National Innovation Forum the Bulgarian Prime-Minister has announced that the Bulgarian government has firm commitment towards increasing the prominence of R&D and innovation in its policy making.

Main policy opportunities	Main policy-related risks
• EU Membership – more opportunities and increased access to funding for knowledge generation and diffusion • Improvements in the legal framework for FDI – the Investment Promotion Act • Commitment to research and innovation at the highest level of governance	• Delay in restructuring the national education and R&D systems • Policy not developed to provide incentives for increased private investments in R&D

2.5 Summary of the role of the ERA dimension

It is yet difficult to assess precisely the impact of the ERA dimension on resource mobilisation in Bulgaria as there is scarce analysis in this direction. The ERAWATCH Research Inventory notes that the development of the ERA dimension has "contributed towards the more focused integration efforts of Bulgarian research in Europe and towards a wider participation by Bulgarian research organisations in the Sixth Framework Programme". The analysis of system characteristics of resource mobilisation in this report show that similarly to other New Member States European funding will play an increasing role in mobilising long-term investments in research. As a result of the ERA initiative a number of research and technology oriented institutions ("soft" infrastructure) were formed in Bulgaria: centres of excellence, the Innovation Relay Centre – Bulgaria, the International Association of Science Parks – Bulgaria, the national network of Euro Info Centres[17]. The Bulgarian government has however so far failed to ensure adequate national support and/or integration of the activities of these organisations in the national policies of the country (ARC Fund, 2008a). Bulgaria is a member of the SEE-ERA.NET project, which coordinates research policies in South-East Europe between Member States and the countries of the Western Balkans.

The ERA dimension has helped develop and streamline the policy consultation process in the country, as the Bulgarian Ministry of Education and Science has launched the first research policy public consultation process on the ERA Green Paper in 2007. More than 250 research institutions, primarily from the Bulgarian Academy of Science and Bulgarian universities took part in the national consultation though no national entity submitted its opinion directly to the European Green Paper consultation process. The national position paper was compiled by the Bulgarian Ministry of Education and Science but was sent to the European Commission after the deadline 31.12.2007.

Actual implementation of the ERA dimension for Bulgaria seems problematic. For the period 2000 – 2006 almost no major goal of the first Bulgarian position paper on ERA from 2001 has been realised in practice. Most notably there was no increase in R&D expenditures, no high-tech parks and centres were introduced, no incentives for non-governmental organisations in support of R&D were implemented, etc[18]. A number of national analyses (e.g. ARC Fund, 2008a) reveal that so far Bulgaria has been a net donor of qualified human resources. According to Eurostat data on student mobility quoted by the report, 21.9 thousand Bulgarian students left in 2005 to study abroad (mostly EU countries), a more than 50% increase compared to 2001, whereas the country attracted only 6400 foreign students, the same number as in 2001. This is an indication of the poor attractiveness of the research system in Bulgaria and of the possibility that the implementation of ERA, without a notable improvement in research conditions in Bulgaria, might exacerbate brain drain.

[17] Gesellschaft zur Foerderung der Forschung, 2007
[18] ERAWATCH Research Inventory.

3 - Knowledge demand

The purpose of this chapter is to analyse and assess how research related knowledge demand contributes to the performance of the national research system. It is concerned with the mechanisms to determine the most appropriate use of and targets for resource inputs.

The setting and implementation of priorities can lead to co-ordination problems. Monitoring processes identifying the extent to which demand requirements are met are necessary but difficult to effectively implement due to the characteristics of knowledge outputs. Main challenges in this domain are therefore:

- Identifying the drivers of knowledge demand;
- Co-ordinating and channelling knowledge demands; and
- Monitoring demand fulfilment

Responses to these challenges are of key importance for the more effective and efficient public expenditure on R&D targeted in IG7 of the Lisbon Strategy.

3.1 Analysis of system characteristics

3.1.1 Identifying the drivers of knowledge demand

According to the analysis of the national economy, presented in OP Competitiveness[19], for 2006 the service sector holds the largest share of 60% in GVA (gross value added), the industrial second comes second with 31.4% and the agricultural sector holds 8.5% respectively.

Since the year 2000 the major changes which have occurred in the structure of the national economy were the decreasing share of agriculture in GVA (13.9% in the year 2000 and 8.5% in 2006, still considerably higher than the EU-25 average of 1.9% of GVA in 2006), the increasing shares of construction (from 5.6% to 6.3%) and trade, transport and communication services (from 20.9% to 24.2% respectively).

Industry registered the most dynamic development in 2005 and 2006. In 2006 the real growth registered by the sector was 8.3%, while in 2005 it stood at 4.7%. Manufacturing registered 11.3% growth in 2006, but still keeps the lowest level of labour productivity among all industrial sectors. Production of foods and beverages (18% of total manufacturing production), metal production and casting (18%), refined oil products (16%), production of machines, equipment and vehicles (14%), textile production (9%) and chemicals (7%) are most prominent in the structure of manufacturing production. **The GVA in manufacturing is concentrated in traditional industries.**

The highest dynamics within the service sector is registered by the retail and wholesale trade, real estates and business services. IT services (software development and data-processing), business processes outsourcing and media services (public relations and advertising) show the highest and most dynamic growth among business services.

[19] Ministry of Economy and Energy (2007a), available at www.eufunds.bg.

In 2004, Bulgaria could not reach the Barcelona objective of 3% of GDP for research - 0.39% of GDP were taken by public expenditures and 0.12% by businesses, the overall expenditures on R&D in 2005 registered a further decrease and stood at 0.5%. These results indicate the low innovative potential of the SME sector, which encompasses over 99% of the companies in Bulgaria. 772 large enterprises were operational in 2005 in Bulgaria, classified as such according to the number of employees – above 250. Only 76 of them have an annual turnover of over €50m, and only 49 have an annual balance sheet value of over €43m.[20] The conclusion is that the Bulgarian large enterprises are less competitive than their counterparts in the other EU Member States as their capacity to invest in the new product development, processes and services and in technological re-engineering and modernisation is limited. Very few of them engage in R&D activities.

The analysis of the *Annual Report on the Bulgarian National Innovation Policy 2007* shows that the country compares better with the EU average values in terms of industrial structure of business spending on research and development. Regardless of certain fluctuations over the past years, the share of R&D expenditures in the medium to high-tech industries amounts to approximately 80% of total industrial spending on research and innovations. This indicator is considered extremely important for the capacity of a given state to invest in leading technologies with a potential for future development.

The latest available EUROSTAT data on intramural business enterprise expenditure on R&D (BERD) by economic activity indicate that during 2004 these were concentrated in a limited number of sectors, namely in **manufacture** of pharmaceuticals, medical chemicals and botanical products; manufacture of fabricated metal products; manufacture of machinery and equipment; manufacture of electrical and optical equipment; manufacture of transport equipment, manufacture of fabricated metal products (except machinery and equipment), manufacture of electrical machinery and apparatus; manufacture of radio, television and communication equipment and apparatus, manufacture of medical, precision and optical instruments, watches and clocks; and in **services** the concentration is in real estate, renting and business activities, computer and related activities, software consultancy and supply, research and development, other business activities, architectural and engineering activities and related technical consultancy; technical testing and analysis.

According to the Country Specialisation Report of June 2006[21], in terms of scientific specialisation, Bulgaria exhibits a strong specialisation profile in terms of natural sciences, but in most other scientific fields except pharmacology and plant and animals it is under-specialised. The report further reads that in terms of technological specialisation Bulgaria is specialised in a number of medium to high R&D intensity sectors such as instruments electronic equipment, office machinery, pharmaceuticals and chemicals.

The National Innovation Fund commenced its activity in 2005 as the major financial instrument for the promotion of innovation activities in the country. Its strategic objective is to enhance the competitiveness of the Bulgarian economy. The Fund finances projects, including research and/or experimental projects aimed at the introduction of new or improved products and services. The overall activities of the National Innova-

[20] Ministry of Economy and Energy (2007a), available at www.eufunds.bg.
[21] ERAWATCH Country Specialisation Report – Bulgaria, June 2006. Available at: http://cordis.europa.eu/erawatch/index.cfm?fuseaction=intService.display&topicID=599#reports.

tion Fund (NIF) are administered by the Bulgarian Small and Medium Enterprises Promotion Agency (BSMEPA). Over the period 2005–2007, four competitive sessions of the Fund were held. A total of **320** projects were approved at those sessions in various economic sectors, both traditional and high-tech ones (Ministry of Economy and Energy, 2007). The average value of the financial support per project remained more or less unchanged (approximately BGN 150,000, which is around €75,000). Since businesses are required to provide 50% co-financing, the total resources provided and generated by the Fund for the development of innovative ideas in industry amounted to approximately €25.56m (BGN 50m). The results of the 4 competitive sessions of the National Innovation Fund held so far reveal that **ICT companies were most active in innovation**. Electrical engineering companies scored a substantial increase at the latest selection procedure. Companies in machine building and metal processing, energy, biotechnologies and food industries displayed relatively stable activity. Considerable decline was noted in tools and devices manufacturing and in pharmaceuticals. Innovation activities were quite weak in the furniture, fur and textile industries, the production of paper, and building technologies.

A new feature of the 4th NIF session was the identification of **priority areas** for the promotion of innovation: nano-technologies; biotechnologies; nuclear energy; energy saving technologies; eco-innovations; and start-ups established within the last three years. Thirty percent 30% of the approved projects were in those priority areas.

Most of the projects (26.5%) were in the field of ICT, followed by electronics and electrical engineering (15.7%), biotechnologies and the food industry (13.7%), machine-building and metal processing (10.7%) and others.

Bulgaria still has not yet introduced a systemic approach to identify the drivers of knowledge demand in general. No foresight programme on a national level has been conducted so far, only some sectoral foresight exercises of a limited scope have been implemented in the country, and most of these have been coordinated by non-governmental organisations or research institutes. Further, the focus of these foresight exercises was not on research priorities definition. The Ministry of Education and Science could not bring these efforts further to scope and launch a fully-fledged national foresight programme on research priorities definition as a basis for long-term national research strategy and reforms in the education and research systems.

The issue of identifying the drivers of business and research knowledge demand has been partially addressed during the implementation of the regional innovation strategies projects, which have been taken up by all 6 Bulgarian planning regions. The RIS projects encompass the study and analysis of the regional demand for knowledge and innovation as part of their methodologies. The implementation of the RIS projects builds upon intensive interactions with the research organisations, universities and companies in the regions, so the RIS could be considered as a good mechanism to consult the regional stakeholders. Though Bulgaria enjoyed a strong bottom-up activity in RIS in all regions, the Ministry of Economy and Energy and the Ministry of Education and Science failed to bring these projects under a common umbrella at the national level, thus each region followed its own methodological approach in studying and analysing the business and research demand for knowledge, which did not allow to use the outcomes of these studies for national research and innovation policy formulation and priority setting in a coherent way.

The ERAWATCH research inventory stresses that there are a great variety of research priorities, mentioned by different strategic documents in Bulgaria, e.g. National Strategy for Scientific Research for the Period 2005-2013, National Innovation Strategy, National Reform Programme 2007–2009, National Strategic Reference Framework, etc. These programmes are not coherent or subordinated to one another so it is difficult to make an overall assessment of the thematic thrust of the research policy in Bulgaria."

There is no clear thematic focus in the funding provided by the two national funding instruments for research and innovation, namely the National Science Fund and the National Innovation Fund. Both funds define their priorities on an annual basis, or invite project proposals in any scientific area. Given the above the national research policy is considered rather generic than thematic.

Currently, the draft of the National Strategy for Scientific Research is under reconsideration. The position of the Bulgarian government is that research efforts have to be focused on a smaller number of well-defined thematic priorities. The researchers of the Bulgarian Academy of Sciences do not support this vision, rejecting the thematic-focused financial support and supporting the generic research funding in a written statement to the Minister of Education and Science.

ERAWATCH further reads that "the difficulty in clearly spelling out the focus of the Bulgarian research policy comes from the disparity between policy documents and available financing instruments. While policy documents outline visions and intentions and contain specific thematic areas of intervention, the available financing is scarce and cannot cover all proposed actions in the policy documents. Scarce public funding in Bulgaria is predominantly channelled through direct institutional grants towards public research institutions, which are distributed to such a great number of research institutes that in practice no thematic focus is possible".

3.1.2 Co-ordinating and channelling knowledge demands

The *Annual Report on the Bulgarian National Innovation Policy 2006* clearly spells out the problems related to the coordination and channelling of knowledge demands, i.e. to say - the coordination between the national research and innovation policies. The report reads that "The Innovation Strategy and the draft of the National Research Strategy have been prepared respectively by the Ministry of Economy and Energy and by the Ministry of Education and Science **at different periods of time and without the needed synchronisation.** This approach, however, contradicts the EC recommendations for developing a comprehensive strategy for scientific and technological development of the country. There is a growing need for integration of both documents in order to improve the coordination and efficiency in implementing their priorities."

Two national councils provide advice upon formulating the national research and innovation policies: the **National Council on Scientific Research**, established under the Law on Scientific Research Promotion, chaired by the Minister of Education and Science, and the **National Innovation Council,** which is a consultative body to the Minister of the Economy and Energy. The National Innovation Council is chaired by the Minister of the Economy and Energy, and the members are representatives of the Ministry of Education and Science, the Ministry of Finance, the Council of University Rectors, the Managing Council of the Bulgarian Academy of Sciences, the Executive Board of the National Innovation Fund, Non Governmental Organisations (NGO), the

Employers Association of Bulgaria, the Bulgarian Industrial Association, and the Bulgarian Industrial Capital Association. Though the membership of both councils builds on a broad representation of the major stakeholder groups in research and innovation and thus provides the grounds for good coordination in setting up research and innovation-related priorities, such coordination has not been achieved so far.

The activities planned for 2008 under the OP Competitiveness, which foresee a grant scheme *Improving the R&D infrastructure of research organisations,* can be considered a positive step towards partially addressing this deficiency. Under the scheme, the applicants will be supported to purchase R&D equipment and to provide innovation services to enterprises. The scheme will be jointly implemented by the Ministry of Education and Science and the Ministry of Economy and Energy, where the National Science Fund will cover the cost of research. Another grant scheme foreseen to be launched during 2008 will provide support for increasing the employment of researchers in enterprises, through which SMEs will hire researchers to implement R&D projects for the enterprise.

3.1.3 Monitoring demand fulfilment

All six Bulgarian regions were involved in regional innovation strategy projects, the pilot one was implemented in the South Central Planning Region of Bulgaria in the period 2001-2004 and the next generation of RIS commenced in June 2005, coming to an end in April 2008. All regions have planned to establish a system to monitor the regional innovation processes. Again, all regions follow their own methodology, and the lack of coordination and common methodology will not allow the collection of data and drawing conclusions on the national level.

In 2006 Bulgaria was included in the regular cycle of the Community Innovation Survey – CIS4, the data encompassed by the survey covered the period 2002 – 2004.

Several surveys which monitor the demand fulfilment have been conducted under public procurement contracts, for instance the survey of Vitosha Research sociological agency on the potential of SMEs in Bulgaria to work with the Structural Funds programmes, carried out in 2006. The survey concluded that during the first 3 years of the EU membership the firms will rely mainly on their own funds and bank loans as sources of financing of their research and innovation projects. Those who intend to apply with projects for financial support under the operational programmes will mainly look for support for technological upgrade of their production facilities, meeting the standards and requirements of the European Union, introducing energy-saving technologies and innovation projects. Even so, the share of those who plan to apply for financing under OP “Competitiveness” remains below 20% of all 1011 surveyed SMEs.

The work of the National Science Fund is regularly evaluated by an international team of experts. During 2007, the Fund restructured its activity following the recommendations of the technical evaluation, placing the focus on:

- Financial instruments;
- Thematic programmes and their impact on development of Bulgarian science;
- Integration among the different research units;
- Quality controls and mid-term evaluation of the ongoing projects;
- Administration and adequate logistics of the Fund.

As a rule, international experts participate in the evaluation of the concrete project proposals during each competitive session.

In 2007, follow-up monitoring was conducted for all completed phases of the projects financed under the first three selection sessions of the National Innovation Fund. The Annual Report on the Bulgarian National Innovation Policy 2007 recommends to the NIF to prepare annual reports of its activity with analysis of the achieved results, impact assessment, as well as analysis of the problems in project implementation and reporting. The report further recommends coordination between the NSF and NIF, where NIF should promote the development of the results achieved in the projects financed by the NSF.

Apart from the European Trend Chart on Innovation and ERAWATCH initiatives, there is no system in place to monitor the processes within the national research and innovation systems.

3.2 Assessment of strengths and weaknesses

The Annual Report on the Bulgarian National Innovation Policy 2007 concludes that "the main challenges are rooted in the lack of effective mechanisms for priority setting, improved organisation and motivating the units of the national innovation system to get actively involved in the process of creation and dissemination of new knowledge and technologies" (Ministry of Economy and Energy, 2007).

There are two project-based schemes operating at the national level – the National Innovation Fund and the National Science Fund, which support private sector R&D demand. While both funds enjoy increasing number of applications and demand for their services rises, they still control a very limited amount of public resources to match private demand on R&D. Though their combined budget for 2008 came at roughly € 40m, only a fourth of these resources are committed to matching private sector R&D demand. There is a need that the established administrative capacity and know-how for managing project-based programmes of the two funds be better complemented by a system for studying an addressing knowledge demand signals, which will make their interventions much more desirable and focused in the future. The country is still missing a coherent approach for identifying national research and innovation priorities and for studying the knowledge demand signals such as regular R&D and innovation analyses at national, sectoral, and regional as well as foresight studies.

Main strengths	Main weaknesses
Good institutional framework.	No system in place to adequately study and address the knowledge demand signals.
NIF and NSF operate successfully - the number of companies applying under the NSF and NIF is increasing.	Lack of national research and innovation priorities and missing coordination between the research and innovation policy.
The principle of project-based funding is strengthening its position.	

3.3 Analysis of recent policy changes

In 2007 the government worked out several strategic documents which formulate Bulgaria's social and economic priorities. They account for the central role of re-

search and innovation in the EU financial instruments for the period 2007 – 2013: the National Reform Programme, the National Strategic Reference Framework and 7 operational programmes. Research activities and renewal and upgrade of research infrastructure will be stimulated through the OP Human Potential and the OP Competitiveness on a competitive basis.

Another major policy development is the legal framework for attracting foreign investment to research and development, which was worked out in 2007. One of the objectives of the latest amendments to the Investment Promotion Act (IPA)[22] and the Implementing Regulation of IPA adopted in September is to enhance the competitiveness of the Bulgarian economy through increased investment in the technological development of industries and services with high added value.

The Annual Report on the Bulgarian National Innovation Policy 2007 concludes that despite some significant improvements in the legal framework, Bulgaria's low-technology orientation is preserved with respect both to individual companies and to the economy as a whole. The extremely limited funding available is insufficient to reverse the unfavourable trends and improve the country's comparative position.

Challenges	Main policy changes
Identification of knowledge demand drivers	Introducing thematic priorities in the competitive calls of the National Science Fund and the National Innovation Fund
Coordination of knowledge demand	National Council on Scientific Research National Innovation Council
Monitoring of demand fulfilment	Bulgaria was included in the regular cycle of CIS4 Monitoring of the NSF projects Monitoring of the NIF projects

3.4 Assessment of policy opportunities and risks

Knowledge demand challenges:

- Legislation related to scientific research and innovation needs to be reviewed and updated, namely the Law on Higher Education, the Investment Promotion Act, the Law on SMEs, the Law on Public Education and the Law on Vocational Education and Training, as well as the legal basis to encourage the mobility of researchers from the public research institutes to the private companies should be developed.
- Public-private partnership mechanisms need to be supported and developed.
- Clear priorities for research, technology development and innovation should be established on the grounds of a national fully-fledged foresight programme.
- Integrated research and innovation policy should be formulated and applied.
- Investments in R&D by the business should be increased.
- The 2007 developments[23] in the EU research and innovation policies should be addressed by the national RDI policies. Because of the slow-running and ineffec-

[22] Promulgated in the State Gazette No. 42 of 2007, effective as of 30 August 2007.

[23] The latest changes of 2007 and the new prospects of European innovation policy are reflected in a number of EC documents related to the revised Lisbon Strategy for Growth and Jobs, and the construction of the European Research Area. The concerted efforts of the member states will largely be aimed at: (i) **Increasing the financial support** for research and innovation, incl. by stimulating the

tive reforms since 1989, the country started its EU membership from a very low point and currently faces the challenge of catching up within an extremely short timeframe.

Risks:

The main problem areas result from the lack of effective mechanisms for priority setting, for improved organisation and for encouraging a more active involvement of all components of the national innovation system in the process of creating and disseminating new knowledge and technologies.

Main policy opportunities	Main policy-related risks
• In order to address the latest changes of 2007 and the new perspectives of the EU research and innovation policy a number of legislative acts related to stimulating the processes of generation, dissemination and application of new knowledge and technologies need modernisation.	• The low-technology orientation of economy as a whole is preserved, the extremely limited and unfocused funding is insufficient to reverse the negative trends. • Lack of effective mechanisms for priority setting. • No integration between the research and innovation policy at the national level.

3.5 Summary of the role of the ERA dimension

There is no national assessment of the contribution of the ERA dimension to the identification, co-ordination and monitoring of knowledge demand in Bulgaria. However, there are a number of European studies that show that the ERA dimension is important in this relation. As noted in the final report of the European Commission on Examining the Design of National Research Programmes European Commission (2005), "the bottom-up ERA-NET Coordination Actions have significantly increased networking activity across all types of programme but there is still a lack of high-level, strategic action to increase the alignment and coordination of national programmes". The Southeast European ERA-NET has been showcased as one of the successful transnational initiatives for coordinating science and technology policies CREST (2007). Bulgaria has also taken steps to align national programming with EU research priorities, e.g. by opening in 2006/2007 for the first time a facility with the National Science Fund to support the preparation of Framework Programme projects by Bulgarian researchers.

Community monitoring initiatives such as the ERAWATCH Research Inventory and PRO-INNO Europe have increased considerably the available analysis on the Bulgarian research system, which is expected to contribute to a better knowledge demand assessment in the future.

risk investment market; (ii) **Encouraging the patent application activity** of universities and industry and more effective use of the potential of the patent system, and (iii) **Enhancing innovation system integrity** at all levels – regional, national, and European, incl. by increasing the capacity of the components to conduct innovation activity.

4 - Knowledge production

The purpose of this chapter is to analyse and assess how the research system fulfils its fundamental role to create and develop excellent and useful scientific and technological knowledge. A response to knowledge demand has to balance two main generic challenges:

- On the one hand, ensuring knowledge quality and excellence is the basis for scientific and technological advance. It requires considerable prior knowledge accumulation and specialisation as well as openness to new scientific opportunities which often emerge at the frontiers of scientific disciplines. Quality assurance processes are here mainly the task of scientific actors due to the expertise required, but subject to corresponding institutional rigidities.
- On the other hand there is a high interest in producing new knowledge which is useful for economic and other problem solving purposes. Spillovers which are non-appropriable for economic knowledge producers as well as the lack of possibilities and incentives for scientific actors to link to societal demands lead to a corresponding exploitability challenge.

Both challenges are addressed in the research-related Integrated Guideline and in the ERA green paper.

4.1 Analysis of system characteristics

4.1.1 Improving quality and excellence of knowledge production

The Bulgarian research system encompasses the Bulgarian Academy of Sciences (BAS), the Agricultural Academy (AA), the universities and a limited number of government research institutes and R&D in private companies. The research is concentrated mainly in BAS and AA institutes. The universities have been primarily educational institutions in the past and recently increased their share in the knowledge creation.

The quality of knowledge production is ensured by a set of activities.

- The mechanism for research funding by the National Science Fund and the Innovation Fund. Though the share of the competitive funding provided by NSF and NIF remains low it allows funds to be allocated to the best proposals. NSF projects are evaluated by international experts because the research community in Bulgaria knows each other quite well. Thus the evaluation is objective and the quality of project proposals is assured. Since 2007 30% of the grants can be used for additional remuneration of the researchers in project proposals where young researchers participate. It is expected that in 2008 the new call for project proposals funded by NSF will increase the share to 50% when the participants are young researchers. Thus more young scientists are likely to be involved in the competitive funding.
- In the universities the competitive funding is also growing. The universities receive their funding in a way that is very close to the institutional one. According to the article 91 of the Law on Higher Education their subsidy is a fixed percentage

of the subsidy for education. However, within the universities research subsidy is allocated to projects that compete for funding. The universities define the priorities for funding, the evaluation criteria and the concrete procedure for application, contract signing and reporting. University researchers can also submit project proposals to compete for funding from NSF.

- In the recent years many Bulgarian universities have introduced quality assurance systems that start to encompass the educational as well as the research activities.
- Peer reviews have been implemented during the institutional and programme accreditation of the universities. Quality of research is a main criterion for their institutional and programme accreditation. Researchers from BAS, AA and the universities have participated in the peer reviewing. Peer reviewing identified common problems in the university research and strengthening the university research capacity is a common recommendation in the accreditation reports. Within the university peer reviewing is part of the quality assurance process but it is still applied mainly for education quality.

The efforts to support the accumulation of knowledge are crucial when the country has limited R&D resources. BAS is the leading research organisation in the country. It creates more than half of the scientific output and has the largest number of research contracts both from Bulgarian organisations and in the Framework Programmes. The university research system is underdeveloped. Most of it is concentrated in few big universities. In order to support accumulation of knowledge the NSF encourages project proposals with consortium from different universities and the institutes of BAS and/or AA. BAS has signed contracts with 15 universities for the provision of educational services and joint research. For some of those universities 30% of the scientific publications are with co-authors of BAS scientists. At university level the competitive funding encourages interdepartmental research.

Bulgaria has 11 centres of excellence. Eight of them are in BAS. These centres of excellence were formed with financing from EU framework programmes grants under FP-5 and FP-6.

The publications of the Bulgarian researchers are growing for the period 2004-2006. However, the scientific output per capita is lagging behind the new EU member countries (ARC Fund, 2008a). More than half of the publications in the international database SCI, SSCI and AHCI are made by scientists from BAS which supports the conclusion that it is the leading research centre in the country. The structure of the scientific output is dependent on the research traditions in the country. The largest number of the publications in the country is in the field of chemistry and physics. According to Essential Science Indicators in eight science fields Bulgaria ranges from 35th to 49th place among 145 countries (ARC Fund, 2008a). The publications and the citations are in traditionally well developed areas of scientific research in Bulgaria. Brain drain influences negatively the publication by Bulgarian scientists since they publish on behalf of the foreign universities and research organisations that have invited them. The social sciences are ranking low. The reason is not just the quality of research papers but the lack of tradition to publish in international renowned journals.

Co-authorship is an important factor in scientific publication. The Bulgarian researchers publish in co-authorship with scientists from 76 countries. Most of the publications for the period 2004-2006 are with scientists from leading scientific schools from Germany and the US. For 2006 the publications with scientists from Germany are 16.8%

of all the publications in the country and with the scientists from the US – 11.7%. Scientific co-operation with the new EU members countries continues to grow. The traditional scientific relations have been renewed and expanded. The co-authored publications are increasing. The largest number is a result from cooperation with scientists from Poland. In 2004 the number is 65 publications and in 2006 it increases to 102. Russian scientists are traditional partners to the Bulgarian scientists and the share of co-authored publications remains stable at about 5.5 percent for the period 2004-2006 (ARC Fund, 2008a).

Ensuring openness to new scientific opportunities. The opportunity to explore new scientific areas is provided both by the priorities for funding by NSF, research priorities defined for competitive funding at the universities and the international cooperation. Limited R&D resources as well as the current industrial needs require orientation of national funding mainly towards applied research, which limits the "blue sky basic research". This should be pointed as an important policy challenge

4.1.2 Improving exploitability of knowledge production

Bulgarian IPR legislation is harmonized with the EU legislation since 1993. The Bulgarian Patent Office was established long ago and is functioning well. It publishes annual analysis of the IPR activity in the country.

The patent activity of the Bulgarian innovators is lower than the new member states with the exception of Romania (ARC Fund, 2008a). A positive trend is the growing number of patent applications filed at the US patent office (USPTO) - from 11 applications in the period of 1995-2003 to 72 in the period of 2004-2006. The holders of the patents are mainly individuals while in other new member states are mostly the national branches of the multinational corporations.

The patent applications in the country remain at a level of about 200 per year in the period 2001-2006. The reasons for the current low level of patent activities of the Bulgarian scientific institutions and the enterprises are the lack of R&D at company level, low demand for patented research results by the companies and the barriers to patenting.

The breakdown of patent applications to the EPO in 2003 shows that in IPS sections the largest number of the Bulgarian applications are in physics, electricity and human necessities. Patent applications have been filed also in mechanical engineering, heating, lighting, weapons and blasting. Though direct comparison is not possible the country science specialization in the field of physics and chemistry is accompanied by patenting in these sections for the year 2003. However, the analysis of patent applications for a longer period of time 1995-2003 identify the highest activity in section A Human necessities and section F Mechanical engineering which do not allow to make conclusions about the direct result of patenting from scientific research.

The definition of clear national scientific priorities is likely to contribute to the concentration of more funds and human resources to specific research areas and to research results that can be protected by patents. The encouragement of interdisciplinary as well as consortiums with partners from different Bulgarian and international research units will contribute to reach the critical mass of human resources needed for the production of high quality research.

4.2 Assessment of strengths and weaknesses

Main strengths	Main weaknesses
• Traditions in knowledge production and international cooperation in basic and applied research in mathematics, physics, chemistry, engineering sciences, biology, etc. • Experience of BAS to publish internationally and thus to receive an objective quality assessment of scientific results • The use of international expertise in competitive national funding	• University research is still limited • The research efforts are fragmented among various institutions under the conditions of limited funding • Low level of commercialisation of R&D results • Lower level of patent application compared to the new member states and 27 EU.

4.3 Analysis of recent policy changes

There are political responses to the main challenges of the knowledge production in Bulgaria. The political actions cover all the components of knowledge production – review of the national scientific infrastructure, encouragement of young researchers, increasing research funding through operational programmes.

In 2007 the Ministry of Education and Science launched an initiative for the elaboration of a national roadmap of research infrastructures. The aims are to identify the strategic research infrastructure in the country, to develop programmes for their upgrading and operating, to provide adequate management and financing as well as to provide an open access and internationalization of the national research infrastructure both at regional level and at EU level (National Astronomical Observatory "Rozhen", Institute of Oceanology in Varna, Molecular Medicine Centre, etc.). The Ministry prepares an electronic catalogue of the projects financed by NSF that have upgraded the research infrastructure in order to be used by other research organisations. The research infrastructure programme in 2006 supported projects in the field of medicine and cultural heritage. In 2007 the Ministry of Education and Science held two competitive sessions for establishment and development of research infrastructure, which will ensure high-quality and competitive research and training activities. The competition is open to consortia of at least three research organisations from BAS, AA, universities and others. Applicants are expected to provide co-financing in the amount of 25% of the actual value of the research equipment, to guarantee the joint implementation of the work programme and to submit a plan for the joint use of the equipment. The submitted projects are in natural sciences, renewable energy sources and evaluation and stock-taking of biological resources of national importance.

Policy measures to encourage young researchers in knowledge production have been implemented in 2007. The Ministry of Education and Science had a competitive session for young Bulgarian researchers aiming at the improvement of the age profile of researchers and the promotion of a new generation of researchers. The measures consist of:

a) Scholarships for post-doctoral fellowship at foreign research organisations and mandatory work at a Bulgarian research organisation. The measure helps R&D activities of young researchers in the country and encourages joint research at modern European research centres. Eligible for participation are young researchers below the age of 35 who have acquired their doctoral degree in the last five years.

b) Support for the development of the research potential and state-owned higher schools. The objective is to promote the rejuvenation of the research potential by attracting young people participating jointly with professors in research activities and developing their original ideas in a dissertation. The projects cover all research areas. The participants are young researchers below the age of 35 who are not enrolled in a full-time doctoral programme and are not full-time employees of the higher school.

Another policy measure aiming at building a critical mass of researchers is the competition for state-owned universities funded by two- to three-year projects of the National Science Fund. It fosters the inter-institutional integration with other higher schools and universities, research organisations, small and medium-sized enterprises, university hospitals and national centres. The effective international research cooperation and the participation of university researchers and units in the European Higher Education Area are promoted. The link between research and industry is reinforced through joint research projects (JRP) with businesses, small and medium-sized enterprises. The specific research areas are health and medicine, energy efficiency and energy security, nano-sciences, information and communication technologies and cultural and historical heritage.

NSF experts give preference to projects with consortium partners from different research organisations in the country. Thus the accumulation of the fragmented and limited R&D resources is encouraged. The very outdated Law on Scientific Degrees is undergoing changes. The aim of the debate is to alleviate the obstacles for scientific careersdevelopment of young researchers and to make research more attractive to young people while assuring high quality of scientific research.

Some of the policy measures discussed in part 5 (title) have an important impact on knowledge creation. The policy measure of NIF “Optimisation of the research – technologies – innovation system” has been discussed by the National Innovation Council in 2007. Experts debate the following financial schemes for knowledge creation at the enterprise level in Bulgaria:

- *Voucher scheme* intended to assist enterprises in their efforts to obtain expert assistance in resolving their technological problems.
- *Techno-starter scheme* aimed at students, faculty and researchers willing to establish their own technology-based company. The objective is to commercialize the knowledge acquired in research and education.
- *”TOP” technological institutes* with the objective to establish and develop centres of knowledge and excellence in important industrial sectors and to facilitate the interaction between research organisations, researchers and businesses.

In 2007, the implementation of the projects for regional innovation strategies continued with the support of DG Enterprise and Industry of the European Commission. RIS projects contribute to the promotion of the dialogue between local authorities, education, research and business at the regional level. Regional consensus among all stakeholders and partners is needed when priorities are identified in the field of research and innovation. (Ministry of Economy and Energy, 2008).

Low foreign direct investment in R&D is a common characteristic for the new member countries with few exceptions. In order to attract foreign investment in R&D in Bulgaria a legal framework was developed in 2007. The latest amendments to the In-

vestment Promotion Act (IPA) aim to improve the competitiveness of the Bulgarian economy through increased investment in R&D and technological development of industries and services with high added value. The Investment Promotion Act envisages the promotion of business operations in computer technologies, R&D activities, education and human health. The law creates opportunities for government support to investments in the development of organisations, businesses, enterprises and other entities performing "high-tech activities in computer technologies, research and development" (Art. 12, para 2).

Challenges	Main policy changes
Quality and excellence of knowledge production.	• Since 2007 30% of the grants of the NSF can be used for additional remuneration of researchers in project proposals with participation of young researchers. • Quality of research is a main criterion for the institutional and programme accreditation of universities. • Expert debate on financial schemes for knowledge creation at enterprises: voucher scheme, techno-starters, TOP technological institutes.
Exploitability of knowledge production.	• Amendments to the Investment Promotion Act – increased investments in R&D and technological development. • OP Competitiveness. • Thematic priorities in the last competitive session of the National Innovation Fund.

4.4 Assessment of policy opportunities and risks

The new policy initiatives respond fully to the identified system weaknesses and strengths. Policy initiatives are generated both by the governmental institutions and the Bulgarian NGOs that have traditions in the implementation of new science and innovation policy tools in the country in the last 15 years. The Lisbon benchmarks have an important role in goal setting. For knowledge production in Bulgaria the study and transfer of best practices from the new member countries is also a valuable benchmark since they faced similar challenges in R&D reforms.

Main policy opportunities	Main policy-related risks
• Prioritizing scientific research in Bulgaria. • Support to the accumulation of the national R&D for the purpose of knowledge production. • Strengthening of the competitive funding. • Overall support to the development of the research infrastructure in the country. • Attracting young people to R&D.	• Lack of consensus on the national research priorities. • Lack of coordination of research and innovation policy. • Deficiency of adequate stimuli for the encouragement of company involvement in R&D. • Limited funding for attracting young people to knowledge creation. • Pressure on BAS restructuring without developed university capacity for R&D.

4.5 Summary of the role of the ERA dimension

The report of an international review panel led by Juliane Besters-Dilger, Vienna University, on the activities of the National Science Fund concludes that "there are relatively many research institutions in Bulgaria which all need money for carrying out

research, there is a tendency to spread the few means of the NSF between as many institutions as possible." The review recommends that a concentration of the funding around national centres of excellence should be sought. Funding for the establishment of Bulgarian centres of excellence under FP 5 and FP 6 has initiated and strengthened such concentration of resources, allowing outstanding research institutes in Bulgaria to position themselves on the international research map. Although, NSF has additionally supported the centres of excellence funded by the framework programmes, the limited resources of the Bulgarian government for R&D mean that European level backing will continue to play an important role in providing research excellence in Bulgaria.

5 - Knowledge circulation

The purpose of this chapter is to analyse and assess how the research system ensures appropriate flows and sharing of the knowledge produced. This is vital for its further use in economy and society or as the basis for subsequent advances in knowledge production. Knowledge circulation is expected to happen naturally to some extent, due to the mobility of knowledge holders, e.g. university graduates who continue working in industry, and the comparatively low cost of the reproduction of knowledge once it is codified. However, there remain three challenges related to specific barriers to this circulation which need to be addressed by the research system in this domain:

- Facilitating knowledge circulation between university, PRO and business sectors to overcome institutional barriers;
- Profiting from access to international knowledge by reducing barriers and increasing openness; and
- Enhancing absorptive capacity of knowledge users to mediate limited firm expertise and learning capabilities.

Effective knowledge sharing is one of the main axes of the ERA Green Paper and significant elements of IGL 7 relate to knowledge circulation. To be effectively addressed, these require a good knowledge of the system responses to these challenges.

5.1 Analysis of system characteristics

5.1.1 Facilitating knowledge circulation between university, PRO and business sectors

Knowledge circulation between universities, PRO and business sector is a major challenge for the Bulgarian innovation system. At present knowledge circulation between universities and the institutes of BAS is put into practice mainly in the educational process. BAS is educating doctoral students. It has established a Centre for Education and towards the end of 2006 BAS has 701 doctoral students. BAS researchers participate in the university education and many of the university professors teach and make research in more than one university.

Knowledge circulation with industry is based on research contracts initiated both by university researchers and industry needs. It is supported by the existing centres for

innovation at BAS, joint BAS and Technical University Centre, the Innovation Centre at the University of Chemical Technology and Metallurgy. Since 1997 in Bulgaria operates IRC which contributes to the international knowledge transfer. However, the technology transfer support of the specialized units at the universities and BAS is still very limited. Therefore special policy measures have been undertaken in the period 2006-2007.

Knowledge circulation is facilitated by competitive funding of NSF and NIF projects that aims at strengthening both university – PRO and research-industry links.

5.1.2 Profiting from access to international knowledge

Access to international knowledge is provided by the involvement of the Bulgarian researchers and institutions in European and Non-European international organisations and programs and by bilateral cooperation.

Bulgarian research organisations have already good traditions in participation and management of FP projects. They were very successful in FP6. During the first year of FP7 operation 60 projects with Bulgarian RTOs were approved for financing.

The participation in FP7 has been supported by the Ministry of Education and Science which held a competition for the preparation of research projects to participate in the 7th Framework Programme. Eighteen projects were supported.

Bilateral cooperation with Non-EU member countries is developed both at national and institutional level. At institutional level BAS is the institution with the largest number of international agreements and projects. In 2006 BAS has 511 international projects and 753 international publications. For the same year the number of long-term travels abroad with the aim of joint research is 371. BAS cooperates bilaterally with the Academy of Sciences from EU member countries, NSF (USA), Israeli Academy of Sciences, the Chinese Academy of Sciences, etc.

The Agricultural Academy also has a good access to international knowledge. In 2007 it developed 103 projects under agreements for bilateral and multilateral cooperation. The universities access to international knowledge is ensured both through participation in the EU Framework programmes and bilateral agreements for cooperation.

5.1.3 Absorptive capacity of knowledge users

Knowledge users in Bulgaria still have a limited absorptive capacity of research results. According to CIS4 data, the share of enterprises in Bulgaria introducing innovations without engaging in any research and development activity of their own is 91% against a European average of 46%. (Ministry of Economy and Energy, 2008). The conclusion is that most of the enterprises rely on external R&D in case it is needed for the introduction of new product and services. It is supported by the increasing number of university and PROs contracts with industry.

The lack of internal R&D could hinder the improvement of the absorption capacity. CIS4 data demonstrate that almost 80% of the Bulgarian enterprises are not engaged in any cooperation activities related to innovation. Research organisations – universities and PRO are considered as important cooperation partner only for small percentage of the companies. The main factors hampering innovation are still cost and market factors and knowledge factors like qualified personnel, partner for innova-

tion, lack of information on technology and market are considered less important. However, recent studies of a limited number of companies in Bulgaria, supported by NIF, identify the lack of qualified personnel as a major concern for the overall operations of the companies and innovation. The improvement of the personnel skills and motivation to develop them are considered as important prerequisites to absorb new knowledge.

The establishment of clusters in Bulgaria is expected to increase the competitiveness of the SMEs. The support for them provided by PHARE at the end of 2007 includes consultancy, investment, training, research and development. Clusters are still in the initial stage of their formation. The increasing awareness of the need to cooperate and the intensification of horizontal links among clustering companies could identify common needs of R&D and closer links of enterprises with the vocational schools and universities in the regions.

5.2 Assessment of strengths and weaknesses

During the years the PROs and universities developed profound knowledge on how to compete for funding at the international level, and the EU-funded and other international programmes supporting research have provided opportunities for access to new knowledge and strengthened transnational research collaboration. Traditionally in Bulgaria, knowledge circulation with industry is based on research contracts. The weaker element of the national research system is the underdeveloped technology transfer support mechanisms.

Main strengths	Main weaknesses
• Good experience of the PROs and universities to compete for funding at international level and to collaborate at international level. • Access to international knowledge. • Traditional contacts between PROs and universities with industry and service sector based on research contracts.	• Limited knowledge circulation between PROs, universities and the business sector. • Low knowledge absorptive capacity of the industry and small number of innovative enterprises. • Lack of qualified personnel.

5.3 Analysis of recent policy changes

The knowledge flow between research organisations and the industry are facilitated by the recent implementation of the policy measures within the framework of the Innovation Strategy of the Republic of Bulgaria (Ministry of Economy and Energy, 2008). They aim at strengthening the links between research and business and the capacity and skills of the Bulgarian companies in R&D and innovation. New financial support schemes for innovation were developed. The National Innovation Fund completed its fourth selection procedure. At present it is supplemented by one more major financial instrument—Operational Programme Competitiveness launched in 2007.

The measures have the following impact on knowledge circulation:

1. National Innovation Fund financing. The National Innovation Fund is partially subsidising the costs of market-oriented R&D and experimental projects for industrial purposes. It promotes the links between research and business and creates conditions to increase the share of private capital in the financing of innovation. Over the

period 2005 – 2007, four competitive sessions were held. A total of 320 projects were supported both in traditional and high-tech sectors. The average value of the financial support per project remained more or less unchanged (approximately €75,000). Since businesses are required to provide 50% co-financing, the total resources provided and generated by the Fund for the development of innovation ideas in industry amounted to €25m. This contributes to overcome Bulgaria's lagging behind the rest of the EU member countries. The projects should have as a final result the launch of new products and processes which will increase output, upgrade quality, create jobs and strengthen market positions. ICT companies are the most active in innovation. Other participants are electrical engineering companies, companies in machine building and metal processing, energy, biotechnologies and food industries. The fourth selection session was held in 2007. 102 projects (81 projects for applied research and 21 projects for feasibility studies) are funded. Thirty percent of the approved projects are in the priority areas of nano-technologies, biotechnologies, nuclear energy, energy saving technologies, eco-innovations and start-ups established within the last three years. The share of feasibility studies projects will increase since they could be considered as a groundwork stage for the more efficient spending of the EU Cohesion and Structural Funds. Evaluation rules for these projects should be simplified and the procedure for their collection and evaluation should become more flexible and able to be done at any time.

2. *Establishment and/or optimisation of technology centres*. The technology centres are expected to be a major mechanism to strengthen university-industry links. In 2007, nine technology transfer offices were established at universities and research institutes and financed by PHARE Project. They will promote the results of scientific research to the business, and will provide specific innovation services related to the technological renewal of production. The activities of the technology transfer offices are the establishment of offices for transfer of technologies and a demo room, development of a web site and a database of the technology transfer offices, development of demo pilot projects, assessment of the intellectual property rights, development of prototypes, preparation of presentations and promotional materials for the prototype, establishment of contacts between the developers and potential users, etc. The technology transfer offices are based at the Bulgarian Academy of Sciences (the Institute of General and Inorganic Chemistry and the Space Research Institute) and the universities with strong research potential in specific fields of science: St. Kliment Ohridski Universityof Sofia, Angel Kanchev University of Rousse, Nikola Vaptsarov Naval Academy in Varna, the Technical University of Gabrovo, Prof. Assen Zlatarov University of Bourgas, the Agricultural University of Plovdiv, and the Vegetable Crops Research Institute in Plovdiv.

3. *Knowledge circulation is supported by the Operational Programme Development of the Competitiveness of the Bulgarian Economy 2007 – 2013*. It is one of the seven operational programmes financed by the Cohesion and Structural Funds of the European Union. The programme is financed from the European Regional Development Fund and the national budget. The total amount of the public financial resources for the programme will be about €1.1b. During the last quarter of 2007, the Ministry of Economy and Energy announced the following grant procedures that have a direct impact on knowledge transfer:

- *Support for the Establishment and Development of Innovative Start-Ups***.** The objective of the grant procedure is to increase the number of successful innovative start-ups, providing support in the riskiest phase of their development,

i.e. the development of the basic innovative product or process of the company in its pre-market preparation until the development of the experimental design.

- *Meeting of Internationally Recognised Standards.* The grant procedure is intended to promote the introduction of quality management systems and internationally recognised standards in the Bulgarian enterprises as a major factor of their competitive development.
- *Technological Modernisation of Enterprises*. The objectives of the grant procedure are geared to the modernisation of the technological equipment related to the expansion of the operation of enterprises and the enhancement of their competitiveness, including support for product or process innovation.

4. *Pilot competition for a doctoral thesis development as a joint operation between a research organisation and/or a university and a corporate structure.* The objective of NAS competition is to build effective links between research and industry through the active involvement of businesses in the development of doctoral theses. It will support the establishment of bridge structures between universities, research organisations and business structures and will open the labour market for highly skilled professionals. 14 projects from different field of sciences (chemistry, medicine, biology, agri-food, engineering sciences, etc.) are supported.

Knowledge circulation is often initiated by the companies. For example the National Centre for Agricultural Sciences at the Ministry of Agriculture and Food developed in 2007 twenty eight projects financed by companies.

5*. Policy measures in support of absorptive capacity.* Operational programme "Human resource development" provides opportunities for in-company training and skills development as well as the improvement of the skills of young people up to the age of 29.

*6. Encouragement of entrepreneurship both at higher and high schools is another policy measure in support of knowledge circulation.*The technological universities in Bulgaria do not have long traditions in the field of entrepreneurship training. The establishment of entrepreneurship centres helps to train undergraduates at technological universities to start up their own business and to assess the commercial value of technological ideas and the market demand for their products, to provide financial resources and assist start-ups of graduates. This could create new jobs and prevent the migration of highly educated staff from the country. Four centres are supported. Their activities include curriculum development, preparation of e-learning web sites, acquisition of study books, writing of entrepreneurship manuals and development of web-based information systems for graduates.

Training for entrepreneurship is implemented also in vocational schools. In 2006, a pilot project on the development of entrepreneurial skills and education in entrepreneurship was launched. It aimed to implement a package of measures for the development of entrepreneurial skills and education in entrepreneurship among secondary vocational school students. The "training company" based at Hristo Botev High School of Construction, Architecture and Surveying was supported by the Ministry of Economy and Energy throughout the 2006/2007 school year. Its goal is to develop entrepreneurial culture, knowledge and skills of young people studying at non-business secondary vocational schools to start up and manage their own companies. A business club functions at the centre with the task to ensure long-term partnership

between vocational education and the construction and architecture industry through the involvement of business practitioners and prominent professionals in the learning process. At present, 23 Bulgarian and international companies are members of the Business Club at the entrepreneurial centre. Two training companies, JA Experts and Future Art, function within the centre. The successful implementation of the Entrepreneurship Centre programme has turned the training company into a working model to be followed by other secondary non-business vocational schools in Plovdiv, Rousse and Sofia.

Challenges	Main policy changes
Knowledge circulation between university, PRO and business sectors.	Establishment and optimisation of technology centres OP Competitiveness to support knowledge circulation.
International knowledge access.	New funding schemes under the National Science Fund to support Bulgarian researchers during the preparation of FP7 proposals and a national co-funding scheme to support the contracted FP7 projects.
Absorptive capacity.	OP Human resources to facilitate in-company training and skill development of young researchers.

5.4 Assessment of policy opportunities and risks

In the policy documents developed in the last year in regard to the Programming Period 2007 – 2013 (operational programmes, etc.) R&D and innovation are given much attention as drivers of the national competitiveness and economic growth. Pro-active measures to support the circulation of knowledge are foreseen in several operational programmes, and a certain number of measures have been launched and implemented to support knowledge circulation between science and industry and between science and education, as well as for building the absorption capacity of enterprises. Some of the major issues, which still need to be addressed, are the coordination of the implementation of different measures among the institutions as well as a more detailed focusing of funding towards the highest impact areas – currently priorities seem to be overly general, which risks "diluting" the programmes' impact, while requiring more resources for their implementation from both the public and the private sector.

Main policy opportunities	Main policy-related risks
• Awareness of the governmental institutions of the need of pro-active measures to knowledge creation and circulation. • Experience in the support of knowledge circulation and absorption capacity building. • Operational programmes provide substantial financial support for various aspects of knowledge circulation and absorption capacity – improvement of human capital skills, networking, etc.	• Coordination of policy measures initiated by different governmental institutions. • Company readiness to submit projects for improvement of their innovation capacity.

5.5 Summary of the role of the ERA dimension

Most national administrations of EU Member States, including Bulgaria, are still reluctant to sponsor non-residents or contribute to central budgets of coordinating initiatives European Commission (2005). Bulgaria has followed the general trend among Member States and has opened its research programmes to foreign researchers in so far as this does not involve actual payments but contributions to common research projects with Bulgarian researchers. The deepening and strengthening of ERA is likely to change quickly this status quo. Bulgaria, like smaller EU Member States is eager to introduce better knowledge circulation through researcher mobility though realizing this aim might be constrained by the limited national resources[24]. For example the real monetary contribution of member countries to the common budget of the initiative SEE-ERA.NET is 20%. As noted earlier in this report introducing ERA mobility schemes in Bulgaria might result in further brain-drain if not supplemented by an overall improvement of research attractiveness in the country.

6 - Overall assessment and conclusions

6.1 Strengths and weaknesses of research system and governance

The analysis of the Bulgarian research system has shown that it just emerges from a prolonged period of downsizing, restructuring and very low investment in R&D. The country's EU accession has promoted the process of setting up modern governance institutions though often their existence remains mostly "on paper", without sufficient resources and discernible impact on the research system. As shown in the table of assessment of the main strengths and weaknesses Bulgaria faces challenges in all four domains, including in the coordination and coherence between them. The low resource mobilisation in the business sector, which goes hand in hand with low knowledge demand and absorption capacity and the concentration of public R&D expenditure in the public sector, coupled with low knowledge circulation to the economy are the most commonly cited deficits of the Bulgarian research system, as noted in the Commission's Assessment of the National Reform Programme for Growth and Jobs of Bulgaria and the PRO INNO European Innovation Scoreboard in 2006 and 2007. The strengthening of important resource mobilisation institutions such as the National Council for Scientific Research and the National Science Fund and the National Innovation Council and the National Innovation Fund provide a good basis for the Bulgarian research system to benefit from the EU research support instruments provided that governance is improved. The current governance structure seems to match rather than change the fragmentation in the country research system pattern.

[24] Ibid.

Domain	Challenge	Assessment of strengths and weaknesses
Resource mobilisation	Justifying resource provision for research activities	Resource provision for research is well justified in Bulgaria, including in the Law on Scientific Research Promotion. However, due to lack of coordination and subordination between policy documents in 2006 GBAORD was twice lower in Bulgaria than in EU-27.
	Securing long term investment in research	Well-established research funding instruments – the National Science Fund and the National Innovation Fund, which provide competitive programme and project-based funding. Still public funding of research remains ineffective as most of it is channelled through direct institutional grants to public research organisations. Long term research funding is to a high extent dependent on European funding, notably EU Structural Fund's support. Income from international programmes, including EU FPs, is increasing.
	Dealing with barriers to private R&D investment	BERD is one of the lowest in the European Union which indicates that local business does not compete on innovation
	Providing qualified human resources	Traditionally high tertiary education attainment in Bulgaria is affected strongly by deteriorating quality, intensifying brain drain, aging academia and low attractiveness of science careers.
Knowledge demand	Identifying the drivers of knowledge demand	Knowledge demand "locked" primarily in the public research sector targeting mostly basic research. Business and financial services and IT lead the business demand for R&D though the lack of foresight and/or technology assessment precludes better analyses of areas of demand.
	Co-ordination and channelling knowledge demands	The National Science Fund and the National innovation Fund attract increasing number of companies though there is a persistent lack of coordination between research and innovation policy.
	Monitoring of demand fulfilment	There is an increasing abundance of monitoring instruments in the public and the private sector, as well as at EU level, though with varying quality.
Knowledge production	Ensuring quality and excellence of knowledge production	Tradition in knowledge production and international cooperation in basic and applied research in mathematics, physics, chemistry, engineering sciences, etc. Research capacity is still concentrated in the Bulgarian Academy of Sciences while it is still limited in universities. Research performance is fragmented among various fields and units under the conditions of limited funding. International peer review is used in the National Science Fund evaluations.
	Ensuring exploitability of knowledge	Low level of commercialisation of R&D results and lower levels of patent applications compared to the New Member States and EU-27 averages.
Knowledge circulation	Facilitating circulation between university, PRO and business sectors	Existing good contacts between PROs and universities with the industry and services sector based on research contracts. Still knowledge circulation between PROs, universities and the business sector remain limited.
	Profiting from international knowledge	Universities and PROs have increasingly better access to international knowledge through long-term agreements with European counterparts and the Framework programmes.
	Enhancing absorptive capacity of knowledge users	Low knowledge absorptive capacity of Bulgarian industry and small number of innovative enterprises coupled with lack of qualified personnel.

6.2 Policy dynamics, opportunities and risks from the perspective of the Lisbon agenda

The analysis of the recent policy responses in the four domains summarised in the table below shows that research and related policies are consistent with the main strengths and weaknesses identified in the preceding analysis. The most pressing policy issue has been the enhancement of competitive research financing, which has resulted in a three times increase of the funds available for distribution at the National Science Fund to €32m. EU accession and the use of EU funds have dominated the research policy discussions in the country though policy and institutional coordination has not been addressed appropriately also in this field. The lack of modern tools for informing research policy on potential emerging patterns and trends in the research system underlines the risk that the initiated increase in public R&D funding might not result in luring a corresponding response from the private sector. The lack of policy and strategy coherence across and within domains, e.g. combining knowledge production and knowledge demand tools and reforming PROs to increase their efficiency remain the main policy-related risks.

Domain	Main policy opportunities	Main policy-related risks
Resource mobilisation	The Bulgarian prime minister has recently announced a drive towards strengthening the Law on Scientific Research Promotion, updating the draft National Innovation Strategy and integrating it with the National Strategy for Scientific Research for the Period 2005 – 2013, modernising science career promotion through changes in legislation as well as increasing competitive public funding for R&D. Accordingly, the NSF annual budget for 2008 has more than tripled to roughly €32m.	There has not been any sign of development of long-term mechanisms for priority setting and for coordination of public R&D policies, e.g. foresight studies, which might lower the effects of increased public funding for R&D. There are no public reform plans in place to address the rigidities in the public research sector and the quality of human capital for research.
Knowledge demand	The government has started to move away from institutional towards competitive research funding. Changes in the investment promotion act indicate a desire to move away from capital intensive towards knowledge intensive industries.	No overall evidence based policy towards upgrading the Bulgarian economy towards more knowledge intensive industries. Lack of coherence between policy initiatives. The lack of in-depth foresight and technology demand studies might hamper the translation of increased public spending into more business demand on R&D.
Knowledge production	The Ministry of Education and Science has announced commitment towards developing more research capacity in universities through launching specific calls for university research capacity under the National Science Fund. The fund also supports specific calls in traditionally strong sectors of Bulgarian science, such as chemistry, mathematics, and physics.	Persisting inadequate environment for the encouragement of company R&D, including weak IPR enforcement. Pressure, but no clear plans, on restructuring the Bulgarian Academy of Sciences and the Agricultural Academy, without existing long-term strategy for developing PROs and university research capacity, which might perpetuate fragmentation in knowledge production in the public sector.

Domain	Main policy opportunities	Main policy-related risks
Knowledge circulation	Awareness of the governmental institutions of the need for pro-active measures to stimulate knowledge circulation. EU Cohesion and Structural Funds provide substantial financial support for various aspects of knowledge circulation and absorption capacity improvement - developing human capital skills, networking, etc.	Coordination problems of policy measures initiated by different governmental institutions create threats of doubling or diluting resource allocation thus reducing their compound impact. Research has discovered that companies are not well prepared to submit and implement projects for improvement of their innovation capacity under the EU programmes and funds.

6.3 System and policy dynamics from the perspective of the ERA

Bulgaria faces most of the challenges described in the Green Paper "The European Research Area: New Perspectives". Bulgaria has followed the general trend among Member States and has opened its research programmes to foreign researchers in so far as this does not involve actual payments but contributions to common research projects with Bulgarian researchers. Introducing ERA mobility schemes in Bulgaria might result in further brain drain if not supplemented by an overall improvement of the research attractiveness of the country. Bulgaria has also taken steps to align national programming with EU research priorities, e.g. by opening in 2006/2007 for the first time a facility with the National Science Fund to support the preparation of framework programme projects by Bulgarian researchers. As a result of the ERA initiative a number of research and technology oriented institutions ("soft" infrastructure) were formed in Bulgaria: centres of excellence, the Innovation Relay Centre – Sofia, the International Association of Science Parks – Bulgaria, the national network of Euro Info Centres (Gesellschaft zur Foerderung der Forschung, 2007). The Bulgarian government has however so far failed to ensure adequate national support and/or integration of the activities of these organisations in the national policies of the country (Innovation.bg 2008). Bulgaria is a member of the SEE-ERA.NET project, which coordinates research policies in South-East Europe between Member States and the countries of the Western Balkans. The ERA dimension has helped develop and streamline the policy consultation process in the country, as the Bulgarian Ministry of Education and Science has launched the first research policy public consultation process on the ERA Green Paper in 2007. However, actual impact of the ERA dimension on major research system characteristics such as the low investment in R&D remains unclear. For the period 2000 – 2006 almost no major goal of the first Bulgarian position paper on ERA from 2001 has been realised in practice. Most notably there was no increase in R&D expenditures European Commission (2007a)..

Community monitoring initiatives such as the ERAWATCH Research Inventory and PRO-INNO Europe have increased considerably the available analysis on the Bulgarian research system, which is expected to contribute to a better knowledge demand assessment in the future.

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List of Abbreviations

AA	Agricultural Academy
BAS	Bulgarian Academy of Sciences
BERD	Business Expenditures on R&D
BGN	Bulgarian Lev (after the 1999 denomination)
BSMEPA	Bulgarian Small and Medium Enterprises Promotion Agency
CSR	Country Special Report
CES	Commission of Education and Science
CIP	Competitiveness and Innovation Programme
CIS4	Fourth Community innovation Survey
ERA	European Research Area
EPO	European Patent Office
FDI	Foreign Direct Investment
FP	Framework Programme
GBAORD	Government Budget Appropriations and Outlays for R&D
GERD	Gross domestic Expenditure on R&D (GERD)
GDP	Gross Domestic Product
GVA	Gross Value Added
HEI	Higher Education Institutions
ICT	Information and Communication Technology
IT	Information Technology

IGL	Integrated Guidelines for Growth and Jobs
IPA	Investment Promotion Act
IPR	Intellectual Property Rights
JRP	Joint Research Projects
MEE	Ministry of Economy and Energy
MES	Ministry of Education and Science
MNC	Multinational companies
NCI	National Council on Innovation
NCSR	National Council for Scientific Research
NGO	Non Governmental Organisation
NIF	National Innovation Fund
NRS	National Research Strategy
NSF	National Science Fund
NSI	National Statistical Institute
NSSR	National Strategy for Scientific Research
OP	Operational Programme
PPP	Public-Private Partnership
PRO	Public Research Organisation
R&D	Research and Development
RDI	Research, Development and Innovation
RIS	Regional Innovation Strategy
RTD	Research and Technological Development
SME	Small and Medium Sized Enterprises
USPTO	US Patent Office

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Abstract

The main objective of ERAWATCH country reports 2008 is to characterise and assess the performance of national research systems and related policies in a structured manner that is comparable across countries. The reports are produced for each EU Member State to support the mutual learning process and the monitoring of Member States' efforts by DG Research in the context of the Lisbon Strategy and the European Research Area. In order to do so, the system analysis focuses on key processes relevant for system performance. Four policy-relevant domains of the research system are distinguished, namely resource mobilisation, knowledge demand, knowledge production and knowledge circulation. The reports are based on a synthesis of information from the ERAWATCH Research Inventory and other important available information sources.
This report encompasses an analysis of the research system and policies in Bulgaria.

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