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An assessment of research system and policies

Slovakia

Stefan Zajac and Vladimir Balaz

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An assessment of research system and policies
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Institute for Forecasting, Bratislava

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Executive Summary

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 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 Slovakia 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.

In transition period (1990s and early 2000s) Slovak R&D sector disintegrated and importance of domestic research sector for knowledge production and circulation decreased. Dissolution of sectoral monopolies and privatisation of large Slovak enterprises in 1990s, and entry of multinational companies in early 2000s contributed to establishment of dual economy, which does not provide R&D-friendly environment. Majority of technology effort was focused on knowledge absorption and diffusion Slovakia has benefited from a very rapid uptake of new technologies developed elsewhere, rather than focusing on extending the innovation frontier. This development was in sharp contrast with successful economic convergence in the same period.

The Slovak R&D system is a centralised one. The public sector is, as in most of the post-socialist countries, split between the sectors of higher education and the Slovak Academy of Sciences. The former is less research-oriented and more focused on teaching while the latter deals mainly with research activity, predominantly in basic research.

Most of existing weaknesses have not been overcome, or partly only, e.g. the mobilisation of resources for R&D (including high share of institutional funding in public sector), links between academia and industry and international collaboration in R&D. Therefore, in the previous period, the Slovak R&D policy-makers have been under the immediate (and growing) pressure of international benchmarks.

Key factor affecting all the four domains of R&D system is that existing relevant policy schemes are not operating fully. Therefore, Slovakia's R&D performance is lagging behind the EU average (as it is reflected in the EIS indicators and in other benchmarking exercises).

In this context, the future challenges (as analysed in this report) are of a cross-cutting nature and will require particular consideration: it is above all and foremost the problem of human resources and that of balanced funding of R&D activities. It seems that R&D funding schemes will need closer links to societal needs, i.e. there is a problem of coherence and co-ordination of the four domains. Another relevant

challenge may be that there still exists a weak demand for innovative products and services in the Slovak firms.

Domain	Challenge	Assessment of strengths and weaknesses
Resource mobilisation	Justifying resource provision for research activities	Secured and increasing long term investment within institutional and targeted funding of R&D (increasing share of GBAORD) but lack of horizontal coordination of R&D and innovation policies.
	Securing long term investment in research	Long-term Objective of the state science and technology policy
	Dealing with barriers to private R&D investment	Investment incentives were assigned to private firms, including multinational enterprises (MNEs), did not cover R&D, venture capital financing is not very developed in Slovakia and private companies spend much less on R&D in comparison with the EU average.
	Providing qualified human resources	Number of university graduates and researchers has been increasing recently but there is still a big lack of R&D personnel and graduates in S&T fields, mainly on universities and in the business sector.
Knowledge demand	Identifying the drivers of knowledge demand	High importance by foreign companies in the Slovak economy is not reflected in high share of these companies in R&D funding. Slovak SMEs generate limited demand on research results. Low R&D expenses in the manufacturing industry are leading to much lower gross value added than the EU average.
	Co-ordination and channelling knowledge demands	Common use of ad-hoc group of experts, foresight methods and multidisciplinary approach for preparation of the key strategic documents and new research programmes but there is still fragmentation of R&D governmental support to R&D and systematic and institutional evaluation culture is in the beginning.
	Monitoring of demand fulfilment	The 'Long-term Objective' promises clearer system of public R&D support including more efficient evaluation and monitoring methods.
Knowledge production	Ensuring quality and excellence of knowledge production	There is strong public research sector (with dominant role of the Slovak Academy of Sciences) and developed network of public universities with research capacities; Low evaluation culture, however, does not support excellence research.
	Ensuring exploitability of knowledge	Twelve thematic R&D priorities may be too many and are only partly reflected in the actual public R&D funding; Low level of patent production in Slovakia is well below the EU average.
Knowledge circulation	Facilitating circulation between university, PRO and business sectors	There exist research programmes supporting co-operation between sectors, but organisations ensuring technology & knowledge transfer into practice are missing. Insufficient supply of mediation services provided to innovative companies and unfavourable conditions for the creation of academic spin-offs. Low support to inter-sectoral mobility of researchers.
	Profiting from international knowledge	Effective system of investment incentives supporting localization of R&D and knowledge intensive services in place.
	Enhancing absorptive capacity of knowledge users	Existence of specialized organisations promoting interests of industrial R&D and innovative companies, but insufficient capacities of businesses to apply R&D outcomes.

Recent policy initiatives were aimed at key weaknesses of the Slovak R&D system, and at the creation of a national innovation system, respectively. As far as innovative activities are concerned, these documents were prepared for the first time in Slovakia, as a positive step towards the EU standard policy initiatives. The same is true for operational programmes. Further positive developments are reflected in the fact that the Slovak policy makers have realised the outstanding importance of human resources, societal needs and institutional evaluation culture.

Domain	Main policy opportunities	Main policy-related risks
Resource mobilisation	• Long-term Objective of the State Science and Technology Policy has created frameworks and conditions for improvements in the field of scientific staff, funding of public research system • Innovation strategy is aimed at the creation of a national innovation system, • Innovation Policy for the first time has started to create an innovation-friendly environment in the Slovak Republic for 2008 - to 2010, • Operational Programme Research and Development is aimed at support to R&D of universities and higher education institutions.	• Low mobilisation of human resources for science and technology, that can significantly touch the newly developed R&D infrastructure needs as well as innovative SMEs; • Private sector is not enough motivated to support R&D and knowledge based economy; • Brain drain of researchers based on unfavourable working conditions in R&D sector is a serious problem in Slovakia; • Not efficient use of European and national funding based on clear evaluation could lead to support of average research teams instead of excellence.
Knowledge demand	• R&D programmes, creating innovation-friendly environment.	• Public research is not flexible enough to produce the research outcomes based on the knowledge demand; • There is a lack of qualified human resources to meet the targeted applied research and development goals.
Knowledge production	• Refining links between science and technology and innovation policies (including co-operation between public and private sectors); • Ongoing reforms in the Slovak Academy of Sciences and in universities with increased role of a new set of performance indicators, stressing socio-economic relevance of research in funding research; • Future impacts of the above steps could lead to a more socially relevant and exploitable knowledge.	• Continuing support to all R&D disciplines disregarding excellent disciplines and workplaces and national thematic R&D priorities has presented main risk in S&T policy implementation; • Potential rigidity of the new evaluation system disregarding differences among individual research sectors and disciplines still persists; • Weak links between universities and external partners (mainly those from industry) has lead to mismatches between university research priorities and needs of the economy/society.
Knowledge circulation	• Operational Programme Research and Development creates better conditions for co-operation between sectors; • Strategy for the Popularisation in Society of Science and Technology has the potential to stimulate scientific careers in society; • International activities supported by	• Problematic sustainability of new R&D infrastructure after termination of public support (in the case of insufficient links to the application sphere and private funding); • There is continuing separation between public and private R&D that is strengthened by low horizontal mobility of human resources; • Decrease of attractiveness of the

	the Agency for Support of Research and Development, within special support scheme, strengthen smaller research potential in Slovakia.	Slovak Republic for foreign R&D investment (also related to the lack of HRST, especially S&T graduates).

One of the key weaknesses not yet appropriately solved is the creation of a mechanism for indirect R&D support (as it is generally used in the EU). It is clear that without such a mechanism one cannot expect a higher contribution of the private sector to R&D support in the years to come.

In Slovakia, ERA plays a minor role in national debate, despite its practical importance. More generally, up to now, Slovak policy-makers have not devoted particular attention to strengthening international scientific and technological co-operation. On the other hand, ERA-related issues (participation at FP programmes) are mainly discussed among scientists and researchers. Further, membership in various international organisations such as COST, EUREKA, and CERN has been significant for the Slovak scientific community. EUREKA offered opportunities for academia-industry collaborations, including co-operation with international industrial partners. Moreover, the large number of bilateral intergovernmental S&T agreements has also accelerated the internationalisation of the Slovak R&D activities. Finally, several funding schemes have been opened to participation of research organisations located abroad.

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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. 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 strength and weaknesses and policy-related opportunities and risks. 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, relaunched 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 four main subsections in correspondence with the four steps of the analysis. The report concludes in chapter 6 with an overall assessment of strengths and weaknesses of

[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.

the research system and governance and policy dynamics, opportunities and risks across all four domains in the light of the Lisbon Strategy's goals.

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

Slovak Republic is a small country with only 1% of the total EU population. In 2007, GDP per capita was on the level of 68.6% (in PPS) of the EU27 average and unemployment rates were 11.2% versus 7.1% of the EU average (Eurostat 2008).

The trends in R&D intensity (as the share of total R&D expenditures to Gross Domestic Product (GDP) have been fairly negative over the years, decreasing from 0.98% in 1995 to 0.51% in 2007. This R&D intensity was only comparable with Cyprus, Latvia and Poland. Most of the decrease in the previous period has been due to the decreased level of private R&D investment that was not linked with the growing attractiveness of the country for foreign direct investment. This is in sharp contrast with successful economic convergence in the same period. According to OECD (2005), an explanation may be that Slovakia has benefited from a very rapid uptake of new technologies developed elsewhere, rather than focusing on extending the innovation frontier. In other words, it is also known that R&D itself can raise "absorptive capacities" and thus facilitate the adoption of technologies developed elsewhere.

The Slovak R&D system is a centralised one. The public sector is, as in most of the post-socialist countries, split between the sectors of higher education and the Slovak Academy of Sciences. The former is less research-oriented and more focused on teaching while the latter deals mainly with research activity, predominantly in basic research.

The institutional structure of the S&T system seems to have changed little in the transition period, in spite of formal changes at the top level of the system. Essentially, the whole S&T system was and continues to be divided in four subsystems:

- Slovak Academy of Sciences (SAS);
- other governmental research institutes;
- higher education institutions;
- branch institutes and commercial research organizations (which have the greatest potential for innovation).

These four sectors remain in place, with some changes in relative size and organizational structures, especially in industrial R&D.

The Slovak Academy of Sciences carries out basic and strategic applied research. The Academy of Sciences supports scientific disciplines which have attained the international level of quality and which are necessary for the advancement of the Slovak Republic. The Slovak Academy of Sciences is subdivided into three scientific sections encompassing 56 scientific institutes and 13 auxiliary organisations, which conduct supporting activities. The Academy promotes the professional development and training of young researchers and co-operation with establishments of higher education.

Besides the Ministry of Education, the Ministry of Economy, the Slovak Academy of Sciences and the universities, there are also other important sectors with high research activities (agriculture, environment, health, transport and communications). Those important sectors for the R&D use quite substantial financial sources from the state budget.

The important supplier of continuing professional education is also the Association of Slovak Scientific and Technological Societies (ZSVTS). This association is co-funded by the Government and by private organisations. ZSVTZ has created 4 Houses of Technology.

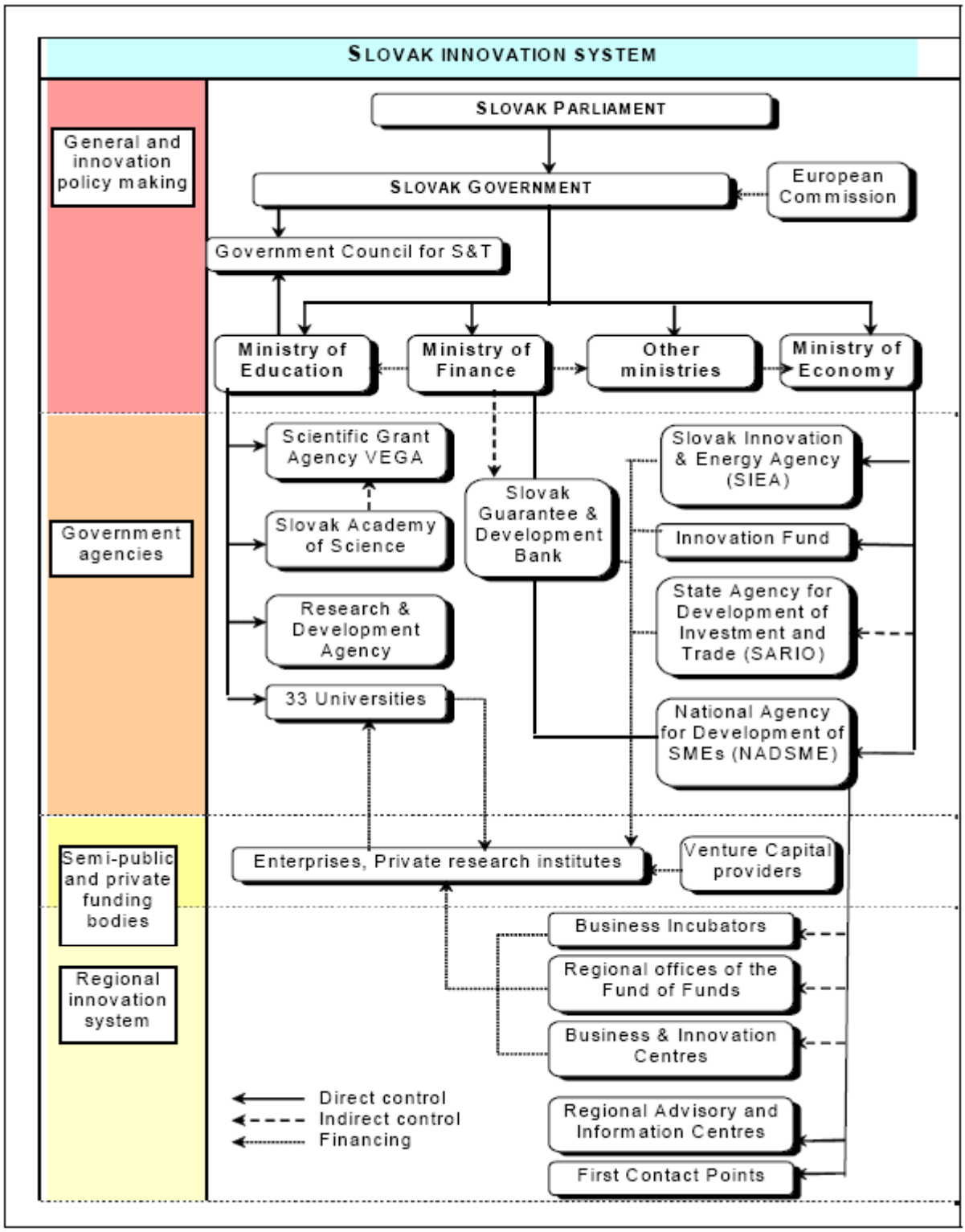
For more consistent interconnection of organisational structures of research and development with the practice also at the regional level, central authorities will co-operate with regional authorities of the state administration in basic activities in the field of science and technology. This step should help in specifying regional problems and their research and experimental development solution through the structures supporting the development and utilisation of science and technology. In this way, science and technology should more efficiently help to the regional development.

In July 2005, the Research and Development Agency (Agentúra na podporu výskumu a vývoja, hereafter RDA) was established by the Act No.172/2005, replacing the previous agency (Agency Supporting Science and Technology) functioning since 2001. The RDA is the most influential research and development grant agency in Slovakia and also the instrument for distribution of public R&D budget on a competitive basis in the country. The agency is responsible for research and development promotion in all research fields, including international research cooperation.

The Committee for Knowledge-based Society (hereinafter referred to as the “Committee”), which is a coordination, advisory expert body of the Government of the Slovak Republic for the issues of the development of a knowledge-based society, will also be involved in the process of coordination of science, technology and innovation. The Committee will have an advisory role for the achievement of harmony between the objectives in the area of science, technology and innovation and the overall context of the development of a knowledge society.

The Slovak Ministry of Education established Central Information Portal (CIP) for science and technology. The CIP contains information on calls for R&D projects and opportunities for research cooperation within Slovakia and in the EU. The CIP also contains links to Framework Programmes and mobility opportunities for Slovak scientists in the EU.

Figure 2: Overview of the governance structure of the Slovak research system



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

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

Resource mobilisation for research has not traditionally been high on the general policy agenda. There is still no clear link between research and innovation policy, which in practice means a lack of horizontal coordination between the ministries concerned (Ministry of Education and Ministry of Economy). The governance structure as well as a better understanding of science by general public is included in measures to be implemented within the Reform of the R&D&I System and Green Paper on the R&D and Innovation in the Slovak Republic. For more information on the Reform see Chapter 2.3.

Trends in share of GBAORD in total government expenditure indicate that importance of research with other government objectives decreased in the Slovak Republic. The share fell from 0.8 percent in 1995 to 0.73 percent in 2006. The Eurostat data also show a decreasing share of GBAORD as % of GDP, namely from 0.39 % in 1995 to 0.27 % in 2007.[2] There are initiatives popularising science and technology with general public, and particularly among children and young people, e.g. *Science and Technology Week* (organised by the Ministry of Education in the framework of European Science Week).

2.1.2 Securing long term investment in research

The state budget channels financial support to science and technology via budget chapters of following institutions:

[2] Eurostat data (2008) on Government budget appropriations or outlays on R&D.

- the Ministry of Education;
- other ministries and central authorities that ensure the solution of their sectoral problems through research and development;
- the Slovak Academy of Sciences.

The state budget funds assist research via provision of:

- institutional support,
- designated support via competitive grants.

The institutional support of science and technology (hereinafter referred to as 'institutional support') is provided through the budget chapters of:

- the Ministry of Education, for the public higher education institutions and state higher education institutions;
- the Slovak Academy of Sciences for the state budgetary and contributory institutes of the Slovak Academy of Sciences;
- the state budgetary and state contributory sectoral institutes, funded by other ministries, or central authorities.

The institutional support to the cited organisations is provided on the basis of contractual relations between the provider of the institutional funding and the relevant organisation, with a specification of the substantive directions for the use of institutional funding.

This support of science and technology from the state budget (hereinafter referred to as 'designated support') is provided through the state programmes of research and development, the state programmes for infrastructure development of research and development, the Agency for the Support of Research and Development, and through the newly introduced category of so-called 'sectoral research and development projects'. This category of projects will be officially introduced within the amendment of the Act No. 172/2005 Coll.

The designated support is provided in accordance with the results of the public competitive procedure, and on the basis of a contract in which the terms and conditions of the use of designated support funds will be specified.

The objective is for the designated support to have a growing trend relative to the institutional and that the ratio of the institutional to designated support in 2015 should reach 30% and 70% respectively.

Finally, there is a problem with sustainability of new R&D infrastructure after termination of public support (in the case of insufficient links to the industry sector and/or private funding).

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

Dual economy and low wage levels probably are major systemic barriers for the achievement of R&D investment objectives. There is both low supply of and insufficient demand on R&D solutions in Slovak economy. The collapse of central planning and introduction of the 'shock therapy' model of economic and social transition was immediately reflected in the disintegration of the system amongst

research agencies in early 1990s. The demand for traditional company-level research has declined in favour of technology imports. A dual economy was established in Slovakia in the late 1990s and early 2000s. Branches of multinational companies (MNCs) form one sector, typically with world-class technology imported from abroad and high productivity levels. Enterprises privatised and/or established by MNCs seldom retained research activities, as research was usually carried out in the MNCs' headquarters. These developments explain why the importance of intramural private research has been falling over the last 10 years in Slovakia. In 1997 BERD generated some 63.5% of GERD. By 2007 the share of BERD in GERD dropped to 41.9%. The decline in business investment was mirrored in the relative increase in importance of public spending: the share of public spending in total R&D spending increased from 34.5% to 58.1% in the period 1997-2007.

Therefore, importance of multinationals and large domestic firms in business R&D is quite low (e.g. Siemens is an exception). The same is true for the contribution of bank and venture capital financing, namely with regard to small and new technology based firms (due to high bureaucratic burdens). Currently, government incentives for private R&D (first of all, tax treatment of R&D expenditures) are under preparation and discussion.

2.1.4 Providing qualified human resources

Traditionally, the Slovak education system, strongly influenced by the socialist model at all levels, has been considered a key strength, even in an international comparison. The number of full-time students in higher education has grown every year. The quantitative boom in higher education, however, came rather costly, and was reflected in low quality of research in the higher education sector.

Slovakia had some 14.0% of population with tertiary education per 100 population aged 25-64 (EU25 = 22.8%) in 2006. Numbers of University students were strictly limited under central planning and it took long time to offset this problem. Access to higher education widened during transition to a market economy in the 1990s. Plenty new universities were established and, although of variable quality, partly satisfied increasing demand for higher education. By 2008 there were some 33 Universities and other higher education facilities in Slovakia. The number of undergraduate students increased from 60,000 to 202,000 between 1989 and 2007, while age-specific university admission rates increased from 13.0% to 43.0% in the same period. There was an even sharper increase in the number of postgraduate students, from about 600 in 1990 to 10600 in 2006. Rapid growth in graduate and postgraduate numbers, however, has not been matched by adequate financial support. While numbers of undergraduate and PhD students, and enrolment rates rose 3.5 times in 1989-2006/7 share of public expenditure on higher education fell from 0.98% to 0.68% in the same period. Fall in real spending on higher education had significant effect on deteriorating quality of the University system. Development of University system has been much more quantitative than qualitative one after 1989. Slovak universities had very limited resources for R&D activities. Consequently, the research quality was mostly poor. None of Slovak Universities ranked to top 500 World Universities (the Commenius University occupied 554th place in World and 235th place in Europe in a league of top 3000 World Universities. Slovakia also failed to transit high numbers of the University graduates to numbers of researchers and PhD students.

Researchers employed at government and higher education sectors, similarly to the Czech Republic and Hungary, fall under the generally strict but stable regulations of public employees, and, therefore, they are usually not well paid, compared to average salaries in Slovakia.

The basic instrument of education policy is a system of doctoral studies carried out in most of universities and in several institutes of the Slovak Academy of Sciences. This system is fully compatible with the EU standards.

Low funding of R&D facilities, however, makes careers in this sector unattractive for young and talented people. The stock of human capital has been shrinking since 1989. The numbers of researchers in headcounts, for example, halved from 34.7 thousands in 1989 to 19.4 thousands in 2007. Total numbers of R&D personnel fell from 63.5 to 23.4 thousands in the same period. Some 3% of the Slovak labour force worked as scientists or engineers in 2006. This share also was one of the lowest in Europe and compared with the EU27 average of 4.8%. The Slovak government launched three major initiatives to counteract these negative trends:

The State Programme 'Development of personality and talent of young employees in research and development and doctoral students' (2003 – 2005) was aimed at: (a) making use of intellectual potential of young people via excellent projects, (b) development and support of co-operation with business sector, (c) creation of conditions for setting-up joint research workplaces, (d) stabilisation of intellectual potential of young generation (doctoral students) in research and development through improvement of their salaries and living conditions and increasing societal status of science, and (e) catching-up with advanced nations in the number of doctoral students in Slovakia.

The Research and Development Agency prepared the 'Programme for Support of Human Resources in R&D and Popularisation of Science'. The Programme states following priorities: (a) creating a positive environment for post-doctoral R&D workers, (b) supporting mobility between Industry and Academia sectors, (c) improving cooperation between Slovak and international R&D facilities and (d) improving education on the subject of R&D ethics. Typical means of achieving these targets include the creation of 3-years job contracts for postdoctoral workers, re-integration grants for Slovak R&D workers employed at least two years abroad, and grants for excellent mentors in PhD education. The Programme also plans to create a database of Slovak scientists working abroad.

The Operational Programme 'Research and Development' contains measures aimed at: (a) encouraging Slovak scientists working abroad (including PhD students and post-docs) to return to Slovakia, and (b) support for top-quality human resources in areas of strategic importance for the development of society and the economy.

2.2 Assessment of strengths and weaknesses

Based on the above discussion, the main strengths and weaknesses of the system regarding resource mobilisation can be summarised as follows:

Main strengths	Main weaknesses
• Secured and increasing long term investment within institutional and targeted funding of R&D (increasing share of GBAORD for	• Existing weak links between S&T outcomes and innovation activities may hamper an efficient resource mobilisation; • Relatively low share of designated purpose

targeted funding); • Long term orientation of R&D based on Long-term Objective of the State Science and Technology Policy will create more clear prospects for research organisations; • Number of university graduates and PhD students accounted for high increases.	support to R&D; • Venture capital financing is not very developed in the country because of high bureaucratic burdens; • Slovak enterprises spend much less on R&D in comparison with the EU average, due to weak demand for domestic R&D outcomes; • Growing numbers of PhD students are not reflected in numbers of researchers. Wages in research sector are low, careers unattractive and researcher numbers falling.

2.3 Analysis of recent policy changes

In the period 2007-2008, four important policy documents were approved by the Slovak government:

1. Long-term Objective of the State Science and Technology Policy by the year 2015 (Ministry of Education, 2007b),

2. Innovation strategy of the Slovak Republic for 2007 - 2013 (Ministry of Economy, 2007a),

3. Innovation Policy in the Slovak Republic for 2008 - to 2010 (Ministry of Economy, 2008),

4. Operational Programme Research and Development (support to research, development and infrastructure of higher schools) (Ministry of Education, 2007d).

Long-term Objective of the State Science and Technology Policy by the year 2015 (Ministry of Education, 2007b)

Chapter on the infrastructure of research and development of the 'Objective' states that 'Available human resources are the basic prerequisite for the development of science and technology; they are the prerequisites needed to increase the competitiveness of the Slovak economy, more expeditious modernisation of the whole society, and, ultimately, they are the necessary preconditions for a successful development of the knowledge society in its full range. Indeed, well-educated human resources are the necessary precondition for the development of the knowledge society, which is why education as one pillar of the knowledge society will be subject of a special attention of the long-term development and exploitation of science and technology'.

With a view to ensuring qualified human resources in adequate numbers for the system of science and technology, Government has started to boost the interest of young people in working in research and development, which entails to focus the attention on raring and educating potential research and development workers already in primary schools, continue at all types of secondary schools, universities and ensure for both the research and development workers lifelong training.

Further direction is to secure permanent qualification advancement for the research and development workers, which implies the creation of a system of upgrading

qualification for research and development staff with a view to achieving certain qualification degrees. The lifelong professional training in research and development with gaining of certain qualification degrees will become the basis for the career advancement of an employee in research and development and his or her financial remuneration. In this context, the Government has increased existing rewarding of the employee in research and development for every qualification degree obtained in public sector.

To ensure the implementation of the objectives of the development of science and technology by 2015, a total expenditure on science and technology will be required at 1.8% of the GDP in 2015 (up from 0.48% in 2006). One important measure in the direct support for science and technology is to raise the participation of the business resources in the support of science and technology so as to reach a 2/3 proportion of these resources in the overall support for science and technology. Therefore, in order to ensure increased participation of business resources, necessary incentives of indirect support for business entities are under discussion.

The trend of setting the increase in the total expenditures for science and technology by the year 2015, including the increase in the expenditures from the state budget, business sources and foreign sources, is based on the fact the overall expenditure on science and technology in 2015 will comprise 1.8 % of the GDP, and that the share of expenditure from the business sources in 2015 will reach the value of 2/3 of the overall expenditure.

The relevant objectives and aims of the ‘Objective’ are harmonised and interlinked so as to enable science and technology to respond flexibly to national and international demands. Their implementation will be continuously monitored, the progress assessed and subsequently they will be updated enabling science and technology to meet the expected mission to be inseparable component of the economic and social development of Slovakia and make a contribution to increasing competitiveness of the Community.

The main objectives of the state science and technology policy by the year 2015 will include:

- increasing the involvement of science and technology in the overall development of the Slovak Republic - a more intense involvement of science and technology in addressing the economic and social problems of Slovakia;
- in order to increase the involvement of science and technology in the overall development of Slovakia, it is vital to create such conditions for their development and exploitation that will take into account the specifics of their development in Slovakia, on the one hand, and the objectives and aims of building the European Research Area, on the other;
- ensure conditions for the development and exploitation of science and technology by setting the objectives for the following areas:

  a) coordination of science and technology;

  b) the infrastructure of research and development;

  c) systemic priorities of research and development;

  d) substantive priorities of research and development,

  e) support for science and technology;

f) the framework organisation model of financing for science and technology in the Slovak Republic by the year 2015;

g) international scientific and technological cooperation;

h) evaluation of research and development;

i) popularisation of science and technology;

j) monitoring of the state science and technology policy.

Innovation strategy of the Slovak Republic for 2007 – 2013 (Ministry of Economy, 2007a)

The strategic objective of Slovakia's innovation strategy (Ministry of Economy, 2007a), adopted by the Government of the Slovak Republic on 14 March 2007, is to achieve a situation in which innovations are one of the main tools of knowledge economy development and ensuring high economic growth of the Slovak Republic with the objective of achieving the level of the most advanced economies of the European Union.

Priorities of the innovation strategy are set to respond to the main deficiencies stemming from insufficient support to innovative activities, particularly for the SME's, and, at the same time, to comply with key national-level strategic documents, especially the National Strategic Reference Framework ("NSRF").

The Slovak firms are innovating but, compared to others, they are handicapped and less competitive. A solution is seen in a multi-source support to financing - from public, international and business sources, while it is necessary to motivate enterprises to use particularly the last two sources.

In the period of strategy, the most important task is that of creating a national innovation system in Slovakia including regional innovation structures (incubators, innovation centres, consulting centres and other elements). The objective of building the regional structures is to bring support activities as close to entrepreneurs as possible, particularly to small and medium-sized enterprises. On the basis of building an efficiently working innovation system, the following is expected to be achieved by 2013:

- a positive trend in the development of innovative processes reflected in the economy and social area;
- an increased number of projects successfully implemented;
- innovation will contribute by 25% to the gross domestic product growth in the year 2013 (presently the contribution is about 8%);
- over 50% of companies in industry and services, particularly SME's, will be of an innovative nature.

Innovation Policy in the Slovak Republic for 2008 – to 2010 (Ministry of Economy, 2008)

The Innovation Policy is primarily based on the Innovation Strategy. The basic goal of the innovation policy is to create support mechanisms for the formation and development of regional innovation structures, innovation enterprises, partnership

and cooperation of companies and universities in the field of research and development, gaining new markets in a sustainable environment so as to ensure and improve the population's quality of life and to draw as much benefits as possible from the prosperity of businesses for the national economy. In particular, the following is involved:

- improving competitiveness of businesses while adhering to the principles of sustainable development;
- development of employment, increasing the expertise and flexibility of labour; and
- regional development.

Introductory part of the Innovation Policy states that 'to reach the main objective of the innovation policy in 2008 to 2010, the following will be necessary:

- to complete the innovation support structure capable of absorbing the allocated funds in accordance with the Innovation Strategy of the SR and efficiently convert them into innovations;
- to prepare and launch the implementation of support programmes, projects, and schemes;
- to establish a network of regional innovation centres – RIC'.

Operational Programme Research and Development (Ministry of Education, 2007d)

The Operational Programme Research and Development (OPRD) is a programme document of the Slovak Republic, based on which assistance will be provided for the development of the knowledge economy in 2007-2013. The document defines the global objectives, the priority axes, measures and activities that will be supported on territories covered by the Convergence and Regional competitiveness and employment objectives in 2007 - 2013, using financial assistance from the European Regional Development Fund (ERDF). From a geographical point of view, OPRD covers the entire territory of Slovakia.

The OPRD follows on the objectives and priorities of the National Strategic Reference Framework for 2007-2013 (NSRF), which is the main strategic programming document of Slovakia. The OPRD implements and further elaborates the strategic priority of the NSRF "knowledge economy".

The key sections of the OPRD document include the analysis of the current situation in research and development, the strategy of the operational programme, the division into priority axes of the operational programme and the financing of the programme.

The analysis of the current situation with respect to the knowledge economy is based on the situation prevailing in the main areas, which should create the preconditions for successful convergence of Slovakia to EU 15. The information obtained is presented also in the form of a SWOT analysis and is used for the identification of the main disparities and development factors in the field of research and development.

The OPRD covers two objectives - the Convergence objective, which applies to the whole territory of Slovakia except for the Bratislava region and the Regional competitiveness and employment objective, which applies exclusively to the

Bratislava region. The document does not define any special measures or activities for these two objectives due to the similarity of the problems faced by all regions of Slovakia in the field of research and development. The specific objectives and framework activities are therefore similar and the rationale behind the solution proposals is analogical to the reasoning applicable to the priority axes. The reason for integrating both objectives into a single programming document is the ambition to unify and increase transparency of activities, which should produce synergic effects between the individual programme activities in the regions of Slovakia. As the territory of Bratislava and its surroundings concentrate about 50% of the research and development potential of the Slovak Republic, it is not possible to guarantee efficient and even attainment of the Lisbon strategy objectives and vision without providing the same support to all regions. Bratislava and the surrounding territories face the same structural problems in the area of research and development as the other regions of Slovakia, namely insufficient equipment and lacking technical infrastructure for research and development.

2.4 Assessment of policy opportunities and risks

These are the main policy opportunities and risks linked to the 2007 and 2008 policy changes outlined in the previous chapter.

Main policy opportunities	Main policy-related risks
• Science and Technology Policy has created frameworks and conditions for improvements in the field of scientific staff, funding of public research system, • Innovation strategy is aimed at creation of national innovation system, • Innovation Policy for the first time has started to create innovation-friendly environment, • Operational Programme Research and Development is aiming at supporting research and development infrastructure of universities and higher education institutions that is obsolete.	• Existing low mobility of human resources for the knowledge economy can critically touch the newly developed R&D infrastructure needs as well as innovative SMEs; • Not enough motivated private sector (mainly foreign firms) to support R&D and knowledge based economy; • Continuing brain drain of researchers based on poor national research career prospects; • Not efficient use of European and national funding based on clear evaluation could lead to support average research teams instead of excellence.

Generally speaking, the abovementioned policy documents are addressing some neglected areas in the previous period and they tackle some problems with creation of the Slovak national innovation system. All proposed objectives would require deep changes, but their real effects can only be expected in the long term. With respect to Lisbon strategy (and lagging behind) Slovakia is on track for the qualitative and mainly quantitative objectives. An efficient use of national and European funding is still hampered by the lack of clear evaluation criteria.

2.5 Summary of the role of the ERA dimension

From the membership of the Slovak Republic in the European Union a challenging task stems for science and technology in the area of international scientific and technological cooperation. Main problem for the Slovak research and development organisations in the common European competitive environment is: to be an equal competitive partner for the organisations in the other Member States. For Slovak organisations to be equal competitive partners they need to ensure qualified human resources, modern technical infrastructure and also adequate domestic financial sources whose co-participation is required by the European Commission in the EU research programmes.

Slovak scientists have been relatively successful at participating in various international research initiatives. Active participation of the Slovak scientists can be observed in various programmes, such as EUREKA, COST and bilateral intergovernmental agreements on cooperation in R&D. For example, within the 6FP Slovak scientists have been collaborating in 270 projects, funding received has reached €27.7m in 2006 (Ministry of Education, 2007a). These and other bilateral and multilateral R&D programmes are important vehicles for the Slovak scientific community to benefit from, and contribute to, knowledge circulation. At the same time, Slovak scientists benefit from having access to large-scale pan-European research infrastructures, for example CERN.

Moreover, currently existing S&T policy schemes are open to foreign researchers. However, in Slovakia, due to historical reasons, it has not been usual to have foreign partners in these projects. Therefore, they have not become an important source to profit from access to international knowledge.

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

In early 1990s Slovak research system experienced a wave of profound shocks, related to fragmentation and privatisation of key large enterprises, disintegration of applied research facilities, falling public spending on R&D and dilapidation of research infrastructure. As a result of economic reforms during the 1990s, networks between industry and academia weakened and scientists from both sectors had to compete for a very limited amount of R&D funding.

There are some 80 thousands small and medium enterprises (SMEs) in Slovakia. Most of these enterprises are based in regions outside of Bratislava and account for limited human, financial and technology resources. They also generate modest demand on R&D results, as they compete with low costs of inputs. This severely limits their capacity to adapt to new production (markets) requirements or to meet the demands of structural adjustment.

The enterprise sector of R&D organisations and workplaces of Slovakia consists of independent enterprise R&D organisations and dependent R&D components of production enterprises. The orientation of their R&D depends and will further depend on the demand of the economic and societal practice. The technology based and most dynamically growing segment of the domestic economy - branches of multinational companies - has still a minimal impact on domestic research and higher education. The R&D demand by foreign firms has been negligible so far. Multinational companies carry out research activities in their headquarters. The participation of the business R&D organisations to address national R&D priorities has been realised primarily through R&D state programmes and state orders.

Co-operation between research community and industry has traditionally been an important issue in public debates and a need for its improvement claimed. Government bodies have been searching for appropriate measures to attain such improvement.

Generally speaking, the situation of business networking in favour of R&D and innovation is influenced by bottom-up activities of various institutions (non-governmental type). Support for business networking in favour of innovation can be identified in the activities of Federation of Employers' Associations and (the newly established) Industrial Institute of the Slovak Republic, but its impact on innovation is rather weak. They help businesses to develop their international activities (mainly participation of national firms in the EU programmes), and via this activity also innovative elements are mobilised. Furthermore, they are providing educational and training programs, consultations, organization of professional events, seminars and conferences.

3.1.2 Co-ordinating and channelling knowledge demands

Technology foresight is obviously considered as a prime tool to identify knowledge demand. The national foresight programme in Slovakia was launched in 2003 (finished on October, 2004), called as Technology Foresight Slovakia 2015. Given the legacy of central planning, it was decided to launch a ‘bottom-up’, expert-driven professional programme rather than a ‘top-down’, centralised, politically laden one. The programme relied on panel activities, and a large-scale Delphi survey, and was

conducted in one stage only: July 2003 – November 2003. The programme involved over 200 experts from top Slovak universities, and public and private research bodies. The programme aimed at raising quality of professional decision-making of the Slovak central authorities in the field of science and technology. The Foresight exercise combined examination of demand and supply sides for knowledge production and circulation and analysed opportunities for coordinating and channelling knowledge demands. The demand side included social and economic challenges of globalisation and prospective areas of sustainable development, while supply side development and utilisation of science and technology in Slovakia, and in the European Research Area, respectively, for raising competitiveness of economy and quality of life.

The Long-term Objective of the State S&T Policy up to 2015, basic document on S&T policies in Slovakia, contains a special chapter on coordinating S&T policies. The chapter set that the Slovak Government Board for Science and Technology would become responsible for preparing both S&T and innovations policies. Special S&T management units should also be established with central government ministries and regional governments. The Technology Foresight exercise should be used for preparation and evaluation of the S&T policies.

3.1.3 Monitoring demand fulfilment

Monitoring and evaluation culture is still underdeveloped in Slovakia

First attempts to evaluate national science and technology policies date back to 2003, when the basic S&T policy document in Slovakia (Concept of the State-Governed Scientific and Technical Policy up to the Year 2005) was evaluated. Section for Science and Technology of the Ministry of Education prepared the Interim Report on the Performance of the abovementioned Concept. The Interim Report suggested significant increases in R&D spending from public resources and support of activities aimed at increases in interest by private sector in S&T promotion and developing suitable indirect policy measures aimed at commercial use of the S&T results. In the course of the national reform programme's analysis by the European Commission, the Commission's Progress Report (January 2006) "encourages the Slovak authorities to develop a stronger approach to stimulating research and development and innovation".

Policy measures related to monitoring demand fulfilment are contained in the Long-term Objective of the State Science and Technology Policy by the year 2015. The chapter on R&D evaluation sets that performance of the Slovak R&D system should be evaluated on annual basis. The chapter envisages individual and complex indicators for evaluation of the R&D system. Individual indicators include input-output data and impact assessment. Complex indicators should be generated via weighted aggregation of individual ones and target investments in knowledge, S&T activities and innovation performance. Impact assessment, benchmarking and evaluation should employ databases and methodologies prepared by renowned organisations, e.g. Eurostat, World Economic Forum, Institute for Management and Development, London Business School, etc. Evaluation methodology will be prepared also for individual R&D organisations in Slovakia. Complete list of indicators is contained in Annex 3 of the Objective.

The subchapter of the Objective on 'Evaluation of the components of the research and development system' states that 'in order to ensure the requisite quality of

research and development supported from the public sources, it will be necessary to put in place a basic common framework for the evaluation of all Slovak research and development organisations'.

The research and development organisations receiving funding from public sources would have to conduct their evaluation at 4-year intervals, with the participation of the Ministry's officials and other external (foreign) experts. This is an important opportunity to raise the quality of research organisations. The basic framework of the evaluation of a research and development organisation will be specified in the methodology to be developed by the Ministry of Education - in collaboration with the relevant experts. The basic evaluation framework will include the accreditation criteria of the research and development organisations. Further evaluation criteria will take into account the differences between institutions of particular research and development sectors, and therefore will be set as framework criteria, and it will be fully in the competence of particular sectors to decide what other criteria of evaluation they will establish that will take account of the specifics of their sector. The criteria of evaluation of the organisations of research and development will include not only the evaluation of research and development undertaken by them, but also the evaluation of the effective use of public source funding, as well as the capacity of the organisation to secure funds from the private sphere, based on the results achieved.

With a view to organisationally secure the process of the evaluation of the state of research and development in Slovakia according to internationally accepted indicators, and the process of the evaluation of the organisations of research and development, including the evaluation of universities and their research and development results, a centre for the evaluation and certification of research and development will be established. This centre will award the organisations of research and development certificates of competence to carry out activities in the area of research and development on the basis of the evaluation.

3.2 Assessment of strengths and weaknesses

Main strengths	Main weaknesses
In 2007 and 2008 science and technology, and innovation policies have for the first time explicitly stressed the importance of support to knowledge demand and devised respective policy tools.	• High importance by foreign companies in the Slovak economy is not reflected in high share of these companies in R&D funding. Slovak SMEs generate limited demand on research results. • Basic research dominates over applied research in the public sector, experimental development dominates over applied research in business sector – this hampers development of the knowledge based society; • Government support to R&D is fragmented. Systematic evaluation culture is still in the beginning and can take years to develop.

Monitoring demand fulfilment has to take into account incumbent organisational structure of the Slovak economy. There were two sectors in Slovakia's economy (multinational companies, MNCs and Slovak SME), which did not cooperate well. Branches of multinational companies had their headquarters and R&D centres located outside Slovakia, and expressed limited interest in networking with Slovak

R&D facilities. Slovak SMEs, on the other hand, competed with low wages costs, generated little demand on R&D inputs and accounted for low R&D expenditure. Higher demand on R&D solution is likely to be supported by rising labour costs in Slovakia in the future.

3.3 Analysis of recent policy changes

The 2007 Innovation Strategy (Ministry of Economy, 2007a) set that innovations would become one of the main tools of knowledge economy development and ensuring high economic growth of the Slovak Republic with the objective of achieving the level of the most advanced economies of the European Union. Priorities of the innovation strategy were set to respond to the main deficiencies stemming from still existing insufficient support to innovative activities, particularly for the SME's, and, at the same time, to comply with key national-level strategic documents, especially the National Strategic Reference Framework ("NSRF").

The 2007 Innovation Strategy goals were further elaborated in the 2008 Innovation Policy document. The document contains a list of six policy measures to be implemented in period 2009-2013. The document (a) promotes implementing state and regional innovation policies; (b) supports regional innovation development; and (c) facilitates development of knowledge-based society. Activities supported via this measure should improve regional competitiveness and promote sustainable economic growth in industry and services. The RICs will generate capacity for development of innovations in SMEs. The measure also aims at improving links between the business sector, and applied industry research organisations and Universities.

Therefore, first reform steps in creation of national innovation system in Slovakia were made, including regional innovation structures. Existing regional innovation structures (incubators, innovation centres, schemes, consulting centres and other elements) have helped to create the basic structure aimed at sustainability of the Slovak Republic's knowledge-based development.

Challenges	Main policy changes
Identifying the drivers of knowledge demand	Major documents on S&T policies (the Long-Term Objective') and Innovation policies (the 2007 Innovation Strategy and the 2008 Innovation Policy) recognise importance of drivers of knowledge demand. System of policy tools supporting knowledge demand was devised and will be applied since 2009.
Co-ordinating and channelling knowledge demands	Growing role of the regions in distribution of the structural funds aimed at stimulation of innovation activities.
Monitoring demand fulfilment	Strengthening the evaluation activities of the public authorities, including the follow up activities.

3.4 Assessment of policy opportunities and risks

Innovation Strategy and Policy documents adopted in 2007 and 2008 adequately respond to the weaknesses in Slovak research and innovation systems. It is expected that cooperation by the industry and academia sectors is positively affected by the initiatives contained in the 'Long-term Objective' and measures applied under the OPRD. The same expectations apply to initiatives applied under the 2008

Innovation policy, implemented under the Operational Programme Competitiveness and Economic Growth, in field of building RICs, and connecting industry and academia organisations in Slovak regions.

Results of these policies, however, may be impacted by factors outside of scope of S&T and innovation policies (dual economy, low-cost, low-value added mode of competition by Slovak SMEs). Slovak research and innovation system have been neglected for two decades. Creation of efficient links between public research and private sector research institutes is likely to take years.

Main policy opportunities	Main policy-related risks
• Science and Technology Policy is one of drivers and channels of knowledge demand in public sector, in the long-run; • Innovation Policy with Science and Technology policy may help with coordinating knowledge demands mainly in business sector.	• Public research is not flexible enough to produce the research results based on the knowledge demand; • Industrial policy supporting extensive business development is not corresponding to the needs of knowledge based economy; • There is a lack of qualified human resources to meet the targeted applied research goals.

3.5 Summary of the role of the ERA dimension

In 2008 Slovak government passed Strategy implementing the 'Long-term Objective of the State S&T Policy up to 2015'. The Strategy lists several measures aimed at international R&D cooperation. One measure potentially supports knowledge demand in Slovakia as it enables Slovak companies to draw on resources provided both by Structural Funds and FP7. Target 'Ensuring complementary provision of financial assistance under the OPRD and the FP7 programme schemes and promoting synergic effects in support to R&D' is implemented by the Ministry of Education and financed from the Structural Funds.

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 Ensuring quality and excellence of knowledge production

Knowledge production in Slovakia is, as in most of the post-communist economies, strongly concentrated into the public sector represented mainly by the Slovak Academy of Sciences and by universities. Unlike in the EU15 countries, higher share of research activities is performed within the Academy (predominantly dealing with the basic research), while the Slovak higher education is less research-oriented and more focused on education.

The Slovak Academy of Sciences, which consists of 56 research institutes, is therefore the most important public research organisation in Slovakia. The Academy formulates its own research policy, plays the role of an advisory body of public institutions on major R&D policy issues, manages national and international research programmes, and promotes cooperation with both applied research bodies and industry to foster technology transfer and the exploitation of scientific knowledge. In addition to the Academy, there are research institutes controlled by individual ministries. As a result of socioeconomic transformation and cuts in public spending during the 1990s, the number of research institutes was somewhat reduced.

Universities in Slovakia consist currently of 27 public and 6 private institutions providing tertiary education. Due to a traditional division of labour between universities and the Academy, the Slovak universities are more focused on education than on research and development. However, this situation started to change in the 2000s and nowadays both types of institution have a comparable amount of scientific output (measured by publications).

Knowledge production by the Slovak Academy of Sciences and Universities is evaluated in following ways:

Systemic evaluations. The Section for Science and Technology of the Ministry of Education accounts for the most comprehensive and influential evaluation activities in field of R&D in Slovakia. The Section carries out regular evaluations of the State Research & Development Programmes. Since 2005 the Ministry of Education has published the Annual Reports on R&D, the most comprehensive evaluation of the Slovak R&D system and S&T policies. The Annual Reports list (a) volumes of R&D resources, (b) R&D input/output indicators (including details on publications and citations), (c) policy measures related of the public support to R&D developed by the Ministry of Education and other central government agencies, and (d) activities by Slovak R&D bodies in area of international cooperation in R&D (including FP and ERA). Evaluation reports are approved by the Slovak government. The 2005 and 2006 Annual Reports provided quite detailed lists of various financial flows related to particular policy measures, but did not try to compute their socio-economic impacts. Evaluation results provided by the Annual Reports on R&D, in theory, are important for decisions on further orientation of research in respective areas and allocation of financial means to researchers and institutions. High numbers of thematic priorities,

however, were not reduced and there are limited data on financial support to particular priorities. Selected science and technology indicators, listed in the Annual Reports, indicate that incumbent system of evaluation does not stimulate excellence in research. Slovakia, for example, lags behind the EU15 countries in production of scientific publications and citations. In 2006 Slovakia reached 0.97 citations per scientific publication. This value was lower than those in the Czech Republic (1.77), Poland (0.99), Hungary (1.93), Slovenia (2.67) and substantially lower than in Austria (5.52) and the EU15 average (3.98) (Thomson, 1981-2006). Dominating specialisation of Slovak scientific publications is considerably reflected in the prevailing scientific citations. When comparing the number of citations with average figures for the EU15, the most successful were Slovak publications oriented at chemistry, material sciences and mathematics, followed by physics and plant & animals.

Evaluations of research performers and individual researchers. Universities and other higher education facilities are evaluated by the Accreditation Commission of the Slovak government. Institutes of the Slovak Academy of Sciences have been evaluated regularly by their own accreditation commission from 1992 onwards. Other research institutes are evaluated from time to time. Main evaluation criteria include (a) citations, publications, patents and industrial designs (b) numbers of domestic and international R&D projects and volume of financial assistance obtained, and (c) results of cooperation with the business sector and government authorities. Negative results of evaluations were reflected in cutting budgets of under-performing institutes. A few Institutes and Faculties did not pass accreditation and were abolished.

Independent evaluations. The Academic Ranking and Rating Agency (ARRA) is a charitable foundation established by former rector of the Commenius University and World Bank experts. ARRA provides for an independent evaluation of Slovak Universities and faculties and institutes of the SAS. The ARRA evaluations were met with criticism by some less excellent Universities and had little impact on formulation of research policies and identifying best research performers in Slovakia.

Excellence of knowledge production has been limited to several science fields in Slovakia (physics and chemistry in particular). In general Slovakia excellence of knowledge production is poor compared to the EU average. Slovakia accounted for one of the lowest numbers of scientific papers and citations, numbers of patents and industrial designs. Slovakia, for example, produced 0.0 triad patents per million population (EU27 = 20.8 patents) in 2005. Numbers of the Community trademarks per million population were 16.7 in Slovakia, while 108.2 in EU25 in 2006. In the same year, Slovakia produced 27.3 Community industrial designs per million population, while EU27 average was 109.4 designs (European Commission 2008). It indicates that Slovak evaluation system may not have been able to ensure quality and excellence of knowledge production.

4.1.2 Ensuring exploitability of knowledge production

Exploitability of knowledge production was affected by several negative trends in 1990s and 2000s. Balance of research performing sectors changed. In 1993 public research institutions accounted for 31.4% and business sector 68.6% of GERD. In 2007 public institutions accounted for 54.0% and business sector for 35.6% of GERD. Change in structure of research performers impacted structure of research activities. The share of basic research in total funding increased from 22.6% to

46.2% and share of applied research dropped from 49.4% to 24.5% in period 1994-2007. Ties between industry and academia sectors weakened. In 2007 two single financial flows generated 79% of the total support to research: (a) transfers from central government to the Slovak Academy of Science and higher education facilities accounted for some 49% of the total GERD and (b) transfers from businesses to private research facilities generated some 29% of the total GERD. Increasing insulations of industry and academia sectors was reflected in low numbers of patents, industrial designs and trademarks.

Insulation of industry and academia sectors partly was generated by factors outside the remit of research policies. Dissolution of sectoral monopolies and privatisation of large Slovak enterprises in 1990s, and entry of multinational companies in early 2000s contributed to establishment of dual economy, which does not provide R&D-friendly environment. Majority of technology effort was focused on knowledge absorption and diffusion rather than on knowledge generation and circulation. Long-term neglect of research sector and low attention paid to research priorities by Slovak governments, however also had negative consequences for exploitability of knowledge production.

4.2 Assessment of strengths and weaknesses

Main strengths	Main weaknesses
• Science and Technology Policy for the first time set evaluation criteria in public sector based on exploitability and excellent scientific output.	• Low evaluation culture not leading to excellence support; • Twelve thematic R&D priorities may be too many and are only partly reflected in the actual public R&D funding; • Low level of patent activities and citations per publication abroad.

In this decade, the excellence centres were created, in the Slovak academy of Sciences and at several universities. The centres are promising step towards the EU standards, as it is expected that they will increase level of scientific productivity. On the other hand, existing volume of financial support for centres is well behind the EU standards.

4.3 Analysis of recent policy changes

The most important policy changes with respect to knowledge production started in 2007, when some key policy documents were adopted (the ‘Long-term Objective and Innovation Strategy in particular). The ‘Long-term Objective’, for example, contains a special chapter on evaluation of public research policies and sets list of evaluation criteria and indicators. As for ensuring quality and exploitability of knowledge production, the chapter explicitly sets that ‘the criteria of evaluation of the organisations of research and development will include not only the evaluation of research and development undertaken by them but also the evaluation of the effective use of public source funding, as well as the capacity of the organisation to secure funds from the private sphere, based on the results achieved’. Evaluation process should be strengthened by institution building. The respective chapter envisages establishing centre for evaluation and certification of research and development. This centre would award R&D bodies certificates of competence.

Increasing exploitability of knowledge also is addressed by measures listed in the 2008 Innovation Policy. Measure No. 3 'Support of innovation activities in enterprises', for example, envisages launching two State Aid schemes:

- State aid scheme to support applied research and development focused on innovation;
- Scheme supporting innovation, introduction of quality management systems, protection of industrial rights, and introduction of technical standards in production practice and services.

4.4 Assessment of policy opportunities and risks

Incumbent system of evaluation of research performers and research policies has not been able to ensure quality and excellence of knowledge production. Data on numbers of publications, citations, patents and industrial designs indicate low levels of exploitability of knowledge production. Policy changes envisaged in the 'Long-term Objective' indicate increased importance paid to evaluation issues. The 2007 Innovation Strategy and 2008 Innovation Policy documents also aim at strengthening links between industry and academia sectors and support to applied research. These documents, however, did not address some persisting problems of excellence of knowledge production and exploitability, namely fragmentation of public support to high numbers of research priorities, cooperation with multinational companies established in Slovakia and low demand on R&D solutions by domestic SMEs.

Main policy opportunities	Main policy-related risks
• Refining links between science and technology and innovation policies (including co-operation between public and private sectors; • Creating new set of performance indicators for public research institutions, stressing socio-economic relevance of research in funding research; • Future impacts of the above steps could lead to a societal more relevant and exploitable knowledge.	• Continuing support to all R&D disciplines disregarding excellent disciplines, workplaces and national thematic R&D priorities present main risk in S&T policy implementation; • Potential rigidity of the new evaluation system disregarding differences among individual research disciplines; • Low demand on R&D solutions by Slovak SMEs and no policies aimed at cooperation with multinational companies. Weak links between public research bodies and industry (mainly SMEs) could lead to mismatches between public research priorities and needs of the economy.

4.5 Summary of the role of the ERA dimension

Importance of the ERA-related policies increased in 2007. Some ERA-related priorities and policies explicitly are mentioned in the 'Long-term Objective'. Chapter 9 on 'International scientific and technical cooperation' states that 'For Slovak organisations to be equal competitive partners they need to ensure qualified human resources, modern technical infrastructure and also adequate domestic financial sources whose co-participation is required by the European Commission in the solutions of the EU programmes for research and development'. Most important initiatives, to be prepared by central government, include:

- reimbursing from the budget chapter of the Ministry of Education the annual membership fees in all international organisations and European programmes and activities to which the Slovak Republic is a party;
- ensuring funds in the budget chapter of the Ministry of Education to carry out the research cooperation within the governmental bilateral and multilateral agreements on S&T cooperation;
- contributing to the 25-pecent financial participation of national resources required for the support of successful projects of FP7;
- considering new memberships of Slovakia in the European organisations, centres, and activities;
- developing grant schemes that would allow simultaneous financial support of projects from the resources of FP 7 and from the Structural Funds.

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

Slovakia exhibits extraordinarily low level of co-operation of domestic firms with public research sector institutes and universities. As mentioned in previous section, new innovation policy has emphasised bridging the gap between academia sector and industry. Cluster activities are not developed in Slovak regions, existing clusters

are aimed at machinery sector. MNEs only occasionally use collaboration with technical universities (for example, Siemens, Volkswagen).

In 2007, Agency for Support of Research and Development prepared several new programmes aimed at the transfer of knowledge between industry and academia.

These programmes included:

1. Support for the creation of, and activities of, Centres of Excellence. The programme supports projects developed by centres of excellence in research and education. Evaluation criteria for supported projects include numbers of jobs for PhD students and post-docs, centres' infrastructure, their ability to obtain resources supported by the FP7 and structural funds, and dissemination activities, as well as numbers of publications, citations and patents.
2. Support for the preparation of the FP7 projects. The programme targets Slovak institutions and researchers wishing to participate in FP7 projects. The rationale behind the support scheme is to address the low success of Slovak institutions when applying for projects supported by former FP initiatives.

5.1.2 Profiting from access to international knowledge

The international scientific and technological cooperation based on bilateral agreements on cooperation in science and technology, signed by the Government, and out of the SR membership in transnational research centres, is determined not only by the high-quality research and development infrastructure (human resources and technical infrastructure) but also by adequate resources in Slovakia that are required to support both the mobility in case of bilateral cooperation and the research participation itself of Slovak organisations in the projects of bilateral cooperation and in the activities of transnational centres.

Given low financial support to international cooperation, Slovak scientists have been relatively successful at participating in various international research initiatives. Active participation of the Slovak scientists can be observed in various programmes, such as EUREKA, COST and bilateral intergovernmental ones. These and other bilateral and multilateral R&D programmes are important vehicles for the Slovak scientific community to benefit from, and contribute to, knowledge circulation. At the same time, Slovak scientists benefit from having access to large-scale pan-European research infrastructures, for example CERN.

Incumbent Slovak S&T policy schemes are, in theory, open to foreign researchers. Participation by foreign scientists in Slovak national research policy schemes, however, was limit by low wages in Slovak research sectors, poor R&D infrastructure and language barriers. Therefore, these schemes have not become an important source to profit from access to international knowledge.

Policies aimed at attracting R&D performing firms from abroad may increase profits from accessing international knowledge. The Act on Investment Aid No. 561/2007 supports investments in (a) lagging behind regions and (b) preferred sectors of national economy. The total volume of investment incentive for each investment project is computed as combination of territorial and sectoral criteria match. The Act allows for provision of regional investment and employment aid for investment or expansion projects of industrial production, technology centres, strategic service centres, and complex tourism centres. The ‘strategic services’ category refers to ‘services with a high added value facilitating employment of qualified experts in

software development centres, expert solution centres, high-tech repair centres, customer support centres and headquarters of multinational corporations'. Eligible costs include tangible assets (land, buildings and equipment), intangible assets (patents, licences and other forms of intellectual property) and wages in newly created labour posts. Most foreign investors rely on the Slovak Investment and Trade Development Agency (SARIO), when negotiating the terms of investment assistance.

5.1.3 Absorptive capacity of knowledge users

Despite the huge number of SMEs, they are not the users of new knowledge (new technology-based firms are almost missing). Large companies (mainly branches of multinational companies) mostly profit from transfer of knowledge from abroad, via FDI or technology transfer. There are some Slovak firms carrying out in-house research and selling its outcomes abroad, but they only exceptionally use these results in their own innovative activities.

In February 2007 the RDA prepared four new programmes aimed at development of knowledge-based society and transfer of knowledge between industry and academia sectors. Most important scheme, in terms of financial assistance, was the Support to R&D in SMEs. The programme is aimed at micro-enterprises, spin-offs and start-ups and supports feasibility studies, technology transfer and R&D project finance. Evaluation criteria for supported projects include intellectual value of the project and its economic impacts. The Programme allocated €16.76m in period 2007-2010.

For more consistent interconnection of organisational structures of research and development with the practice also at the regional level, central authorities intend to co-operate with regional authorities of the state administration in basic activities in the field of science and technology. This step should help in specifying regional problems and their research and experimental development solution through the structures supporting the development and utilisation of science and technology. In this way, science and technology should more efficiently help to the regional development.

5.2 Assessment of strengths and weaknesses

The creation of R&D co-operation system, both between academia and industry and across the borders could be a good basis for the circulation of knowledge. The problem not yet addressed sufficiently is that of co-operation between academia and foreign-owned companies in Slovakia. This is important at both regional and national level, including implications for R&D-related policy mix.

Main strengths	Main weaknesses
• Approved policy measures to foster co-operation between public sector and industry; • Growing participation in international scientific co-operation; • Effective system of investment incentives supporting localization of R&D and knowledge intensive services in place.	• Existing working conditions for scientists do not encourage the mobility between public and private research and development • New evaluation system will need a number of experts from abroad; • Private sector does not create strong demand for new knowledge.

5.3 Analysis of recent policy changes

Strategic documents, as described earlier, are aimed, inter alia, at strengthening production, circulation and use of new knowledge.

In this context, it is necessary to mention Strategy for the Popularisation in Society of Science and Technology (Ministry of Education, 2007e). Strategy takes into account that an important goal of today's knowledge society is an increase in the social status and acknowledgement of the importance of science and technology within society, as part of the long-term development of Slovakia. Achievement of this goal presupposes construction of a society in which youth will value training and education. Research and development must be more user-friendly. Workplaces for research will be reconstructed into open institutions with good interconnection with the business sphere. This interconnection promises more knowledge and innovation with a beneficial impact on the whole society, which in turn will assist in the popularisation of science and technology in society.

5.4 Assessment of policy opportunities and risks

The main opportunities and risks linked to the abovementioned policy changes in field of knowledge circulation are summarised in the table below:

Main policy opportunities	Main policy-related risks
• Operational Programme Research and Development create better conditions for co-operation between sectors; • Strategy for the Popularisation in Society of Science and Technology has the potential to stimulate scientific careers in society; • International activities are supported by the RDA, within special support scheme.	• There is continuing separation between public and private R&D that is strengthened by low horizontal mobility of human resources; • Despite existing policy support schemes there is low attractiveness of Slovakia for foreign R&D investment (also related to the lack of HRST, especially S&T graduates).

These policy initiatives respond to the main weaknesses, but both the OPRD and Popularisation strategy are still in their start-up phase. Nevertheless, their potential is in creation necessary analytical basis for future policy-making. Support scheme for international activities is of great importance but it is influenced by existing budgetary framework.

5.5 Summary of the role of the ERA dimension

Slovak scientists have been relatively successful at participating in various international research initiatives. Active participation of the Slovak scientists can be observed in various programmes, such as EUREKA, COST and bilateral intergovernmental ones. These and other bilateral and multilateral R&D programmes are important vehicles for the Slovak scientific community to benefit from, and contribute to, knowledge circulation. At the same time, Slovak scientists benefit from having access to large-scale pan-European research infrastructures, for example CERN.

Moreover, currently existing S&T policy schemes are open to foreign researchers. However, in Slovakia, due to historical reasons, it has not been usual to have foreign

partners in these projects. Therefore, they have not become an important source to profit from access to international knowledge.

In the previous period, international activities are supported by the Agency for Support of Research and Development, within special support scheme. This support is concerning the project applications and participation of the Slovak scientists in research consortia.

6 - Overall assessment and conclusions

6.1 Strengths and weaknesses of research system and governance

The analysis has shown that Slovakia has not had a developed and well functioning research system. In each of the main domains there are mixed system responses to the domain challenges (see also the summary assessment table below). Main weaknesses of the Slovak system are related to its adaptation and enhancement of the changes being put in place. The only area in which system strength is closely related to the governance structure is the existence of relevant policy documents.

Domain	Challenge	Assessment of strengths and weaknesses
Resource mobilisation	Justifying resource provision for research activities	Secured and increasing long term investment within institutional and targeted funding of R&D (increasing share of GBAORD) but lack of horizontal coordination of R&D and innovation policy.
	Securing long term investment in research	Long term orientation of R&D based on Long-term Objective of the State Science and Technology Policy by the year 2015 with a relatively high share of institutional support to R&D.
	Dealing with barriers to private R&D investment	Investment incentives were assigned to foreign firms including MNEs but venture capital financing is not very developed in the country and the Slovak firms spend much less on R&D in comparison with the EU average.
	Providing qualified human resources	Number of university graduates and researchers has been increasing recently but there is still a big lack of R&D personnel and graduates in S&T fields, mainly on universities and in the business sector.

Domain	Challenge	Assessment of strengths and weaknesses
Knowledge demand	Identifying the drivers of knowledge demand	High importance by foreign companies for Slovak economy is not reflected in corresponding levels of in-house research by branches of multinational companies. Low R&D expenses in the manufacturing industry lead to much lower gross value added than the EU average.
	Co-ordination and channelling knowledge demands	Common use of ad-hoc group of experts, foresight methods and multidisciplinary approach for preparation of the key strategic documents and new research programmes but there is still fragmentation of R&D governmental support to R&D and systematic and institutional evaluation culture is in the beginning.
	Monitoring of demand fulfilment	Approved Innovation strategy is promising clearer system of public R&D support including more efficient evaluation methods but basic research dominates over applied research in the public sector, experimental development dominates over applied research in business sector – this hampers the knowledge based society.
Knowledge production	Ensuring quality and excellence of knowledge production	Strong public research sector (with dominant role of the Slovak Academy of Sciences) and developed network of public universities with research capacities but low evaluation culture not leading to excellence support. Starting programmes supporting R&D excellence. Recent faster growth of publication activity slowly catching up the EU15 average but low level of citation production.
	Ensuring exploitability of knowledge	Public R&D funding only partly reflects the National thematic R&D priorities. Low level of patent production.
Knowledge circulation	Facilitating circulation between university, PRO and business sectors	Existence of R&D programmes supporting inter-sectoral co-operation and industrial R&D with the aim to lead research towards practical outcomes but lack of organisations ensuring technology & knowledge transfer into practice. Insufficient supply of mediation services provided to innovative companies and unfavourable conditions for the creation of academic spin-offs. Low support to inter-sectoral mobility of researchers.
	Profiting from international knowledge	Effective system of investment incentives supporting localization of R&D and knowledge intensive services.
	Enhancing absorptive capacity of knowledge users	Existence of specialized organisations promoting interests of industrial R&D and innovative companies but insufficient capacities of businesses to apply R&D outcomes.

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

Generally speaking, recent policy documents are addressing some neglected areas in the previous period and they tackle some problems with creation of the Slovak national innovation system. All proposed objectives will require deep changes which take their necessary time but their real effects can only be expected in the long term.

With respect to Lisbon strategy (and lagging behind) Slovakia is on the track for the qualitative and mainly quantitative objectives. Clear evaluation criteria leading to support excellent research results, however, have been missing.

The links between research/innovation policies and existing sectoral policies are weak as they have not yet entered the policy agenda. The ‘Long-term Objective’

states some 12 thematic priorities for R&D policies. This number may be rather excessive for a country, where the 2007 GERD accounted for €252m and 0.51 percent of GDP in 2007.

A set of opportunities and risks can be identified in the four policy domains:

Domain	Main policy opportunities	Main policy-related risks
Resource mobilisation	Innovation Policy in the Slovak Republic for 2008 – to 2010. Long-term Objective of the State Science and Technology Policy by the year 2015. Operational Programme Research and Development.	• Low mobilisation of human resources for the knowledge economy, that can critically touch the newly developed R&D infrastructure needs as well as innovative SMEs; • Not enough motivated private sector to support R&D and knowledge based economy; • Remaining brain drain of researchers based on bad conditions in R&D; • Not efficient use of European and national funding based on clear evaluation could lead to support average research teams instead of excellence.
Knowledge demand	R&D programmes, creating innovation milieu	• Public research not flexible enough to produce the research results based on the knowledge demand; • Industrial policy supporting extensive business development and not corresponding to the needs of knowledge based economy; • Lack of qualified human resources to meet the targeted applied research goals.
Knowledge production	Innovation Policy in the Slovak Republic for 2008 – to 2010. Long-term Objective of the State Science and Technology Policy by the year 2015. Promoting international R&D co/operation	• Continuing generic support to all R&D disciplines present in Slovakia disregarding excellent disciplines and workplaces and national thematic R&D priorities; • Potential rigidity of the new evaluation system disregarding differences among individual research disciplines; • Low dependence of universities on external subjects (including industry) could lead to mismatches between university research and needs of the society.
Knowledge circulation	Innovation Policy in the Slovak Republic for 2008 – to 2010. International activities are supported by the Agency for Support of Research and Development, within special support scheme.	• Problematic sustainability of new R&D infrastructure after termination of public support (in the case of insufficient links to the application sphere and private funding); • Continuing separation of public and private R&D strengthened by low horizontal mobility of human resources; • Low attractiveness of Slovakia for foreign R&D investment (also related to the lack of HRST, especially S&T graduates).

6.3 System and policy dynamics from the perspective of the ERA

In Slovakia, ERA plays a minor role in national debate, despite its practical importance. More generally, up to now, Slovak policy-makers have not devoted particular attention to strengthening international scientific and technological co-operation. On the other hand, ERA-related issues (participation at FP programmes) are mainly discussed among scientists and researchers. Further, membership in various international organisations such as COST, EUREKA, and CERN has been significant for the Slovak scientific community. EUREKA offered opportunities for academia-industry collaborations, including co-operation with international industrial partners. Moreover, the large number of bilateral intergovernmental S&T agreements has also accelerated the internationalisation of the Slovak R&D activities.

International activities are supported by the Agency for Support of Research and Development, within special support scheme.

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List of Abbreviations

AIRDO	Association of Industrial Research and Development Organisations
ASRD	Agency for Support of Research and Development
ASSTS	Association of Slovak Scientific and Technological Societies
BERD	Business Expenditures on Research and Development
ERA	European Research Area
ERDF	European Regional Development Fund
ESF	European Social Fund
EU	European Union
FPs/FP7	EU Framework Programmes on R&D / Framework Programme 7
GBAORD	Government Budget Appropriations or Outlays on Research and Development
GDP	Gross Domestic Product
GERD	Gross Expenditures on Research and Development
HERD	Higher Education Expenditures on Research and Development
HRST	Human Resources in Science and Technology
IG	Integrated Guidelines
MEc	Ministry of Economy
MEd	Ministry of Education
MNE	Multinational Enterprise
NRP	National Reform Programme 2005 - 2008
OECD	Organisation for Economic Cooperation and Development
OPs	Operational Programmes
R&D	Research and Development
RDI	Research, Development and Innovation
RTDI	Research, Technology, Development and Innovation
SAS	Slovak Academy of Sciences
SGA	Scientific Grant Agency
SKK	Slovak Koruna (Slovak currency)

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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 Slovakia.

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