

**THE SLOVAK HIGHER EDUCATION SYSTEM AND ITS RESEARCH  
CAPACITY**

***EUA SECTORAL REPORT***

**Henrik Toft Jensen  
Alojz Kralj  
Don McQuillan  
Sybille Reichert**

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## **An EUA Sectoral Report**

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## **1. Introduction**

### **1.1 Mandate**

The European University Association (EUA) has been commissioned by the Ministry of Education in the Slovak Republic (ME SR), jointly with the Slovak Rectors' Conference (SRC), to evaluate the universities and higher education institutions during 2005-2007. The agreement between the two parties means that the EUA Evaluation will examine the following areas, taking into account the local, national and international contexts (EUA, 2005a, p. 5):

- Organisation and structures for carrying out the main missions of higher education institutions.
- Effectiveness of internal quality processes and their relevance in decision-making and strategic planning.
- Perceived gaps in the internal mechanisms and frameworks and recommendations for resolving them.

This evaluation is taking place in a wider context of the Government's:

- strategic objective of placing Slovakia in a favourable position for meeting the Lisbon objectives;
- interest in ensuring the successful implementation of the Bologna reforms;
- acknowledgement of the need to increase the transparency and attractiveness of the public sector.

The intention of this evaluation is to support Slovak higher education institutions in their continuing development in order to meet best standards and practices that are adapted to their specific context. The overall analysis reaches across the whole publicly funded higher education sector which includes the evaluation of all Slovak public and state higher education institutions with a particular focus on the research capacity at the national level.

### **1.2 Background of the EUA Institutional Evaluation Programme**

The European University Association (EUA) includes about 780 member universities in 46 countries. Since 1994 these universities have been offered the possibility of being reviewed in order to assess their strengths and weaknesses in quality management. The aims of the Institutional Evaluation Programme are to support the university leadership and management in their efforts to improve institutional management and to promote the university's capacity for change. The university's Self-Evaluation Report (SER) opens the possibilities to discuss its future and to help it understand its strengths and weaknesses. EUA does not wish to provide the university with a blueprint for its development. The review process is a consultative and supportive one with a long-term perspective. EUA hopes to contribute thereby to the promotion of a quality culture among European universities, and to disseminate examples of effective strategic management among its member universities.

Since 2001 EUA has conducted sector-wide evaluations in order to identify and give recommendations on systemic challenges and common issues shared by all institutions in a given sector. In addition to this review, examples of sector-wide evaluations include the Irish universities in 2004 and the Portuguese higher education system in 2006-2008.

### **1.3 Methodology**

The following analysis is based, first and foremost, on the series of 23 institutional evaluation reports which were submitted by the international institutional evaluation teams of each Slovak higher education institution. A total of 56 experts from 24 European countries participated in these evaluation teams. These reports summarise the findings of the international evaluation peers, based on the self-evaluation reports of the institutions and the 2 visits to the institution. They provide an in-depth insight into the challenges, opportunities and capacity for change of the institution. These institutional evaluations take the aims and self-understanding and strategic objectives of an institution as points of departure to explore to what extent the institution is in a position to realise these aims and what it would have to do to realise these aims and objectives.

For the purpose of the system evaluation, a special systems evaluation team was formed to review the reports in order to identify common concerns, framework conditions, constraints, opportunities, threats and future challenges. The team consisted of:

- Henrik Toft Jensen, former Rector of the University of Roskilde, Denmark; former chair of the Institutional Evaluation Programme of the European University Association (chair)
- Alojz Kralj, former Rector of the University of Ljubljana, Slovenia
- Don McQuillan, former Chief Executive, Irish Universities Quality Board, Ireland
- Sybille Reichert, Director Reichert Consulting: Policy and Strategy Development in Higher Education, Switzerland (rapporteur).

On the basis of the common denominators as well as diverging experiences of the institutional evaluations, an overall description of the system was distilled and common questions were formulated which were then discussed with higher education representatives and other stakeholders in a week-long systems site visit, which took place in May 2007. This visit comprised a wide range of interviews with different actors and stakeholders which influence the higher education system and have a vested interest in its development. The expert team conducted interviews with:

- the rectors' conference
- the Minister for education and research and the Director General as well as representatives from the ministry of finance
- representatives from the academy of sciences
- the directors of the main funding agencies
- others stakeholders (e.g., Union of employers)
- university representatives.

During the visit, individual aspects of the research system were also discussed in short visits to three further universities (beyond the 23 site visits in the context of the individual institutional evaluations), namely the University of Economics and the Slovak Technical University in Bratislava and the Constantine the Philosopher University in Nitra.

In addition to the evaluation reports, the interviews with system actors and stakeholders, as well as the legal and strategic documents relating to the national system, the analysis was able to benefit from quantitative and qualitative data provided by the Slovak Rectors' Conference's working group (composed of Marta Cimbáková, Mária Čikešová, Jozef Jurkovič, Ján Kalužný, Ivan Ostrovský, Juraj Sinay (Chair), Eva Tučná, and Karol Zalai). A report on some bibliometric and funding agency grant success (ARRA report) was also available for 2005 (in English), and 2006 (in Slovak). Furthermore, the country reports of the European Commission, Key Figures 2005 and 2007 of the European Commission, the IMD

Competitiveness Report and the World Economic Forum as well as the most recent available OECD science and technology indicators<sup>1</sup> were consulted for international comparative data. However, such data served merely as a backdrop against which institutional and systemic challenges of higher education institutions could be placed since they are not only influenced by national conditions but also by competition with international institutions and systems. On the basis of all of these findings, but with a strong emphasis on the qualitative findings of the institutional evaluation reports, the system evaluation team composed the following report.

In all analyses and comparisons, the report takes the high aspirations of the Slovak Higher Education system seriously, including the frequently expressed wish to take part in international competition, as these aspirations seemed to be shared by many Higher Education representatives all over the country and are the chief motivation for participating wholeheartedly in the review process.

## **2. University Research in an International Context**

The following sections set the international and European policy context and trends that provide the framework for the analysis of the 23 institutional reports and the research capacity of Slovakia.

### **2.1 Universities and Research in a Globalising World**

Globalisation is becoming a prominent preoccupation of politicians, citizens, media, employers and employees as well as researchers and educators across Europe. At first, it tended to be associated mainly with the economic realities of an increasingly interdependent world in which globally positioned corporations can relocate and distribute their development and manufacturing sites as they please – often to the disadvantage of the high-cost labour environments. But effects of globalisation can be observed also in other sectors of collective social practice: thus, in the world of scientific research, which has always been characterised by the comparatively high degree of internationality, global competition for funds and talented individuals as well as international comparisons and rankings are emerging with considerable speed and growing impact on individuals' choices. Moreover, advanced economies such as the European Union, the US and Japan represent a shrinking share of global R&D expenditure worldwide. According to OECD data, the EU-27 share declined from 29% in 1995 to 25% in 2005. Similarly the US and Japan have lost 4 and 3 percentage points respectively of their shares over the same period. As part of the overall process of globalisation, R&D activities are becoming increasingly internationalised.

With the rapid rise of newly emerging economies (mainly Asian), a 'multi-polar world' is developing in which the sources of competitiveness such as technology and human capital are more evenly distributed than ever before. The EU represents a diminishing share of worldwide population. Moreover, newly emerging economies are no longer competing on the basis of low-cost activities only. China is about to overtake the EU in terms of world share in exports of high-tech products. It should be noted that the increasing importance of newly emerging countries in globalised R&D is not only due to their rapid economic development and rising share in world GDP, but is also due to substantial increases in their R&D intensity (R&D expenditure as percentage of GDP).

At the same time, there has been a significant shift in the level of internationally controlled business R&D: according to the OECD, the share of domestic business R&D controlled by foreign affiliates increased from less than 12% in 1993 to 16.5% in 2001 in the OECD area, an increase of almost 40%. Thus the

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<sup>1</sup> See bibliography at the end of this document for detailed references.

progressive international relocation of R&D facilities is fast becoming a key element in the overall process of economic globalisation.

The increasing international mobility of knowledge resources also includes researchers in general and university researchers in particular. At internationally-oriented universities, the competition for leading researchers has led to increased flexibility and levels of salaries and start-up funds, but also to increasing awareness of the importance of competitive infrastructure and attractive doctoral programmes to support and renew research capacity. But research is not only pursued in its own right. More and more, it is seen in its role as a fundament for innovation and wealth creation in knowledge economies, with a range of new demands on university performance and relevance. Thus research intensive universities respond to the growing competition and the new demands with a whole set of aims and measures, addressing:

- Internal procedures/ incentives to reward and increase quality performance (after evaluation by peers), create attractive conditions for the best to come
- Prioritised thematic areas in which universities have outstanding strengths and critical mass, incl. formation of centres of excellence
- Fostering consortia, larger research groups/centres to increase visibility, to address fragmentation through specialisation – researchers don't force interdisciplinarity, but the benefits of clustering are recognised
- Increase of external grant income, enhancement of research support services to facilitate this
- Research and graduate training:
  - ⇒ Number of PhD students and post-docs in which fields (critical mass, relation to research strengths)
  - ⇒ Quality of graduate training, from mentoring to integration in graduate schools
  - ⇒ Internationalisation of graduate offer, joint degrees, programmes in English
  - ⇒ Attention to transferable skills to allow for diversified research-based careers (not just in academia)
- Careful planning and efficient (sometimes shared) use of technology platforms and costly scientific infrastructure, in conjunction with strategic planning and hiring policies
- Extension of innovation activities of universities, intensified partnerships with regional authorities and businesses.<sup>2</sup>

Such aims and measures only lead to success, however, if they can be supported with resources and flexibility of action. Thus, universities in most European countries are trying to convince their governments to gain more autonomy and resources so as to be able to face the challenges of globalisation and increasing international competition, often pointing to the model of the US, Canada and the UK where the advantages of autonomous institutional development have been visible at many research intensive and teaching oriented universities for several decades already. Accordingly, several formerly highly regulated countries (such as the Netherlands, Austria, Switzerland, Denmark, and some Länder in Germany) have opened up their universities to more autonomy, while emphasising accountability to the public funding authorities as well as the establishment of clear institutional responsibilities for rigorous quality development.

In the same vein, the Glasgow Declaration of European Universities (2005) underlines that "Europe needs strong and creative Universities as key actors in shaping European knowledge society through their commitment to wide participation and lifelong learning and by their promotion of quality and excellence in teaching, learning, research and innovation activities. [...] This will be achieved by self-confident

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<sup>2</sup> Sybille Reichert: *Research Strategy Development and Management at European Universities*. EUA Publications 2006.

institutions able to determine their own development and to contribute to social, cultural and economic well being at regional, national and European and global level (EUA, 2005b, p.2).” To achieve this, universities have to take “the responsibility for providing a broad research-based education to students at all levels in response to society’s growing need for scientific and technological information and understanding” (EUA 2005b, p. 4).

## 2.2 The Lisbon Agenda and the Challenges of the European Research Area

The diverging growth patterns in the output performances of the EU compared to the US, together with the increasing challenges and new opportunities created by the new major players, have been a source of deep concern for policy-makers. At the European level this concern has led to the initiation of the Lisbon process and efforts to encourage governments to launch employment- and productivity-enhancing reforms. In response to these challenges, the heads of state and government at the Lisbon summit set a 3% average economic growth target and the creation of 20 million jobs by 2010, identifying the main steps necessary to achieve this in policy areas such as enterprise, research and development, the opening of markets and environmental sustainability.<sup>3</sup> The EU vowed to push forward a wide-ranging reform programme, embracing new measures on innovation, liberalisation, enterprise and social inclusion. In particular, the EU became aware of having to take the necessary steps to increase substantially the efficiency and attractiveness of its research, in order to remain an important location for internationally mobile R&D investments. The subsequent streamlined version of the Barcelona summit in 2002 set two main EU targets: an R&D investment rate of 3% and an employment rate of 70%. In the EU’s latest annual progress report *Time to Move up a Gear* (January 2006)<sup>4</sup> the most urgent challenges were identified as:

- investment for higher education (under “upgrading skills”),
- innovation,
- cutting down bureaucracy and overregulation,
- improving the enterprise environment and
- bringing people to the workforce.

Simultaneous and overlapping with the Lisbon Agenda and inspired by the Bologna reforms in Higher Education, Philippe Busquin, the then EU Commissioner for Research, announced the creation of the **European Research Area** in 2000 as a means of co-ordinating national research policies and activities in terms of objectives, expertise and resources. Various conferences and forums for research policy debates and exchange of experience have been organised since then, leading to increased osmosis between reform debates in Europe. Increasing level and competitiveness of funding and focussing more on excellence have become core values in many research environments in Europe, even though they have not yet been realised as much as often proclaimed. Member States are developing commonly shared R&D policy objectives.

Observers often point to the Lisbon agenda’s over-ambitious overall objective, namely to turn the EU into “the world’s most competitive, knowledge-based economy by 2010” and highlight the fact that Europe is

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<sup>3</sup> Presidency Conclusions, Lisbon European Council. 23 and 24 March 2000. Available online at: [http://europa.eu.int/ISPO/docs/services/docs/2000/janmarch/doc\\_00\\_8\\_en.html](http://europa.eu.int/ISPO/docs/services/docs/2000/janmarch/doc_00_8_en.html)

<sup>4</sup> European Commission: *Time to Move up a Gear*, the European Commission’s 2006 Annual Progress Report on Growth and Jobs. Brussels, 2006. Available online at: [http://ec.europa.eu/growthandjobs/annual-report\\_en.htm](http://ec.europa.eu/growthandjobs/annual-report_en.htm)

not making any progress in catching up with the US. Indeed, although the EU's R&D intensity rose slowly but steadily during the late 1990s, by 2001 it had started to level off then decreased to just 1.84% in 2005, the last year covered by the most recent report.<sup>5</sup> If the current negative trend continues, by 2010 Europe's R&D intensity will have declined to its mid-90s level of less than 1.80% of GDP. It should be noted that over 85% of this 'R&D intensity gap' is due to differences in the levels of R&D funding from the business sector. In 2004, just 55% of R&D in Europe was funded by the private sector, compared to 64% in the US, 67% in China and 75% in Japan and South Korea. The Key Figures report attributes this difference in research intensity to differences in industrial structure and to the smaller size of the EU's high-tech industry.

In spite of the Lisbon agenda's lack of success in terms of R&D spending, one should observe that the Lisbon programme has provided EU governments with possible solutions, setting targets and benchmarks against which to measure national performance. It encourages EU countries to learn from each other. More and more EU Member States recognise the important place of R&D and R&D investment in the overall policy agendas. R&D is increasingly considered a key source for sustaining economic growth and welfare. Not surprisingly, those countries which have increased their R&D investments considerably in the last decade and have created favourable conditions for innovative initiatives, such as Finland, Ireland, Denmark, Netherlands, now benefit from increased innovation performance and competitiveness. In an attempt to reinvigorate the Lisbon agenda, consequent to the renewed Lisbon strategy in mid-2005, 26 Member States have set more attainable targets for their R&D expenditures as percentage of GDP for 2010 or other years. Even more importantly, the Lisbon Agenda is now being integrated more closely with national policies. On this basis, on March 22-23 2005, the heads of state endorsed the revision of the Lisbon Strategy as proposed by the Commission:

**The Integrated Guidelines for Growth and Jobs (2005-2008):**

To overcome the rather limited implementation of reform in Member States so far, the Commission has proposed focusing partnership with Member States on growth and jobs, and has introduced a Lisbon Action Plan that outlines actions to be taken at the EU and national levels in three policy areas:

***Making Europe a more attractive place to invest and work***

- (1) Extend and deepen the internal market
- (2) Ensure open and competitive markets inside and outside Europe
- (3) Improve European and national regulation
- (4) Expand and improve European infrastructure

***Knowledge and innovation for growth***

- (5) Increase and improve investment in Research and Development
- (6) Facilitate innovation, the uptake of ICT and the sustainable use of resources
- (7) Contribute to a strong European industrial base

***Creating more and better jobs***

- (8) Attract more people into employment, increase labour supply and modernise social protection systems
- (9) Improve the adaptability of workers and enterprises
- (10) Invest more in human capital through better education and skills

In order to ensure that some action is taken by the member states in accordance with their own declared commitment, the Commission publishes its assessment of progress on the implementation in its Annual Progress Report, indicating at the same time where it deems further action is necessary at Member State

<sup>5</sup> 'Key Figures 2007 on Science, Technology and Innovation. [http://ec.europa.eu/invest-in-research/pdf/kf\\_2007\\_prepub\\_en.pdf](http://ec.europa.eu/invest-in-research/pdf/kf_2007_prepub_en.pdf)

or Community level. On the basis of the Progress Report, the Commission can then propose amendments to the integrated guidelines, if necessary. Thus, in the Commission's 2006 Annual Report on Slovakia, the Commission agrees with the Slovak National Programme's identification of the business environment, R&D and innovation and information society as the key challenges in the micro-economic area, but also notes that despite the low starting point in terms of overall investment in R&D (0.58% of GDP in 2003), the National Reform Programme does not set national targets. The Commission then suggests that Slovak national policy could focus more explicitly on

- R&D and innovation in Small and Medium Enterprises (including early stage financing),
- increasing the impact of the high level of foreign direct investment in R&D and innovation and
- more and better leveraged public spending on R&D and innovation.

With respect to these policy suggestions it should be mentioned that these weaknesses noted for the Slovak Republic are also, only to a lesser degree, competitive shortcomings of the European Research Area in general. The latter falls short in its comparisons with the US and Japan in its low degree of business R&D investment. Indeed, the business sector's role in R&D funding differs sharply across the three main OECD regions. It funds almost three-quarters of R&D in Japan and 63% in the United States, but only 55% in the European Union. One should add that, since 2000, the business sector's share of R&D funding has not increased in most countries. But in the Slovak Republic, Hungary and the United Kingdom, it has even declined by more than 4 percentage points.

#### **Strategic Challenge 1:**

Since the Slovak Higher Education system compares unfavourably to the already low European average with respect to research and innovation investments, the Slovak Republic should seek urgent action in redressing the imbalance rather than letting it grow even more. Otherwise Slovakia runs the risk of losing the possibility of joining the competition since the pace of development is accelerating rather than slowing down in the more favourably placed institutions and systems in the world. In addition to increasing the level of funding significantly, the framework conditions will have to be adapted to

- provide opportunities for rewarding performance and initiative,
- reduce the fragmentation of the research system both in terms of funding streams and structures,
- foster institutional alliances, networking and creating critical mass,
- incentivise private investments in public research
- provide adequate competitive infrastructure for research.

(See section 4.2)

A short review of key features and challenges in the European Research Area would be incomplete without mentioning the key resources for researchers: external **research grant opportunities**. Increasingly, European researchers have looked beyond their national grant agencies to the growing number of funding opportunities at EU level. In this context, the Framework Programmes have clearly been the principle means of driving research cooperation and competition within Europe. Important recent FP funding instruments include the 6th Framework Programme's Networks of Excellence which are designed to bring together excellent groups across Europe; Technology Platforms which are industry-led public-private partnerships that focus on areas with high degrees of industrial relevance and technological promise. The familiar Marie Curie grants continue to be very desirable grant schemes for young researchers. While the available overall research funds at EU level are small compared with the total of national research funding across member states, the density of European cooperation which it fosters has had significant effects on flow of ideas and research contacts in Europe. Moreover, in countries such as

Slovakia, with comparatively low levels of research grant funding, EU research grants can have a decisive impact on the competitiveness of individual research groups, especially in research areas in which scientific equipment is costly and easily outdated.

There has been a growing realisation that excellence in basic research is not only a value in its own right but also the feedstock of innovation, as the lead-time between discovery and application decreases. It is basic research which endows those trained in it with powerful transferable skills, flexibly deployable to a wide variety of applications. In response to the perception that Europe's performance in basic research had fallen below the level required, the Commission created the **European Research Council** in 2005, with a remit to fund basic research on the sole criterion of excellence. The ERC grants are distributed purely on the basis of excellence of the groups and proposals, regardless of geographic origins. As yet, the overall level of funding is low compared with that in most national research budgets so that it is unlikely to have a major impact on national processes. However, there is considerable support and lobbying for an increased ERC budget in the future. The awards of young researcher grants of the first round show a wide distribution across Europe. It is important to note, however, that the ERC takes into account the research working conditions in institutions as part of its selection criteria.

In 2004/5 the Commission also proposed the creation of a **European Institute of Technology**, inspired by the success of MIT, and by the recognition that Europe needs to improve the impact of its research in the innovation process. In principle, such an initiative would be the natural complement to the ERC. The EIT concept has been subject to strong criticism, from within both the research and business communities. The compromise solution has been to base EIT grants on networks of highly competitive research groups from existing universities: "pilot networks that will design, implement and test new models of integrated partnerships between the actors involved in technological innovation and transfer (such as universities, research organisations, small, medium-sized and large companies, innovation centres, etc.). The knowledge and experience therefore produced should not just support these networks in taking their integration a step further, but also provide good practices and support both for existing networks operating in the knowledge triangle and for policy-makers who are designing new instruments and initiatives to support integration. The final goal is to facilitate knowledge-sharing and technology transfer by building up the capacity of European networks in strategic interdisciplinary fields to bring their collaboration to a new, more integrated form of partnership."<sup>6</sup>

Finally, the European Research Area debates can be said to have led to a significant shift of focus in the deployment possibilities for EU Structural Funds. While the latter have already made a decisive difference to the research capacity of some countries and regions in Europe because of generous support for scientific infrastructure (as has been observed e.g. in Ireland, Spain and northern England), the possibilities of using Structural Funds for research capacity development have expanded even more considerably in recent years. The usefulness of these major funds (significantly larger than the EU's research grant expenditures) is dependent on the ability of the national ministries and regional agencies to coordinate their competences, to design flexible competitive funding channels and to make sure the money ends up in the most promising channels with long term structural effects. Recently, some Eastern European regions (such as Moravia around Brno) are beginning to show excellent methods and energy in using these funds to their competitive advantage by focussing on research investments.

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<sup>6</sup> [http://eur-lex.europa.eu/LexUriServ/site/en/oj/2007/c\\_143/c\\_14320070628en00090012.pdf](http://eur-lex.europa.eu/LexUriServ/site/en/oj/2007/c_143/c_14320070628en00090012.pdf) Each grant will amount to between EUR 0,5 and 1,5 million. The maximum grant will be EUR 1,5 million.

**Strategic Challenge 2:**

The Slovak Research and Innovation System should use the Structural Funds as a unique window of opportunity in the coming years by making full and effective use of these substantial means for renewing the research infrastructure, networking and framework conditions for all actors in research and innovation in order to build their international competitiveness. Today, better infrastructural conditions and maintenance of workplaces are vital preconditions for competitive research environments. The central role of the universities as providers of research competences and of the research foundation for innovation should be recognised and supported. Hence, in the implementation of the Structural Fund programmes universities should be consulted in order to ensure effective funding instruments and networking incentives. In addition, the ERC institutional criteria should be carefully considered in order to ensure that higher education institutions provide the appropriate research environment.

## **2.3 The Bologna reforms and the European Higher Education Area**

The Bologna reforms (Bologna Declaration, 1999) are often associated with European systems adopting a three cycle degree structure (Bachelor, Master, PhD) to allow for greater international comparability of their degrees. While such a change is indeed major for any national system that was previously based on long degrees, the Bologna reforms actually reach even farther than the more “superficial” restructuring of curricular content. Part of the objective of the European reforms, to which ministers have publicly subscribed, is a deeper change of focus from a teacher-centred to a learner-centred approach in tertiary education throughout the European Higher Education Area.

Such a shift of focus seeks to respond to the changed career and work environment in which graduates have to succeed. In a world in which professional careers and vitae are becoming less determined, less continuous, and characterised by more international and inter-sectoral mobility, with people changing employers and places of employment several times in their lives, adaptability has become a key asset. Moreover, more people choose to be self-employed, constructing their own professional portfolio. Entrepreneurial activity is becoming a prominent value in our societies. Interdisciplinary competences are becoming vital in careers which are based on research, technological development and innovation. All of these trends have a profound impact on the way we perceive university research and education and their function for the individual and society. To respond to these demands, university education is shifting its focus away from pure knowledge acquisition to defining competence profiles as structuring principles of university curricula. It is becoming increasingly difficult to define a body of knowledge that can be regarded as a definitive and a more or less complete foundation which will enable a university graduate to feed from this knowledge ground for decades to come. Thus curricula and teaching policies are increasingly focussing on the analytical, methodological, conceptual and communicational skills which will enable a university graduate to adapt to changing requirements and be innovative throughout his or her life.

Such changes of perspectives require new ways of organising curricula and the teaching process itself (e.g. less ex-cathedra, more counselling of independent projects and teams). Hence the above-described shift of focus, which the Bologna reforms have emphasised and which some countries have already introduced, calls for a new educational approach and culture in undergraduate and post graduate education. Teachers in higher education need to become aware of the fact that they may have to develop their own skills in order to be able to change roles, from being the authority and communicator of

knowledge, to becoming a creator and facilitator of learning, with diverse flexible learning possibilities offered to a variety of student groups.<sup>7</sup> Thus, if taken seriously in their deeper vision and ambition, the Bologna reforms do not just concern the formal curricular structures but also didactics and assessment. These changes are sometimes summarised under the term “student-centred curricula or teaching methods”, and often begin with a clear definition of learning outcomes which are to be reached in each given module or course. While this already proves to be quite challenging, new methods of assessment which would reflect the orientation toward these learning outcomes may be even more so. Clearly, across Europe, the move to learner-centred teaching and curricula is still a vast experimental field and far from being truly realised anywhere. But attitudes are changing quickly and the attention to the support of the individual learner and his or her needs is gaining remarkable momentum especially in the most competitive university environments.

**Strategic Challenge 3:**

Slovak higher education has whole-heartedly adopted the Bologna reforms and has adapted legislation and curricula according to the new structural demands. The paradigm shift in teaching, as in other places in Europe, will need to be addressed. The institutional evaluation reports note that this deeper challenge of shifting attention to the diverse needs of the learners and the competences they need to excel in tomorrow’s working environments has not yet been addressed at all universities. Given the rapidly changing industrial and employment structure in Slovakia, the increasing mobility and international orientation of the country’s key employment sectors, the time has come to take the challenge of competence orientation seriously at all universities, both in the dialogue between universities and employers as in the approaches to teaching and learning within higher education institutions.

Another central concern of the Bologna reforms centres on common standards and trust among quality assurance systems in Europe. On the basis of increasingly close cooperation between the different quality assurance and accreditation agencies, the European Standards and Guidelines for Quality Assurance have been developed and were adopted by the Ministers in Bergen in 2005. In this context, the ministers have emphasised the key role of higher education institutions in quality assurance, particularly in developing a quality culture of continuous self-improvement. Accordingly, external quality assurance may become lighter if such institutional quality culture can be observed. Hence, Europe is moving away from the traditions of state control of quality to a system based on trust in the initiative and willingness of institutions to monitor their quality effectively on their own. Quality audits of such institutional quality arrangements are replacing multiple programme evaluation and accreditation and institutional quality systems are becoming more robust, coherent, systematic and strategic in their outlook.

**Strategic Challenge 4:**

As part of the Bologna reforms and for the benefit of its own overall improvement, the Slovak higher education system, like others in Europe, is facing the challenge of introducing a more trust-based and more systematic approach to quality assurance within higher education institutions and of moving away from methodologies of external control of minimal standards toward internal improvement-oriented processes of quality enhancement. These processes require some resources, however, to address the need for improvement wherever it is identified. Undoubtedly, such a change will be vital for building self-reinforcing quality culture at Slovak higher education institutions.

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<sup>7</sup> Sybille Reichert and Christian Tauch, *Trends IV: European Universities Implementing Bologna*, EUA Publications 2005.

A last ingredient of the Bologna reforms should be mentioned in a system review which focuses on the research capacity of the system, namely the remarkable attention and energy which has recently been invested in the reform of doctoral provision all over Europe. While Bologna turned its attention to doctoral education only after 2003, to ensure completeness and allow for a link with the development of the European Research Area, several national systems had already addressed the weaknesses of traditional doctoral training since the early 90s. Many of their analyses of the weaknesses as well as some of their ideas for solving them were picked up at European level in the beginning of this decade and have recently developed into a relatively coherent reform agenda. In addition to the central issues of improving the quality of support and supervision and embedding individual doctoral candidates in an interdisciplinary culture of intellectual exchange, the European debates have focused strongly on raising awareness of the diverse career tracks which doctoral candidates should be prepared for. While Europe may have enough doctoral degree holders for the needs of academia, the value of doctoral researchers for raising the innovative capacity of industry still has to be realised. Only if doctoral candidates can look beyond the narrow confines of their own specialisation and are able to work in international teams and distributed processes of innovation can Europe make increased use of them. Some research intensive national environments such as UK, Germany, Netherlands, France and Scandinavian countries, have invested considerable money and grant agency attention to making doctoral education more attractive and internationally competitive.

**Strategic Challenge 5:**

In the light of Slovakia's needs in industry and academia which imply a considerable increase in demand of doctoral degree holders for a wide range of different function, the higher education funding agencies, ministry and universities should ensure that sufficient attention is paid to the attractiveness and international orientation of doctoral education in order to prepare candidates for an internationally oriented career and to provide them with a supportive and stimulating research environment that foster interdisciplinarity and prepares them for a variety of career tracks in university or industry.

These five strategic challenges are further substantiated and detailed in the remainder of this report.

### **3. Slovakian Higher Education Institutions in Transition**

#### **3.1 Facing Widened Access and Diversified Needs**

Slovak higher education has undergone fundamental changes since the fall of the iron curtain. First, the new Higher Education Act which was adopted in the former Czechoslovakia in 1990 marked a new era, bringing academic freedom to higher education after a period of central management by the government of contents and procedures. The Higher Education Act of 2002 (Act No.131/2002 of Law Code on Higher Education) introduced another set of radical changes, such as the implementation of the Bologna Declaration and the establishment of higher education institutions as legal entities (having been State budgetary institutions before) as well as profound changes in the allocation of funds to Higher Education Institutions (see sections 3.2 and 3.3).

As far-reaching as these changes were, they were surpassed by the even deeper transformation which occurred in the context of widening access to higher education. Several new universities were newly established to satisfy the increased demand for higher education. Others were merged from existing institutions. Yet others added many new programmes, even entire faculties, to try to face the challenges posed by doubled student numbers. Thus the number of undergraduate students (first and second level)

increased from 60,000 to 168,000 in just 16 years (1989 and 2005); the percentage of new entrants to tertiary study rose from 27.2% to 61.4% of all 18 year olds (two thirds of which are registered as full time students), which is a remarkably high proportion. Having tripled in just a decade, the number of students has increased further by one third over the last three years. In particular, the number of part-time students rose sharply, partly due to ambiguous legislation which allowed extra income through tuition from part-time students. That such quantitative expansion was not only difficult but also necessary is reflected by the fact that even after this enormous expansion in the last decade, Slovakia's share of the population with a tertiary education still reaches only 58% of the EU-25 average (and 68% of the EU-25 average of S&T graduates). But among 18 year olds, the share of persons entering higher education is now over 50%, which implies a considerable range of qualifications and abilities.

It should be added that student increase also includes the third level. During the last fifteen years, there was also a sharp increase in the number of postgraduate students, from about 600 in 1990 to 10,400 in 2005. As can be imagined, the increase in staff and their training to cater for this hugely increased demand obviously lags behind.

Hence one may say that, until recently, the main focus of higher education reform was on the quantitative development of the higher education system. Since there was no concurrent change in the profile or definition of higher education institutions, apart from adding institutions and programmes, this resulted in a softening or even removal of strict entry requirements, such as *numerus clausus* or other strict selection processes. Only the most popular subjects, such as medicine, and some of the niche subjects such as fine arts, retain strict entry requirements. Moreover, as universities were largely funded on the basis of student numbers, there was a systemic incentive to allow for greater variety in the quality of students' and graduates' qualifications. At the same time, universities have not fundamentally adapted their expectations. Nor has the system introduced differentiated types of institutions with significant differences in institutional and student profiles (as was done in some other European countries facing massification, for instance Germany, Austria and Switzerland, which introduced Fachhochschulen to cater for different qualification profiles). As a result, while the number of university graduates is reaching a level which in some fields may even go beyond the demand for university graduates, drop-out rates are increasing, particularly in the natural and technical sciences. The student drop-out rates reflect the differences of entry conditions: in the natural sciences it is over 50% of the entering student cohort, while in subjects with entry exams it is under 10%. Many institutions have kept their entry qualification standards higher for full-time students and softened the requirements for the paying part-time students. All in all, the process of expansion is extremely rapid and, in spite of increasing funds, the higher education system remains too under-resourced to be able to adapt to new demands.

**Strategic Challenge 6:**

While the Slovak higher education system may be applauded for the enormous effort to increase higher education participation and universities have done a remarkable job of expanding their teaching provision and building up research activities at the same time, the quality of educational and research activities has suffered from the pace and insufficient financial coverage of that expansion. The time has come to address the quality of the provision and to allow for sufficient internal differentiation and experiments to cater for the wide range of diverse needs and student profiles. The current differentiation, in terms of admission criteria and tuition, between part-time and full-time students seems rather unfair and too crude to provide institutions with sufficient incentive to develop differentiated qualification profiles. The fact that institutional grants are mainly based on student numbers provides further disincentives to differentiate among different target groups and qualification profiles.

Of course, the above comments should not be seen to diminish the commendable dedication of the Slovak Republic to the goal of trying to face the key challenge of providing more chances to more of its citizens and a sufficiently large and qualified work force for an expanding economy. For this the Slovak Republic and its higher education institutions should be congratulated. Only now that the pace of economic growth has shown several years of strengths, can the full scope of the demand for qualified labour begin to be felt. Indeed, even though graduate supply has as yet been more of a strength than a weakness, with respect to some fields, a qualified labour force is lacking: in recent years increasingly urgent concerns have been voiced by Slovak industrialists concerning the insufficient supply of science and engineering graduates, as is often noted in many highly developed countries (such as the UK and the US).

This growing demand could hardly be foreseen and reflects the changed structure of industry: fifteen years ago industry did not need many technical university graduates since most foreign investment concerned low-cost manufacturing. At that time, the Slovak industry structure was uncompetitive, with huge over-employment and insufficient capital leading to much needed restructuring. Thus in the nineties, there was a great need to regenerate the supply of technically trained workers as industry was reducing its forces. As far as higher qualification needs were concerned, these related more often to new management skills and business know-how. In response to the new demands, universities developed more programmes and educated more people in economics or business subjects, either at separate, often newly founded, faculties or at departments of existing ones. Since these subjects were seen as less challenging for a larger variety of students, they continue to be very popular to this day, even though there is no evidence of a corresponding demand for business graduates. In contrast, technical subjects have not been promoted. Since universities are paid by student numbers these subjects absorb more money than is covered by the government grant, and thus there is a disincentive to offer difficult study programmes with higher expenditures and lower budget returns. Hence a major disproportion of student numbers in subjects of scientific or technical orientation can be seen when compared with those in economics or social sciences. In the meantime, today's industry shows an increasing capacity in higher skilled and technical labour and a concurrent demand for both technical non-academic workers as well as university graduates with science or engineering degrees, as recent growth in high-tech exports shows.<sup>8</sup> Industrialists from the relevant sectors comment that they increasingly face a human resource shortage in these fields. Supply is especially scarce in electrical engineering and computer science and it is difficult to find graduates, especially for more remote locations or less well paid jobs. The highest concentration of graduate demand can be found in the automotive industry which makes up 33% of economic production.

**Strategic Challenge 7:**

To underpin the rising Slovak economy and to foster its knowledge intensity and productivity in key sectors, the Slovak Republic has to enable its universities and other higher education institutions to educate and train more graduates in natural and technical sciences and some organisational social sciences, which has implications not only for the number and qualifications of professors but also for the provision of up-to-date scientific infrastructure and library resources.

Slovak higher education is facing another major challenge which is linked to the challenges of widened access and of supplying sufficient science and engineering graduates: the renewal of its academic body. At most universities visited in the context of the EUA system review, the age distribution of the academic staff was a serious issue, with many professors and associate professors over fifty and in some faculties averages were even higher. While the imminent need to renew a major part of the academic staff is an

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<sup>8</sup> IMD World Competitiveness Yearbook 2006, Hayek Foundation, p.259.

obvious threat to the future pedagogical and research development of the universities, it could also present an opportunity for injecting new blood, ideas and qualifications for the future development of the university sector. This opportunity can only be seized, however, if the conditions for an academic career in terms of salary, infrastructural support, research possibilities and other benefits are attractive in comparison to other professional options (see section 4.1.5). Currently, most university leaders and academics report that conditions are very far from being competitive in these respects.

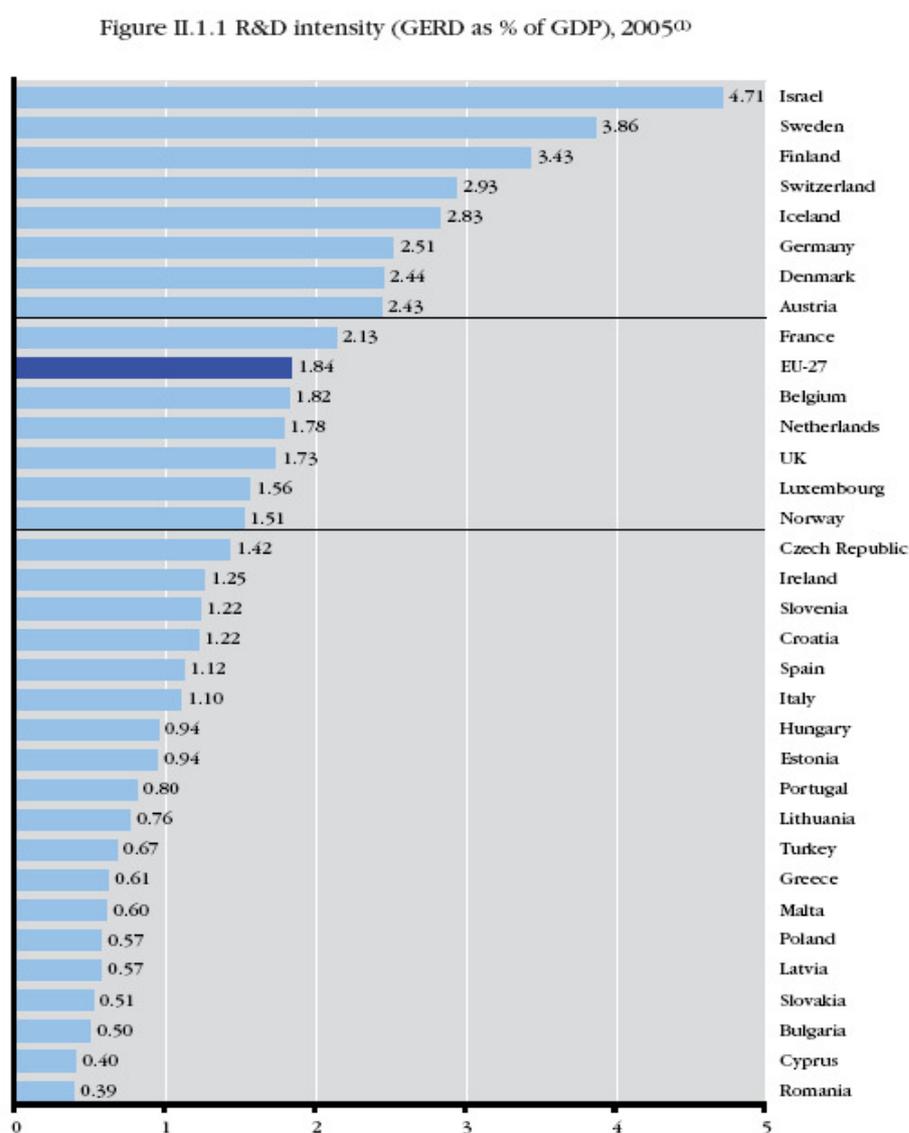
**Strategic Challenge 8:**

In the next decade, the Slovak higher education sector will have to replace a majority of its academic staff. While this may be seen as a major opportunity for intellectual renewal, it will also require a major investment to create competitive conditions for academic careers. If such conditions are not created, Slovak higher education will be unable to produce the qualified labour it needs to underpin its economy and society and to increase its knowledge base and productivity.

### 3.2 Funding Higher Education Institutions

As mentioned above, comparative figures show that the Slovak Republic has not given R&D its prioritised attention. With slow growth rates over the last decade the Slovak Republic is noticeably lagging behind the already low average spending on R&D in EU 25, as well as the average growth rates, as the charts from the European Commission's Key Figures 2007 show below. Thus, in its overall assessment of R&D funding, the European Commission notes that a group of six low R&D-intensive Member States, including Greece, Bulgaria, Poland, Slovenia, Malta and Slovakia, has been falling further behind since 2000.

**Figure 1: R&D Expenditures of EU 27 in Comparison as % of GDP**  
(Key Figures 2007 of European Commission)



Source: DG Research

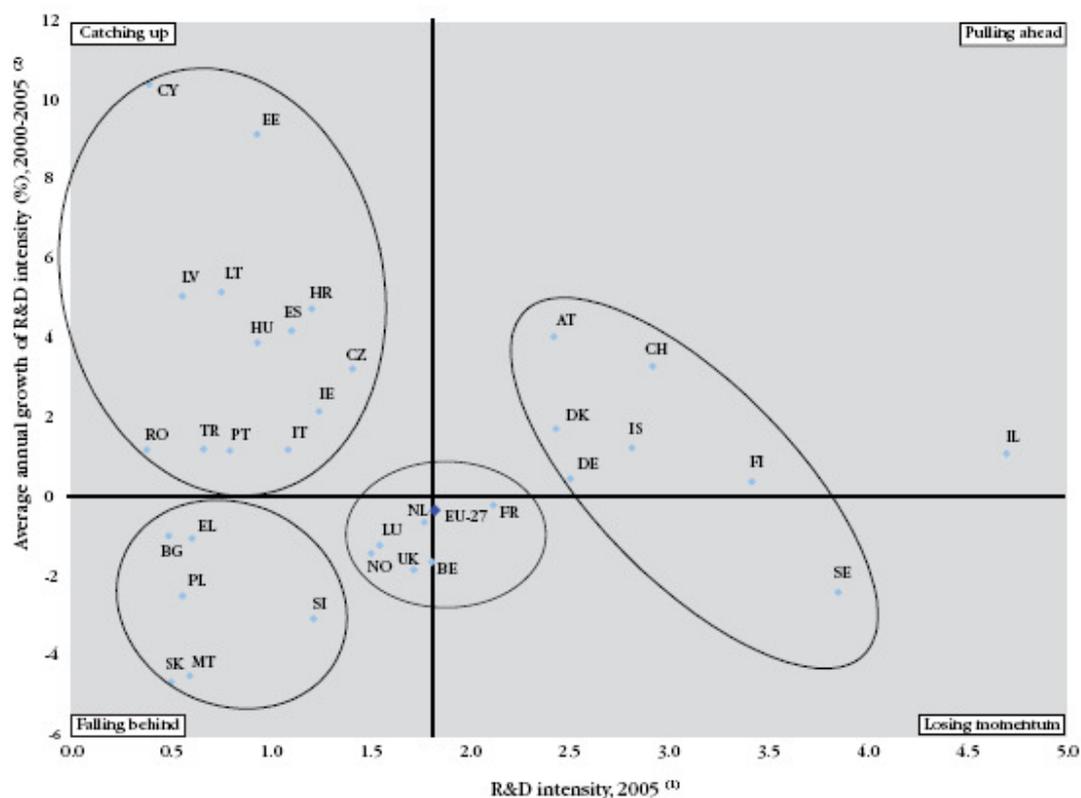
Data: Eurostat, OECD

Note: (1) IT, NL, RO, UK, HR, TR, IS, CH: 2004; AT, FI: 2006.

Key Figures 2007

**Figure 2: Recent Trends in Annual Growth of R&D Expenditures**  
(Key Figures 2007 of European Commission)

Figure II.1.2 R&D intensity, 2005 and average annual growth, 2000-2005



Source: DG Research

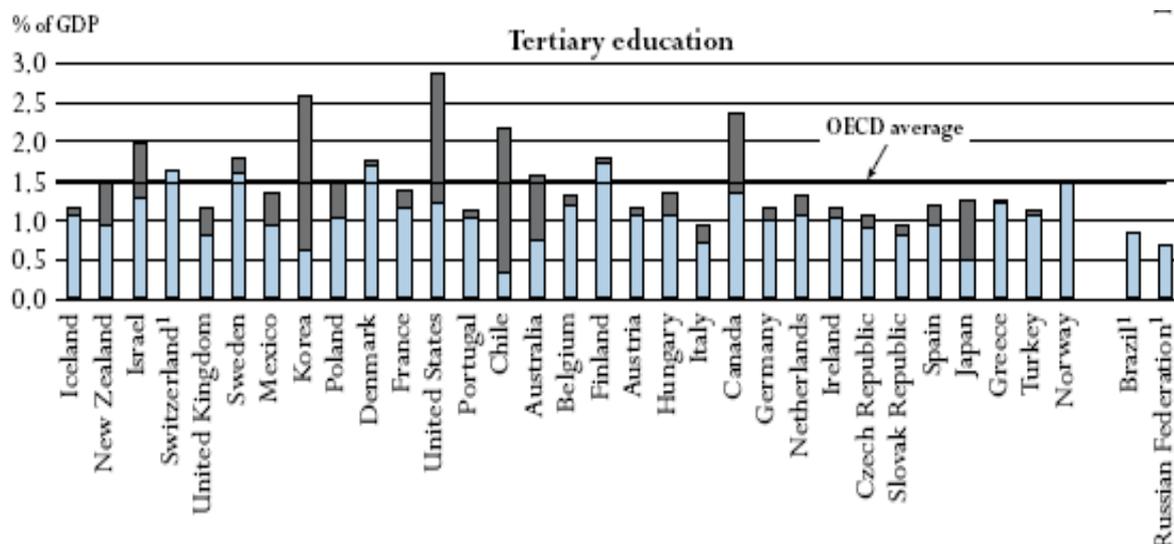
Data: Eurostat, OECD

Notes: (1) IT, NL, RO, UK, HR, TR, IS, CH: 2004; AT, FI: 2006.

(2) IT, NL, RO, UK, TR, IS, CH: 2000-2004; AT, FI: 2000-2006; EL, SE, NO: 2001-2005; HR: 2002-2004; MT: 2004-2005.

Key Figures 2007

On the more optimistic side, it should be added, however, that government investment, while low in relative terms, has improved significantly in absolute terms and that conditions may well improve rapidly in the future: The Slovak Republic has been benefiting from a healthy growth of its GDP from 2% in 2000 to 5.4 in 2006, with further increases expected from 2007 onwards. Accordingly the GDP per capita income also rose from only 47.2% of the EU average in 2000 to 55.2 in 2006 (58.7% predicted for 2008). In the same period, higher education expenditures also rose significantly from 5.1 billion to 11.5 billion SKK (309 million Euro) from 2000 to 2006, an increase of 125%. Expenditures in 2006 have risen by 11.6 percent compared to those of 2005. Thus public expenditure on the higher education system has increased from 0.71% of GDP to 0.75% of GDP in 2006, a slight improvement but still well below the OECD average of 1.5% (see table below for international comparison).

**Figure 3: Tertiary Education Expenditure as Percentage of GDP**

1. Public expenditure only.

Countries are ranked in descending order of expenditure from both public and private sources on educational institutions in primary, secondary and post-secondary non-tertiary education.

Source: OECD, Table B2, 1b. See Annex 3 for notes ([www.oecd.org/edu/eag2006](http://www.oecd.org/edu/eag2006)).

StatLink: <http://dx.doi.org/10.1787/633760656440>

If the above figures may seem rather abstract, they become more accessible if one expresses them in terms of the resources available for each student. From 2000 to 2006, the expenditure per student rose from € 3045 to €4678 (57930 to 101716 SKK) per student, as compared to the OECD average of \$11,254, or EU average of \$ 9872. Very few countries in the EU spend as little per student as the Slovak Republic does, e.g. Greece (\$4925 per student). Only Poland has a slightly lower expenditure per student.<sup>9</sup>

Of course, it is not only the level of funding but also the funding mechanisms which determine higher education conditions. Here it should be noted first that the largest part of state funds for higher education are distributed to the universities for their teaching function based on the input parameter of student numbers. While the public higher education is funded by four type of subsidies, by far the largest part of the subsidy is provided for teaching accredited study programs. This part is based directly on number of students. The other three kinds of subsidies for research, development or artistic activity, the subsidy for development of a higher education institution and the subsidy for students' welfare are based on different criteria, but only make up a small part of the institutional budget. Only 20% of university budget is based on research performance, although this is being increased to reach 30% in the near future according to government officials. As we shall see in the section on university research funding, the current allocation of research funding at national and institutional level is not only insufficient quantitatively and proportionally, but would also benefit from more effective and less fragmented funding channels (see section 4.2.2). One should note already here that significant attention has been paid in recent years to increasing competitive and performance-based allocation of institutional grants and individual grants for researchers. However, the bigger part of national research funds does not end up with the universities or university researchers, either through institutional grants or through competitive research grants, but

<sup>9</sup> OECD: Education at a Glance 2006, p.188 (Table B1.1c.:Annual expenditure per student on core services, ancillary services and R&D (2003))

rather with the institutes of the Academy of Science. A greater part (SKK 1 744 million) of the overall national research budget is spent on the “government sector” which does not include higher education institutions but the Academy (SKK 1 481 million) with its 56 research institutes as well as the 20 research institutes that are directly under the responsibility of individual ministries. The higher education sector itself only receives an annual budget of SKK 1 305 for research and development. While the previous government has already started to redress the imbalance of research funds between universities and institutes of the Academy slightly, university research still remains dramatically under-resourced.

**Strategic Challenge 9:**

The gap between Slovak R&D expenditures and the rest of the EU, especially the most competitive Members States, is considerable and increasing further. Recent increases (in absolute terms) of R&D and higher education expenditures by the Slovak government are commendable but insufficient to close that gap. Although the consequences in terms of government prioritised spending still remain to be drawn, the Slovak Republic’s Lisbon Competitiveness Strategy has recognised that the current growth of the Slovak economy could be sustained provided there is greater investment in research and innovation, and commitment to the production of highly qualified labour. This also requires favourable framework conditions for research production and knowledge-intensive industries.

### **3.3 Institutional Differentiation**

As mentioned above, the higher education sector has seen a decade of remarkable expansion which has been shouldered both by existing universities, many of which have doubled or tripled their student numbers, as well as through the founding of new public universities, such as UCM Travná, or the merging of existing smaller institutions or faculties into new universities. While the Slovak universities differ in disciplinary profile they are alike in basic institutional types, missions, and core functions, though very different in size and research intensity.

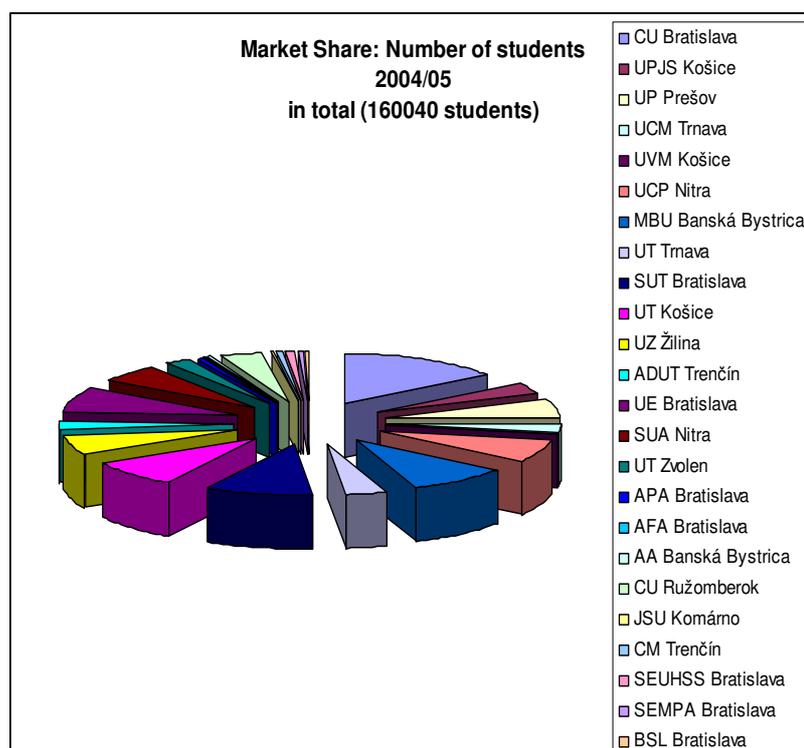
With respect to disciplinary differentiation, more than half of the 20 public universities have some subject area monopolies or a profile which is strongly dominated by some subjects: the universities of Zilina (transportation) and Veterinary Medicine in Kosice (veterinary sciences), the Slovak Medical University in Bratislava, SUA Nitra (agriculture), the Economic University of Bratislava, which is the largest of the strongly subject-focused universities, the Technical University of Zvolen (forestry, environmental and ecological technology, engineering and sciences), Presov University (Greek Orthodox and Catholic theologies), J. Selye University in Komárno (Hungarian Reformed Theology), the Academy of Performing Arts, the two Art Academies in Bratislava and in Banská Bystrica, as well as the two state academies (Police and Military). Four universities are restricted to humanities and social sciences and have a similar subject profile that combines theology, humanities and education (with some recent additions such as economics, law or health care). They have their origins in divinity schools or in catering to the needs of different Christian churches or denominations: the University of Trnava (Jesuit catholic), Catholic University in Ružomberok, J. Selye University in Komárno (Hungarian Reformed), Presov University (Greek Orthodox). Their Faculties of Education are also responsible for teacher training and often attract large numbers of students. UCP Nitra also strongly focuses on education, but has added a strong focus on central European studies, as well as programmes in other arts and social sciences, the natural sciences, and health care, to its portfolio. Five universities are strongly technically oriented: the Slovak Technical University, the Technical Universities of Kosice and Zvolen, the University of Zilina and the Alexander Dubček University of Trenčín. Among the comprehensive universities, Comenius stands out in size and

breadth of subject areas, followed by UCP Nitra which is in the process of becoming comprehensive, Pavel Jozef Šafárik University in Košice, UCM Trnava which is younger and has two strong focus areas of media and mass communication and physiotherapy and rehabilitation.

Thus the Slovak higher education system is highly differentiated in terms of subject profile. At the same time the sharper contours of such subject differentiations are being blurred in the process of expansion as most of the originally specialised universities have added a wider range of subject areas in the last decade, moving little by little toward more comprehensive universities.

**Figure 4: Distribution and Market Share of Student Numbers among Slovak Higher Education Institutions** (Source: Slovak Rectors Conference, Data for EUA Sector Report)

Higher education institution	Number of students 2004/05 in total
<b>CU Bratislava</b>	24.401
UPJS Košice	5.503
UP Prešov	9.523
UCM Trnava	4.368
UVM Košice	860
<b>UCP Nitra</b>	11.147
<b>MBU Banská Bystrica</b>	15.215
UT Trnava	6.222
<b>SUT Bratislava</b>	16.185
<b>UT Košice</b>	13.885
UZ Žilina	9.996
ADUT Trenčín	4.064
<b>UE Bratislava</b>	13.142
SUA Nitra	9.572
UT Zvolen	3.869
APA Bratislava	820
AFA Bratislava	525
AA Banská Bystrica	349
CU Ružomberok	6.278
JSU Komárno	637
CM Trenčín	884
SEUHSS Bratislava	1.455
SEMPA Bratislava	619
BSL Bratislava	521
<b>Total - public HEIs</b>	<b>156.561</b>
<b>Total - private HEIs</b>	<b>3.479</b>
<b>Total - SR</b>	<b>160.040</b>



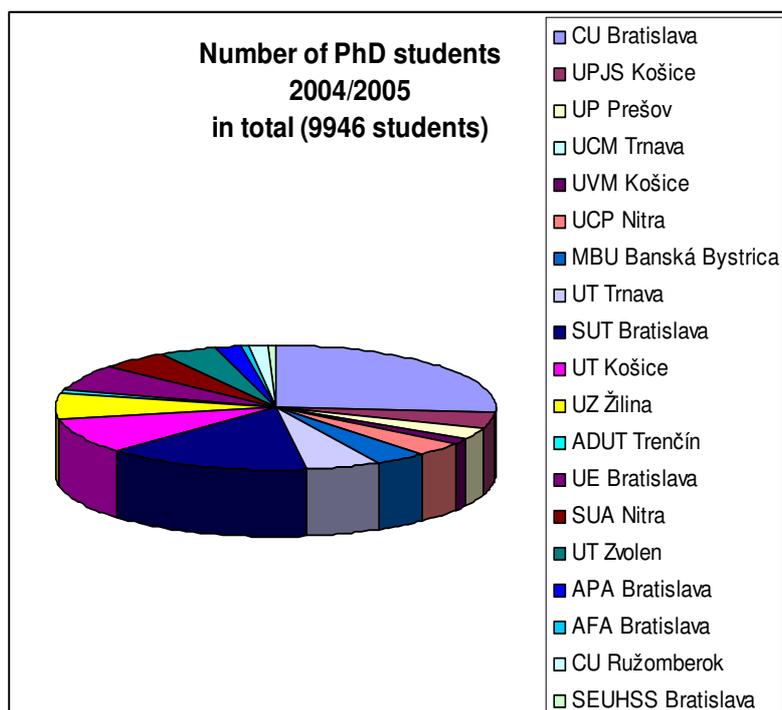
In terms of size, there are five large, ten medium-sized and five small universities or higher education institutions. The five large universities comprise the classical comprehensive university Comenius University in Bratislava (24000 Bachelor and Master level students and 2600 PhD students in 2004/5), the Slovak Technical University in Bratislava (16000 and 1500), the Technical University in Kosice (14000 and 900), the Economic University of Bratislava (13000 and 700) as well as UCP Nitra (11000 and 500). In addition to nine medium size universities (between 3900 and 9500 students), there are five public higher education institutions and one state higher education institution with around 2000 or fewer students, namely the three academies of arts, the Police Academy and the University of Veterinary Medicine in Kosice and the youngest of the universities the Hungarian speaking J.

Selye University in Komárno. The four private universities are also small in size: three have fewer than 1000 students.

Apart from differentiation through disciplinary orientation and size, there are no differences in institutional types. The three basic functions of teaching, research and service to the community (including cooperation with external partners and continuing education) belong to the mission of all universities, in principle without any differences of weight. De facto, however, the distribution of weight attributed to research functions differs widely, not only within institutions but also between institutions, as reflected by the number of PhD students.

**Figure and Table 5: Number and Distribution of PhD Students at Slovak Higher Education Institutions**

(Source: Slovak Rectors Conference Data for EUA Sector Report)



Higher education institution	Number of PhD students 2004/2005 in total
CU Bratislava	<b>2.629</b>
UPJS Košice	383
UP Prešov	308
UCM Trnava	0
UVM Košice	143
UCP Nitra	336
MBU Banská Bystrica	387
UT Trnava	557
SUT Bratislava	<b>1.498</b>
UT Košice	<b>916</b>
UZ Žilina	657
ADUT Trenčín	89
UE Bratislava	692
SUA Nitra	492
UT Zvolen	418
APA Bratislava	192
AFA Bratislava	66
CU Ružomberok	129
SEUHSS Bratislava	54
<b>Total - public HEIs</b>	<b>9.892</b>
<b>Total - private HEIs</b>	<b>54</b>

As this figure and table show, the lion share of research training -- which is often associated with research capacity and intensity of an institution -- is represented by Comenius University and the Slovak Technical University of Bratislava, followed by the Technical University of Kosice. Significant numbers of PhD students are also enrolled in the University of Economics in Bratislava, the University of Zilina, the University of Trnava, and Slovak Agricultural University, and still significant but fewer, in descending order, in the Technical Universities of Zvolen, UPJS Kosice, MBU Banska Bystrica and UCP Nitra. If we look at the PhD student percentage compared to first and second level students, the Academy of Performing Arts has the highest proportion of PhDs, followed by the University of Veterinary Medicine in Kosice, the Academy of Fine Arts, Comenius University in Bratislava, TU Zvolen, Slovak Technical University, and the University of Trnava.

It should be noted that until 2002 the designation "university" was dependent entirely on the applicant institutions regardless of their academic profile, professional or vocational orientation, research intensity or breadth. However, after 2002, when the new higher education act came into force, the higher education institutions were supposed to be strictly divided between university and non-university type of HEIs.

According to the law “The university type of higher education institution shall provide education in the study programmes of all the three levels with a significant portion of study programmes of the third level.” The non-university type of HEI “shall be named professional HEIs and they should provide higher education predominantly in the study programmes of the first level (Bc)” thus corresponding more to the German, Swiss, or Austrian “Fachhochschule” or Dutch “Hogeschool”. The law also introduces a third type of institution, or subtype of university, namely the “research university” which “shall achieve outstanding results in the field of science and technology as well as implementing the study programmes of the third level (PhD)”. In order to establish the institutional type of a given HEI, the law foresaw that the Accreditation Committee would make a proposal to the Ministry of Education which would then make the final decision. However, the law’s typology has not yet been realised. In spite of the above legal definitions, to this day, no HEI has been designated a “research university” nor been given more money on the basis of institutional type, and none of the higher education institutions which called themselves university before 2002 has changed its name. Instead, the institutional differentiation continues to be a widely discussed issue among politicians and higher education representatives.

The new HE Act which was drafted and ratified in the course of 2007 again differentiates between three types of institutions but no longer distinguishes the research university. The three types are called university, higher education institution, and professional higher education institution and are distinguished by the level of teaching provision and the kind of research pursued:

1. University, described in the law as “A university higher education institution shall provide for education in the study programmes of all three levels and shall carry out especially the basic research. The study programmes shall be carried out in connection with its activities in the field of science, technology and art and in agreement with the current state and development of these fields. The word “university”, eventually the forms of words derived thereof may be indicated in its name by a university higher education institution only.
2. “Professional higher education institution”, described in the law as: “A professional higher education institution shall provide for higher education in the study programmes of the first level and shall carry out especially the applied research. The name of a professional higher education institution contains the words “professional higher education institution”.
3. “Higher education institution”, described in the law as: “The higher education institution which is not incorporated among university higher education institutions or professional higher education institutions, shall provide for higher education especially in the study programmes of the first level, second level and in the study programmes pursuant to Section 53 par. 3 and shall carry out especially the basic research. The name of the higher education institution which is not incorporated among university higher education institutions or professional higher education institutions contains the word form “higher education institution”.

The Accreditation Commission will review the relative performance of the institutions to identify its type. Threshold levels of number of students per level and per number of staff, research performance (with three categories of performance fixed) and third party grant income have been set to determine the institutional type. Regarding the research capacity of the Slovak higher education system, it is of interest that five out of the six parameters on which institutions are evaluated in order to obtain the title “university” are research-related. These comprise the following indicators: the number of doctoral students per staff, the number of doctoral graduates in all, the research results of their theses, the average grant income per professor and the overall research performance. For all of these parameters, threshold levels have to be reached. It is unclear as yet how the attribution to a particular type will affect the eligibility to particular kinds of funding and the overall level of the institutional grant. It is unclear to the evaluators how the line

between basic research and applied research will be clearly drawn, especially because it is becoming increasingly difficult to make a distinction between the two.

**Strategic Challenge 10:**

The Slovak Republic should be highly commended for its efforts to promote the diversity of its higher education institutions in order to be able to cater to the growing diversity of its needs and student profiles. While the most recent efforts have concentrated on the definition of minimal thresholds for different types of institutions, systematic attention should also be paid to a differentiated set of financial and other incentives to promote the quality of teaching, research and innovation respectively. Institutions should feel free to decide on their preferred profile and on the weights they want to attribute to fostering the quality of teaching, of research and of innovation or entrepreneurial activities, taking into account the different strengths of faculties. Separate incentives are needed to allow for excellence standards to be pursued in each of these areas. Thus institutions which focus on first and second level education with fewer research activities and research training programmes should be allowed to pursue quality in their teaching and in their support of different student groups. Likewise, the most research intensive universities should be rewarded for their efforts to pursue the highest standards of quality in such research. If universities or other higher education institutions choose to focus most strongly on being particularly responsive in their contacts with business sectors and on actively promoting commercialisation of research results, such initiatives should also find a group of incentives as fuel to their motors of quality.

### **3.4 The Legal Framework and Institutional Autonomy**

The Higher Education Act of 2002 (Act No.131/2002) introduced the real institutional identity of higher education institutions, firstly by abolishing the legal independence of the university faculties (inherited from pre-1989 regimes) and secondly by introducing lump sum budgets (determined on the basis of pre-established criteria) controlled by the individual universities, subject to internal checks and balances. The Act of 2005 gave institutions ownership of their physical infrastructure and buildings which allowed for more efficient and speedier maintenance, renovation and sale of buildings. However, while the autonomy of the higher education institutions was thus greatly extended compared to the previous decades, it still falls short of the autonomy which Canadian, US, British, Irish, Dutch or Austrian institutions enjoy. Internationally, such autonomy is widely regarded to be a major determinant of an institution's capacity to adapt to changing conditions, to face increasing competition and ensure rigorous quality standards.

The Slovak Institutions are autonomous with respect to:

- The selection of students, as well as setting corresponding admission criteria;
- Decisions on the academic rights and duties of students;
- Awarding the degrees of “docent” and “professor”;
- Course content and organisation, research, education and development activities;
- Number and structure of the staff;
- Establishment, changes and termination of labour relations;
- Economic and asset management;
- Election of representatives of self-government.

They have limited freedom to decide on:

- Their study programmes: the institutions can develop them but these programmes have to undergo an ex-ante accreditation by the national accreditation commission which has a set list of programmes with input indicators as threshold criteria;
- Internal organisation of the institution and the faculties theoretically falls within the scope of their autonomous self-government, as listed in the law of 2005, but for which the law, at the same time, provides a significant degree of detail, e.g. on the number of members, term of mandate, and composition of the academic senate, on not having deans as members in the senate; this is also true for the self-government structures of the faculties;
- Tuition fees: institutions are in principle “free” to decide on the level of tuition for students who are not enrolled in full time study or whose study time exceeds the standard length, but a limit is fixed at 10% of the average sum of total operating expenses given as a clear base. It should be noted, however, that the rules for setting of maximum tuition fees have been changed after September 2007.

One of the most important changes of the 2002 Law was the abolition of the faculties’ legal independence which acted as a straight-jacket and was a major cause for institutional fragmentation, making it impossible for institutions to design overarching policies. However, while faculties have no longer been independent institutions since 2002, the history of strong faculty independence can still be felt in most institutions (and is still responsible for considerable fragmentation, resulting in obstacles to interdisciplinary programmes and teaching, in lack of synergies and doubling of programmes and administrative staff in two or more faculties, see section 3.5 below). It should be noted that, in the 2002 Act, there are still very detailed provisions regarding the internal decision-making structure of faculties, whereas any other possible sub-unit (departments, schools or institutes) does not receive any such high regulatory attention. Indeed, only those institutions that do not have faculties are truly autonomous as to their internal organisation and are free to look for their own optimal structuring choices. Strangely, even those smaller institutions which do not currently have faculties, and which benefit from their absence, are still aspiring to establish faculties, as if these structures were regarded as a symbol of status.

The many detailed provisions of the Higher Education Act (old and revised) deserve a general comment: the fact that the Higher Education Act is a document of 86 pages in small print underlines its highly developed will to regulate even the smallest detail of institutional organisation and decision-making procedures. Thus, in contrast to many of their international partners, Slovak higher education institutions have less room for action. Indeed, many of the institutional conditions which are regulated by law in Slovakia are left to university statutes or bylaws at institutional level in other countries. According to many higher education researchers at all levels, the regulatory detail and impenetrability of these as well as grant agency regulations require years of experience to find one’s way, thus deterring young researchers from gaining smooth access to the system. Researchers from abroad would have an even more difficult time to understand and master the rules and regulations. Most importantly, flexibility to adapt to changing conditions is often pre-empted by the strict regulatory provisions.

In addition to the density of regulations and consequent lack of flexibility, higher education institutions are challenged by the frequent legislative changes and lack of sustainability of government decisions. Even important changes, which are results of long deliberations and have medium- to long-term planning implications for universities, can be suspended through a change of government. Examples range from grant agency policies and their instruments to institutional budget formulae and even such fundamental decisions as to the type of higher education institutions in the system and their funding modalities.

This is not to say that the new amendment which is currently being debated in parliament does not introduce welcome changes. In particular, the stress on qualitative development, which parliamentarians also highlighted as the key feature of the amendments, brings improvements to framework conditions. But governments should ensure that some continuity remains to make the system dependable and that as few regulations as possible are fixed down by law. Moreover, higher education institutions experience difficulties when the acquired expertise of the civil servants in the ministries disappears with a change of government. Since it was not only the minister and highest secretaries of state who changed but even the directors and heads of unit, much valuable knowledge got lost in the transition, resulting in rash and not always well-informed decisions. Most importantly, the national research agency should remain as independent as possible from government changes and intervention in order to ensure the stability of its policies and funding channels. Governments should restrict themselves to setting very general weights and priorities, with high level scientific councils designing policies and instruments, supported by agency administrators, without any prior or post interference from governments. It should be noted that those countries in Europe in which science and the knowledge economy play a substantial role all have entirely independent research and science councils, so that their decisions can do as much justice as possible to scientific process and progress.

**Strategic Challenge 11:**

The Slovak higher education system would benefit from being granted higher degrees of autonomy with respect to the internal organisation and governance structures of the higher education institutions. The national law goes into too much detail with respect to decision-making processes and internal bodies, preventing universities and other higher education institutions from developing structures that fit their purposes and allow them to respond flexibly to their needs. Institutional profiling would also benefit from more freedom of institutional choice in this respect.

The Slovak higher education system would also benefit from more reliable long-term legal conditions which are not dependent on party and coalition changes but which transcend such ephemeral movement to look at the longer-term development needs of the country's research and education. University activities usually extend over several years, and both research projects and educational programmes need several years of continuity to bear fruit. Hence universities need some planning security to be able to provide meaningful services. University policies should be designed, implemented and adapted within a long-term perspectives and vision. Non-partisan groups should be formed to ensure such long-term stability and to allow for optimal development potential.

### **3.5 Framework Conditions for Governance**

As mentioned above, university governance in the Slovak Republic is laid down, in its main contours, by the national law. The latter defines the internal decision-making bodies both at institutional level as well as at faculty level, with decision-making structures mirrored at several levels. Only those institutions which have no faculties but other types of subunits are free to design the governance structures of these subunits. However, the transition from a faculty structure to a non-faculty structure is not easy since, by law, senate approval is needed to decide on the dissolution of the faculties. Thus, most Slovak universities are relatively similar in their governance structures. At institutional and faculty level, there are academic senates with wide-reaching decision power. Within the faculties, there are also departments as sub-structures. In addition to the senate, there are scientific councils at both levels, essentially responsible for academic decisions and strategic perspectives. The faculty deans and the rector of the university have rather limited strategic power and are not allowed to be members of the senate. Hence, there is a division

between actual power and responsibility. The Senate has the power to make or approve the Rector's decision in almost all areas, yet, as a 45-member body (with representatives of all faculties) it cannot be held accountable for these decisions. Conversely, the rector is held responsible for all matters of the university without being able even to orchestrate the decision-making sessions. While rectors can initiate strategic changes, their powers are limited by the senates. Even the budget is decided upon by the senate, although senate members have no particular competence with institutional financial management. Of late (with the 2007 amendments of the law), the budget also has to be approved by the board of trustees.

The universities have a whole range of different bodies which are involved in decisions on and management of university development. Such "diversified" management which includes all university levels for most types of decisions, may satisfy a need for democratic participation in all aspects of daily institutional life but it also reduces the efficiency and effectiveness of university adaptation to change and the university's ability to seize new opportunities. The idea of separating out different kinds of decisions, some of which would be decided at faculty level while others would be reserved for central level, seems to find support among some institutional representatives and leaders though probably not enough to constitute a senate majority. While the necessity to convince many people, one by one, before decisions are made in the public senate sessions contributes to the consensual environment which many appreciate, it also makes more difficult and controversial changes or shifts of strategic direction as well as changes which do not average out over the units less likely to happen. In terms of quality, general averaging effects are thus more frequent than the reinforcement of strengths. Choices on a redistribution of the powers and resources of the different parts of the institution or even the dissolution of particular units are virtually impossible. Hence, one can see that many new initiatives result in the creation of new additional units or centres rather than in the redefinition of existing ones.

It should be added in this context that the institutional evaluations show that most senate representatives represent the interests of their faculties rather than bearing in mind the optimal development of the whole institutional community. Moreover, the selection process of faculty representatives does not take account of international experience, teaching or research performance, so that decisions do not necessarily lie in the hands of the most competent and forward-looking individuals. In many institutional evaluations, the evaluators were struck by "the lack of independent critical appraisal of the issues and challenges facing the institution on the part of the senate."

Without doubt, the most problematic aspect of governance is the rigid internal structure of the universities. The far-reaching faculty independence pre-empts cross-faculty initiatives, flexible creation of interdisciplinary modules and courses, as well as economies of scale. At most institutions, peers observed that

- there were comparatively few options for students to choose subjects from other disciplines and faculties;
- there were few cross-faculty research initiatives;
- there were few strategic thematic platforms or larger interdisciplinary research consortia or centres to increase international visibility, and thus fewer options to bid for larger scale international funding;
- the international trend to create larger research or graduate schools around wider thematic research contexts is made difficult if faculty divisions hinder such clustering;
- cross-faculty appointments are a rarity;

- the identification of, or response to, outside needs, relating to the solution of problems set by industry or society, is made difficult if interdisciplinary cooperation is hindered by vertical divisions. Indeed industry representatives mentioned internal fragmentation and faculty division when pointing to their difficulties in cooperation with universities;
- there are many missed opportunities of economies of scale and more efficient use of resources which shared courses, professorships and facilities would bring. While most universities have some institutional support infrastructure (language centre, international relations, libraries, computer facilities), even larger scientific facilities (laboratories, larger equipment) seem to be entirely faculty-based.

Nevertheless, some institutions are beginning to establish more and more cross-faculty synergies and activities. There are also a few vibrant examples of completely differently organised institutions, which benefit from the complete absence of faculty structures through many overarching activities and considerable flexibility of institutional response, as one evaluation report describes:

*“The basic academic organization of the university by departments (... ) rather than faculties works very well, and given the good working relationship between the heads it is clear that this has advantages over a more cumbersome faculty arrangement. It eases the way to interdisciplinary work, makes it easy for a student from one department to take a course in another with minimal bureaucratic intervention, and shortens the distance from artists to top management. The system encourages flexibility and innovation and creates the environment where a quality culture can develop. It should also simplify the task of identifying targets in the strategic plan.”*

As laid out above, university decision-makers are placed within a dense web of checks and balances within the institution. It is the academic senates that have the final say on all activities, academic and non-academic (finance, planning, etc.), rather than any governing boards with outside stakeholders. In contrast, universities have been only weakly accountable to the outside society that pays for them until recently, unlike many countries (e.g. Netherlands, Ireland, UK, Austria, Denmark, some Länder in Germany or Cantons in Switzerland) where governing boards or strategic advisory boards bring in the outside stakeholders' perspective to ensure attention to societal and economic relevance. With the recent legal amendment, the board of trustees will gain more influence. It will be important to select members to the board who are willing and competent to fill in this accrued strategic role of the board. Unfortunately, the increase of the board's power has not diminished the power of the senates, which means that rectors are now even more straight-jacketed with respect to their strategic leadership role.

#### **Strategic Challenge 12:**

The governance of Slovak Higher Education Institutions is largely prescribed by law when they are organised in faculty structures. Decision-making is controlled at multiple levels by multiple bodies, with institutional and faculty leadership having very limited power to respond to new international and national challenges. While most faculties do not seem to see a problem with the current decision-making and organisational structures, the international evaluators were struck by the lack of flexibility, interfaculty cooperation and strategic initiatives in most Slovak higher education institutions. The Slovak higher education system should provide more legal leeway for institutions to define and experiment with new internal structures and decision-making procedures, adapted to the challenges and needs of the institution. Slovak university members should allow more initiative and room for action to their academic leaders on condition that the latter are selected on the basis of their institutional leadership competences and academic credibility.

If the academic senates are to be taken seriously as decision-making bodies, they will have to pay more attention to the institutional development competences of their members and to play a pro-active institutional role as a body that identifies with the overall institutional development, in a manner

commensurate with its legal powers. Otherwise the senates simply act as a brake on urgent developments.

Universities with faculty structures should pay systematic attention to, and provide incentives for, cross-faculty initiatives, courses, research consortia, and should bring more administrative functions to the central level to allow for economies of scale and concentrated competence. A more centralised administrative structure would improve the efficiency and effectiveness of administration, from co-ordinated IT-based course scheduling which allows students to take cross-faculty course options to a centralised information system with reliable data for effective strategic planning. Part of the budget should also be reserved for strategic initiatives at university level and perhaps also at faculty level.

### **3.6 From External Quality Control to Internal Quality Assurance**

Quality assurance and development can be pursued with a whole range of different methods and instruments and at all levels of institutional development. In Slovakia, as in all European countries, three methods can be regarded as central for higher education institutions:

1. Performance-based methods of distributing funding to institutions and within them;
2. External quality assurance of institutional conditions and programmes through quality or accreditation agencies;
3. Internal quality assurance by institutions to assure institutional quality standards and ensure continuous self-improvement.

With respect to the first point, the Slovak system of higher education has made considerable efforts in the last few years to emphasise the performance of institutions and reward the quality of individual university members' activities and plans. With the introduction of some output indicators reflecting research capacity (PhD graduates, grant income and publications) which determine 20% of the institutional grant, a major step has been taken to create incentives within institutions for quality development. In addition, the grants which are distributed by VEGA, KEGA and the Slovak Agency for Science and Development are distributed on a competitive basis. While some improvements may still be necessary with respect to the funding modalities (see section 4.2.2), the basic principle of distributing grants on a purely competitive basis, rather than any other distributive policies, can only be applauded. The positive effects of competitive research grant distribution have been recorded across Europe and in the US. Together with the right level of funding, they are major success factors of any research system.

With respect to external quality assurance, the Slovak system has relied on accreditation mechanisms. Two kinds of accreditation procedures can be distinguished. Firstly, there is programme accreditation which judges whether a proposed higher education programme corresponds to preset minimal threshold criteria of sufficient number and qualifications of staff, as well as infrastructure, but also some formal aspects of programme design. As part and parcel of a programme accreditation, the right to habilitate and nominate professors is also granted. This form of accreditation is essentially an external control mechanism which is meant to assure minimal standards and prevent the mushrooming of undersupplied programmes. However, it obviously cannot have any effect on the actual quality of the programmes since it is an *ex ante* input-focused mechanism. Moreover, as formal control mechanisms are always accompanied by imaginative ways of undermining them, universities have found legal ways to circumvent strict thresholds: this rule has entailed some academic tourism with full professors acting as guarantors at several institutions so as to complement their salaries. Given the low level of salaries, this is, of course, quite understandable. However, it creates considerable lack of transparency with respect to the real

available human resources for a given programme so that sufficient teaching and underlying research support cannot really be ensured. Accordingly, the new law pre-empts this practice by allowing professors to act as guarantor only at one university in one programme track (comprising the different levels).

However, the principle of external ex ante accreditation remains untouched. The idea of universities themselves having a vested interest in watching over the quality of their programmes, as part of their self-understanding as well as in the context of their competition for qualified students and public recognition, has not been debated yet. While the Slovak system of accreditation is still built on external control rather than internal quality culture, the European Standards and Guidelines for Quality Assurance which have been adopted by all the Bologna signatory countries, including the Slovak Republic, stress the primary responsibility for quality assurance lying with the higher education institutions themselves and point to the importance of coherent policies and improvement-oriented attitudes, to a “quality culture”, in institutions. Indeed, at Slovak institutions, as well as all over Europe, it can often be observed that the existence of quality assurance mechanisms is meaningless without the underlying quality culture to use them for critical self-reflection and improvement. The European Standards and Guidelines thus demand:

“Institutions should also commit themselves explicitly to the development of a culture which recognises the importance of quality and quality assurance in their work. To achieve this, institutions should develop and implement a strategy for the continuous enhancement of quality.”

The European Standards and Guidelines also emphasise that external quality control should be lighter if institutional quality processes and culture are found to be rigorous:

“If higher education institutions are able to demonstrate the effectiveness of their own internal quality assurance processes, and if those processes properly assure quality and standards, then external processes might be less intensive than otherwise.”<sup>10</sup>

**Strategic Challenge 13:**

Having committed itself to following the European Standards and Guidelines, the Slovak quality evaluation system will have to address the challenge of shifting the focus from a central quality control system to a university-based quality development system and of establishing a more coherent quality culture in higher education institutions while reducing the control mechanisms that currently dominate the system.

A second, more recent, aspect of the Slovak accreditation system goes beyond the idea of formal ex-ante control by including evaluation of institutional performance. This evaluation and accreditation method is named “complex accreditation”, and includes the cyclical evaluation of the universities by peers (including international peers). The complex accreditation process would establish whether a higher education institution can be called a university, based on number of PhD programmes and involvement in basic research, or another type of higher education institution with master and bachelor programmes, conducting both basic and applied research, or a professional higher education institution which only offers bachelor programmes. The different profiles of these types of institution would be reflected in funding and grant schemes which would apply to them. As yet, this new complex accreditation has not been realised, but it is currently being prepared. Criticisms were voiced concerning the delay in implementation as well as the composition of the accreditation commission. Some institutions, who had filed their application for (the earlier type of) complex accreditation back in 2002 when the Act came into force, had to wait until autumn of 2006 when the rules were finally adopted and have still not been visited or reviewed. Apparently, the Accreditation Commission was engaged in accrediting all the new Bologna

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<sup>10</sup> European Standards and Guidelines for Quality Assurance in the European Higher Education Area, 2005, [http://www.bologna-bergen2005.no/Docs/00-Main\\_doc/050221\\_ENQA\\_report.pdf](http://www.bologna-bergen2005.no/Docs/00-Main_doc/050221_ENQA_report.pdf)

programmes and could not turn to the implementation of the complex accreditation process. Universities seem to agree with the basic idea of this external form of quality assurance as long as it is fair and includes a sufficient number of external and internal peers in the review process.

In so far as the Complex Accreditation process may lead to a more multi-faceted comparative data on institutions, it may lead to some institutional self-enhancement, beyond the current intention of attributing institutions to categories of different institutional types. However, the evaluators fear that the planned bureaucratic approval would give semi-permanent benefits to some institutions and not facilitate or stimulate competition on an equal base through the same measures for all, supporting continuous enhancement of quality. It will be important to ensure that any institutional comparisons and labelling of institutional types is accompanied by a wide variety of equally accessible competitive funding incentives which help to promote quality improvements in all dimensions of higher education activities, in research, education and innovation initiatives.

It should be added that another kind of evaluation is currently being conducted in the Academy of Sciences where all its 56 institutes are being reviewed simultaneously. With three different committees overseeing the evaluation and reportedly one third of the peers coming from outside the Academy, the evaluation brings qualitative comments and international comparisons. 107 experts were sent to the institutes of the Academy. Their reports were collected in the summer. The main goal of this sub-system evaluation was to compare the Academy's performance with European level performance. (It is also based on quantitative data on the basis of seven indicators: publications, citations, international involvement and activities, grant income, doctoral studies, application and popularisation of research results, and aspects of management and organisation.) Consequences on the budget of the institutes are expected, with increases or decreases of 1-2%. Since the EUA evaluation focuses on institutional and systemic development issues rather than scientific quality as such, it may be advisable to conduct some form of subject-oriented research reviews in the higher education sector, preferably at the initiative of the institutions so as to ensure willingness to improve wherever room for improvement is identified. However, such evaluations are only useful if resources are put aside for improvement measures and strategic initiatives based on units or consortia with higher performance and potential.

With respect to the 3<sup>rd</sup> type of quality assurance, namely the one conducted by higher education institutions themselves which is emphasised so strongly in the European Standards and Guidelines, one should note that Slovak higher education institutions are showing an **increasing awareness of the importance of internal quality culture**. In general, quality assurance and enhancement instruments have been introduced and a general awareness is reported regarding the importance of quality control of teaching, research and management. **However, evaluators reported that quality monitoring is still largely seen as monitoring of data according to standards introduced by the Accreditation Commission rather than being set by the institutions themselves**. This hinders the ownership of an effective quality culture. Moreover, not all quality assurance instruments are used in such a way as to enable quality development to occur. While all Slovak higher education institutions have introduced student evaluation questionnaires which should be filled out and handed back towards the end of each course, many professors or other university docents do not carry this out and students fear that their handwritten comments could be deciphered and thus lead to negative assessments. **At most institutions, many students complain that there is no feed-back to their criticisms**, neither in discussion or teaching committees nor in changes of teacher behaviour. Likewise, departments or faculties cannot describe a feedback process so that the "quality assurance" mechanism of handing out student questionnaires has no bearing on the improvement of teaching effectiveness. This problem is also frequently noted at many other European universities and is a key concern in many current quality improvement initiatives. Other forms of teaching related improvements seem to be entirely up to the

individual initiative of the teachers. Departmental, faculty or institutional discussion of teaching methodology, changes of teaching approaches were not reported, not even in the context of the changes based on the Bologna system which was approached as a more formal structural change. Graduate success in the labour market and alumni feedback on their university education are not tracked anywhere, even though there are high drop-out rates of over 50% in some subject areas.

While there are no incentives to improve teaching performance, **some institutions or individual faculties within institutions encourage improvements in research performance through performance-based resource allocation**, rewarding faculties or departments or even individual university professors with higher external grant incomes and PhD graduates. This is not yet frequent practice, but seems to be increasingly accepted.

Numerous quality development initiatives could be found in the improvement of some of the central management and services, such as establishing innovation and development support through a central unit, expanding international exchange and cooperation support and language course provision. However, more ambitious policy changes, such as fostering minimal English language skills for PhD students and professors, are often proposed as ideas but central leadership still shy away from pushing these necessary changes through the cumbersome decision-making processes of university governance. The consensual orientation often seems to be stronger than the awareness of a need for change. However, less controversial improvements in management are undertaken without hesitation.

The most important quality measure in a higher education institution relates, of course, to the hiring and development of its academic and administrative staff. In this context, a first remarkable change has been the fact that professors and associate professors are no longer appointed for life, but receive tenure after three re-appointments. This measure could indeed be regarded as a contribution to quality development of staff. However, its effects are mitigated by the fact that there may soon be a shortage of qualified individuals who would be interested in an academic career so that in practice, very few professors end up not being re-appointed and tenured. Indeed, many problems could be observed with respect to hiring academic staff. First and foremost, dramatically low salaries as well as professorial appointments which are made when people are already comparatively old not only prevent hiring qualified academics from abroad but also make academic careers uncompetitive in comparison with industry careers in many branches. Thus the replenishment of the pool of university researchers is becoming a daunting task, especially in those subject areas in which more attractive employment opportunities can be found abroad or in the private sectors. Hence, the talent pool, from which Slovak institutions can currently draw upon, is increasingly shrinking. Indeed, if drastic measures are not taken to ensure the attractiveness of academic careers, the quality of the university staff and thus of the universities will decline rather than improve within the next decade.

**Quality development measures for existing staff are also in need of improvement.** Didactics courses are often offered only for secondary and university teachers together so that the specificity of the challenges and new developments in university teaching cannot be addressed. From project-based teaching methodologies and acquiring competences for coaching of team work and independent learning, from academic writing and presentations in English to research management skills and innovation know-how and intellectual property information -- the need for staff development measures is considerable in some cases, as especially younger teachers and students emphasise. However, resources as well as incentives and faculty time, which would have to be freed up for such training to occur, are lacking so that university staff is increasing lagging behind competitive international standards of staff competences.

With respect to quality assurance, we can conclude, first of all, that the **Slovak Higher Education system is emerging slowly from a system of external control aimed at ensuring minimal standards and**

**avoiding abuse, toward an awareness of the importance of quality assurance and culture within everyday institutional life.** Such internal quality culture is beginning to take root within higher education institutions, leading to the design of a coherent quality assurance system at some institutions. However, internal quality development is still going through difficult times since, at a majority of institutions, decision-making procedures are cumbersome, central resources for incentives and development measures remain minimal and external funding for many such measures practically non-existent. And yet, all over the country, international peers have found highly motivated individuals with a will and capacity to induce and sustain change. Especially in those research niches in which intense international exchange and cooperation takes place, university researchers advanced many ideas and combine their energy in order to improve their environments. Thus optimism has room to bloom if only some additional incentives were fed into the system: that is, resources from the national level and forceful strategic actions from central university leadership.

In general, all evaluators were struck by the high level of mistrust and controlling attitudes which seem to dominate Slovak quality assurance, from the control-based methods of the Accreditation Commission, to the heavy control bureaucracy of the research grant agencies, to the multiple control bodies in the decision-making processes, most aspects of institutional development seem to be bogged down by controlling attitudes – a problem which Slovakia shares with many other continental European higher education systems. The evaluators are in agreement that the Slovak higher education system should aim to build up methods of encouragement, through financial incentives and rewards as well as staff promotion, in order to support forward-looking initiatives and high striving performance, rather than concentrating too much time and effort on trying to prevent possible abuse. Any higher education system is strongly based on individuals who choose to become academics because of intrinsic motivation. It is widely known that the creation of conditions in which such intrinsic motivation can thrive is a more effective way to improve the overall performance of the system than to invest in controlling mechanisms at all level.

**Strategic Challenge 4 (repeated):**

As part of the Bologna reforms and for the benefit of its own overall improvement, the Slovak Higher Education system is facing the challenge of introducing a more trust-based and more systematic approach to quality assurance within higher education institutions and of moving away from methodologies of external control of minimal standards toward internal improvement-oriented processes of quality enhancement. These processes require some resources, however, to address the need for improvement wherever it is identified. Undoubtedly, such a change will be vital for building self-reinforcing quality culture at Slovak higher education institutions.

## **4. The Research Capacity of Slovakian Higher Education**

### **4.1 Research Capacity at Institutional Level**

#### **4.1.1 Institutional Missions and Research Strategies**

Apart from the five Academies (Arts, Police and Military) with their specific artistic and professional missions, the one state and seventeen public universities do not differ much in terms of their missions within which research is an integrated dimension. This self-understanding may seem well-established, but it is not as self-evident as it may seem. First of all, universities have only recently, since 1989, been able to revive their original research mission, since research is no longer concentrated in the Academy of Sciences. Secondly, with the previous government's announcement of a stratifying classification of higher education institutions which would include research universities as a distinct institutional type, released some strategic energy among the universities who wanted to consolidate and expand their research standing. Such ambitions to be classified as a research university are clearly reflected in the strategic development plans of the universities. Since the project of introducing a separate type of research university was still an explicit policy of the government when institutions developed their strategic plans, such positioning is a prominent goal of about half of the universities. In addition to this explicit positioning as a research university, which seems to have little to do with the international usage of the term "research university" (see section 4.1.2 below), many institutions show an acute awareness of their subject area profile which they would like to strengthen further, both in teaching and in research. However, beyond the general awareness of the value which a clear subject area profile brings to the institution, there is no institution which actually mentions in some detail which priority areas are going to be strengthened and how such strengthening will be achieved (e.g. hiring policy, investment in scientific infrastructure, graduate schools or other profiling measures). Instead, developmental aims tend to be restricted to general institutional infrastructure and support, such as language training, international cooperation services, quality measures etc. Evaluators report that a great deal of reflection has gone into the formulation of such institutional aims, sometimes linked with convincing SWOT analyses, but that there is no mention of how these aims would be realised. There is no institution which has laid out in its strategic plan how priorities would be set also with respect to resource allocation to and between the faculties, what actions would be taken when and by whom, with what responsibilities and resources, in order to realise the institutional aims which were agreed upon. Thus, there is a great danger of most strategic plans remaining wish lists rather than orienting institutional action plans.

Moreover, it should be added that **most institutions have hardly any strategic reserves at institutional level leaving little room for strategic incentives** or initiatives. As mentioned above, prioritisation of resources which would favour some units over others (on the basis of their performance and development proposals) would have difficulties in passing through the Academic Senate. Evaluators have found institutional **leadership to be more in favour of necessary changes than the majority of representatives of faculties and departments**. Thus, under current governance structures, with most power vested in faculty representation structures, strategic action is likely to be difficult and limited to issues in which consensus can be reached more easily.

With respect to research development, this **lack of strategic power makes it very difficult for institutions to strengthen their most competitive research areas further**, in order to be able to compete internationally.

**Strategic Challenge 14:**

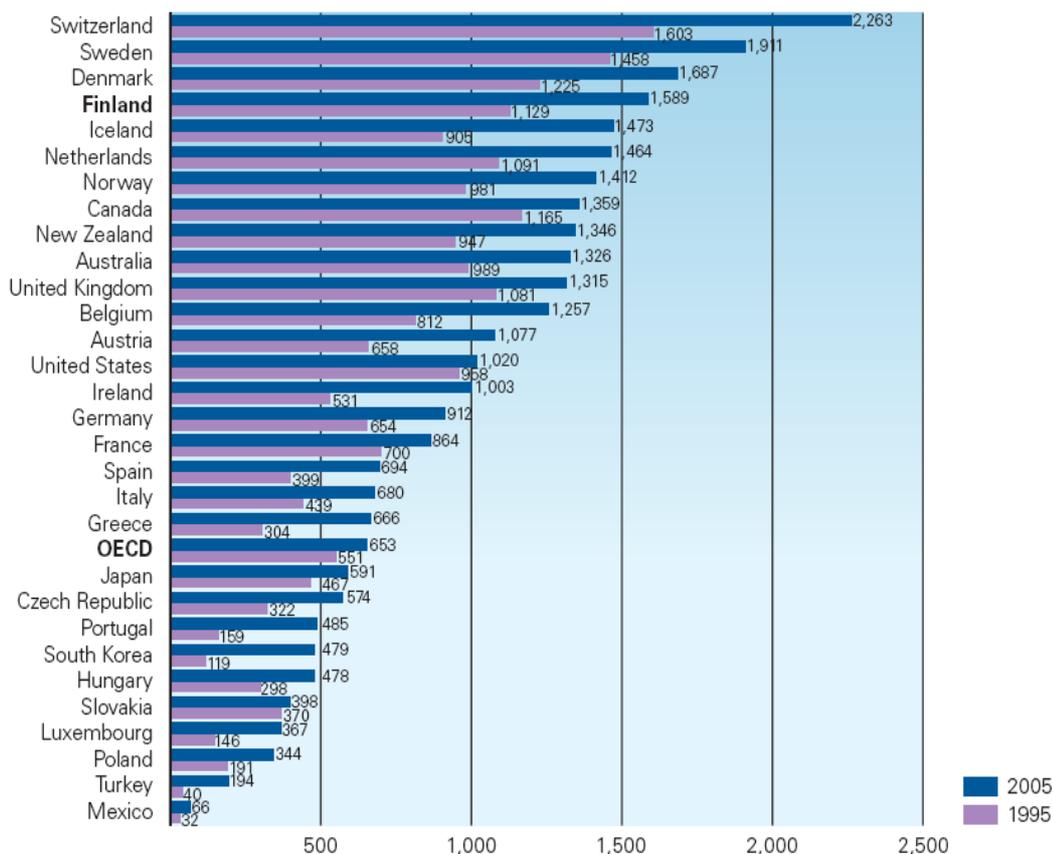
Slovak universities and higher education institutions should develop their strategic capacity further by drawing consequences from their agreed institutional aims, in terms of resource priorities, realistic targets to be reached, and concrete measures with specified responsibilities. Current decision-making is consensual, collegial and favours average treatment thus preventing building on strengths and faster changes. In order to create an environment where excellence will prevail and to enable institutions to set real priorities, build on their strengths, help areas with high potential, support urgent and promising development initiatives, strategic reserves have to be made available at institutional level.

Since the money which can be freed through enhanced economies of scale is very limited, and institutions are severely underfunded, in comparison with the tasks they have been given by the state, the government should dedicate additional “fresh” money to institutions in order to enable them to build such strategic capacity.

**4.1.2 Variation of Research Intensity and Output**

Of the twenty three public or state higher education institutions in Slovakia, eighteen are called universities, the other five Academies. Among these institutions the intensity, orientation and weight attributed to research activities are very unevenly distributed.

If we look first of all at the overall research output of the Slovak higher education system and compare it with other national research systems, we find a comparatively low output. Taking the only internationally comparable type of data currently available, as published in the 2005 ARRA report (based on the Web of Knowledge), a total of 1243 Web of Knowledge registered journal papers were published by 10 065 university teachers and 1239 research and artistic workers. This represents 0.11 papers per university academic (in 2004 it was still 0.12

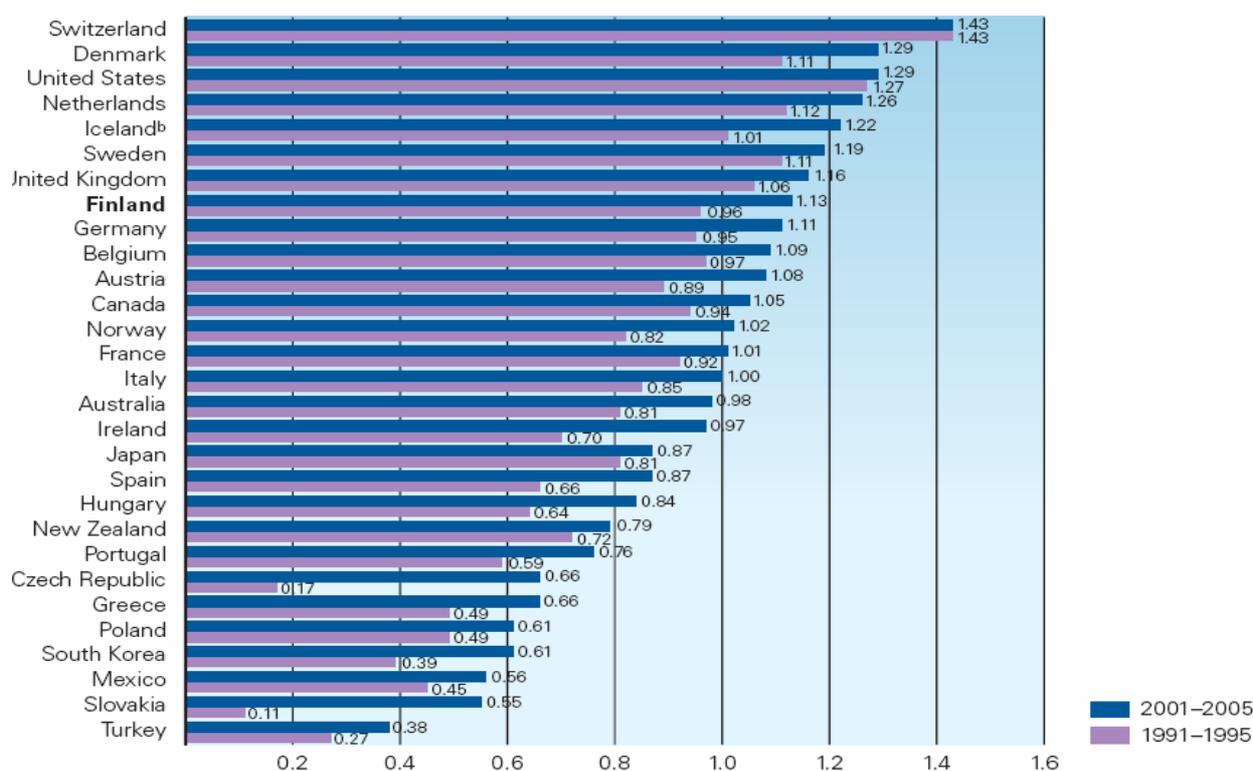


**Figure 6** Number of scientific publications in OECD countries in 1995 and 2005 relative to one million population (in 1995 and 2004). Countries listed in order of the number of publications in 2005.

Sources: Main Science and Technology Indicators 2006/1; Thomson Scientific, NSI 1981–2005.

papers per creative worker).<sup>11</sup> Even if this data does not take account of many Slovak publications and thus may be said to give a distorted picture, in particular in the case of the humanities and social sciences, one should add that other European countries face precisely the same problem, so that the international comparison with other non-English speaking countries can be said to be fair and telling. Looking at the publications per million population, the usual international comparative indicator, Slovakia is also found in a low position compared to competing countries, as can be seen in Figure 6.

Looking at citations per paper we find a high variation across the country. The most highly placed Slovak university has an average number of 5.2 citations per paper (2005), with 8 citations per paper in its Faculty of Mathematics, Physics and Informatics (2006). This compares reasonably well with other recognised universities in Europe, such as Copenhagen University (8.7 per paper) or Oxford University (12.2 per paper). In contrast, fifteen other public universities have below 3 citations per paper.<sup>12</sup> It is uplifting to note that the impact of Slovak research publications has strongly improved in recent years as both the ARRA report and OECD comparison show (see Figure 7 below), with impact growth rates well above those of the neighbouring countries Hungary, Czech Republic, Poland and Austria.



**Figure 7** 1. OECD countries' relative citation impacts<sup>a</sup> in 1991-1995 and 2001-2005. Countries listed in order of the citation impacts for the most recent period.

<sup>a</sup> Relative citation impact = impact factor e.g. for Finland (number of citations / number of publications) / impact factor for OECD.

<sup>b</sup> The number of publications for Iceland is small in comparison with other OECD countries. Values for Luxembourg are missing because of the small total number of publications.

Source: Thomson Scientific, NSI 1981-2005.

<sup>11</sup> ARRA Report (2006): Správa 2006. Hodnotenie verejných vysokých škôl a ich fakúlt. Bratislava.

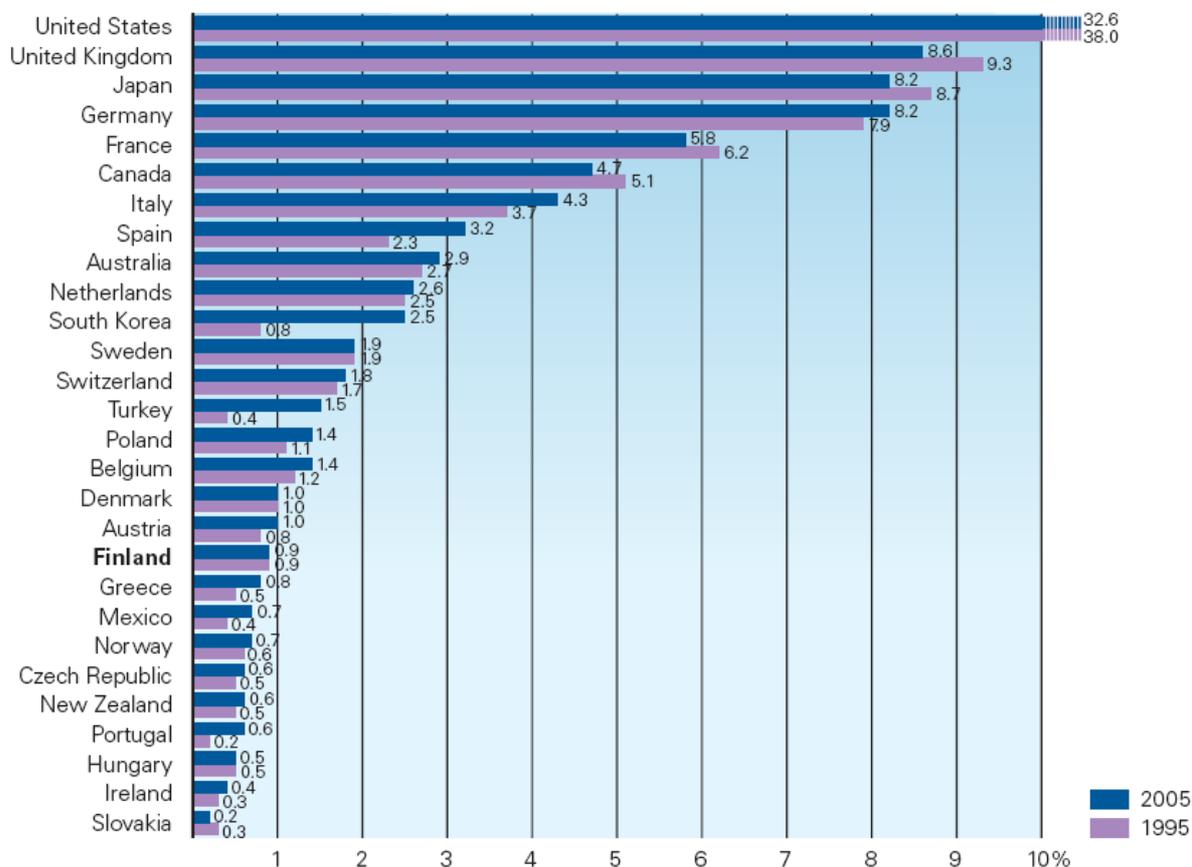
<sup>12</sup> ARRA Report 2006, op.cit.

However, in spite of the positive trend of increased international impact, Slovak research still falls behind its neighbouring countries, Hungary, Poland, and the Czech Republic. The gap with its competitors remains the same or is even increasing, as Figure 8 shows. Also, while even most developed countries may be slowly losing some market share in the international arena of research output, they do so at a significantly lower rate and continue to contribute at a considerably higher level, as figure 9 shows. Here one should also note that, while Slovakia's share has declined by 33%, some other countries have increased their share in 10 years, e.g. Portugal (by 300%), Turkey (by 375%), Austria (by 25%) and the Czech Republic (by 20%).

**Figure 8: Comparison of Number of Publications in ISI registered Journals**

	1995	2001	2002	2003
<b>SR</b>	<b>2179</b>	<b>2214</b>	<b>2124</b>	<b>2264</b>
Czech R	3755	5276	5280	6184
Hungary	3666	5026	4776	5418
Poland	8077	11817	12237	14526
Austria	6437	9578	9057	10608
Slovenia	917	1744	1749	2045
Estonia	448	648	652	754

Source: Data and Information for EUA Sector Report, Slovak Rectors Conference



**Figure 9: OECD countries' shares (%) of all OECD publications in 1995 and 2005.**

Of course, as mentioned above, the data included in the Web of Knowledge with its International Science Information base to which all international comparisons refer, does not include some of the national journals published in Slovakia. Hence it may be assumed that there are many more publications by researchers from Slovak higher education institutions. However, the impact of these publications is bound to be minimal since the pool of readers is so restricted. As science and scholarship thrives on exchange and mutual learning, it may be assumed that researchers have a vested interest in publishing in the most widely recognised and read journals in their fields. And indeed, in each group of fields, there is an increasing number of Slovak university based researchers who are getting their research published in internationally recognised journals.

**Strategic Challenge 15:**

While Slovak researchers should be commended for their increased efforts to publish their research in internationally visible journals, further efforts are needed to close the gap between overall research performance in the Slovak Republic and other European and developed nations. In order to allow Slovak university researchers to compete with their international peers in their research production, there is a need for more research time, resources, up-to-date scientific infrastructure, and support for improved language competences in English, as the lingua franca of international research.

Turning now to the variation of output across institutions, we can observe that Slovak higher education institutions show very different degrees of research output, and thus implicitly of research intensity. In the natural sciences, the variation in publication output per researcher ranges from 5.8 publications per researcher to 0.15 in the group of Faculties of Natural Sciences, or from 3.15 to 0.16 publications per researcher in group of agricultural and veterinary sciences, as the ARRA report points out.<sup>13</sup> While some of these differences may be due to different publication habits in the various fields as well as to the subject mix of the faculties, these figures do show the range across institutions in cognate areas. Such variability reaches not just across institutions but also across the different faculties within one institution. However, some institutions clearly show a greater concentration of more highly active researchers than others. In terms of scientific impact, as judged by the number of citations in internationally recognised journals averaged across the institution, some universities stand out as significantly more embedded in the international research community than their sister institutions.<sup>14</sup> Of course, such institutional comparisons should not be interpreted to imply that individual faculties and researchers at other institutions cannot be also highly integrated and competitive in their respective international research environment. But, if we take the institutional average, some institutions clearly appear more internationally connected in the majority of their research fields than their sister institutions. The fact that a couple of comparatively small universities with a limited subject profile and focus (in the humanities, theology and law) can stand out in this respect shows that research impact is not simply correlated to size and comprehensive breadth, as some may suspect.

Two other indicators are used internationally to compare research intensity of institutions. One relates to the external grant income since it reflects success in competitive bidding for projects. Another consists in the number of PhD students of the institutions, especially the proportion of PhD students in relation to the whole student body. With respect to external grant income, again we find wide variation across institutions. Within cognate areas of subject fields, we find the same universities doing comparatively well, in addition to two more specialised institutions.

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<sup>13</sup> See ARRA Report 2005, p.30.

<sup>14</sup> See ARRA Reports 2005 and 2006.

When looking at the number of PhD students as a proportion of the whole student body, the same institutions, with an additional one, appear high on the list.

To conclude, we can say that the Slovak university research landscape is on average still well below competitive level, in terms of number of publications, citations per researcher, and number of highly cited researchers, when compared with advanced research environments in successful European countries. But Slovak researchers are clearly catching up. Some institutions are significantly better positioned to compete internationally and show a considerably higher degree of internationally recognised research presence. In addition, for individual subject areas, individual faculties are also well placed. In general, the Slovak universities are rather differentiated in terms of level of research performance, even though incentive structures are the same for all institutions.

In this context, it should be noted that the effort made by the ARRA agency to compose internationally comparable data which gives institutions the opportunity to benchmark their performance at least in superficial quantitative terms is of great strategic development value. It allows institutions and faculties to ask themselves first questions that may trigger a self-reflection process on research capacity and its international competitiveness, which is highly needed in a national system that has had few opportunities of comparing its performance with other national environments in the past. The Slovak higher education sector should be applauded for having taken this initiative. Of course, it should be added that the data compiled by ARRA is only a first necessary step which should be followed by a deeper qualitative enquiry into the strengths and weaknesses of individual units and sectors. Only when such qualitative analyses are added, will institutions be able to base their internal prioritisation on firmer ground. It should be emphasised that, in a country where research resources are still scarce, clear priorities are vital. But they have to be based on analysis and impartial arguments in order to maintain trust in the system and ensure its fairness. The current review of research performance in different subject areas in the Academy of Science may provide valuable experience in developing a process which would lay the foundation for rational research investments, and which would strengthen the already strong research groups and help new groups which show potential.

**Strategic Challenge 16:**

The Slovak higher education landscape is highly diverse in its research performance and in the connectedness to international research environments. While individual faculties stand out in several institutions, a quarter of the institutions are noticeably better placed in their international research competitiveness, though still being positioned below the average performance level of their competitors in other European countries. In order to help research environments with high potential to excel in international competition, concerted efforts should be made to identify the best environments and give them prioritised support, so that they may act as beacons for the Slovak research and innovation environment. At other institutions efforts should be made to create research possibilities to ensure that they also contribute to research and research-based education in order to ensure an adequate pipeline for knowledge workers.

It should be noted that the many research groups which conduct more industry-oriented research at the technical universities may have different priorities from excelling in international research competition. These priorities may be just as important for the overall research landscape of Slovakia (see section 4.1.7 and 4.2.3). Both are generally recognised as being complementary and dependent on each other. Only in a research context in which internationally competitive basic research may thrive, will industry choose to base its own knowledge-intensive activities. At the same time, industry also needs university researchers who are willing to invest their time and efforts into applied research, in order to remain technologically

competitive. Last but not least, both academia and industry need bright innovative people with good research and entrepreneurial skills.

#### 4.1.3 Institutional Incentives and Obstacles to Research Activities

At Slovak universities, research activities are still conducted in comparatively adverse conditions, most importantly with respect to the available time and financial resources but also regarding other incentives. Most noticeably, research activities are conducted with an extremely low base budget provided through institutional grants. This implies:

- Scarce money for starting up new research activities;
- Scarce money for investing in new equipment and improvement of facilities;
- Insufficient funds to support mobility of students and staff. For international mobility, even to attend conferences which is a basic ingredient of a researcher's life, researchers have to apply for special (VEGA) grants;
- Low investment in new books, international journals and other resources in the library, i.e. reduced access to necessary information;
- Low income of researchers resulting in comparatively low public recognition of a research career in society.

A second obstacle hindering involvement in research activities consists in the remarkably **low time budget which university researchers have at their disposal**. Some institutions or individual faculties seem to have fixed some minimum threshold: at one university, in theory, university academics are supposed to have at least 25% of their working time for research. In reality, many university academics report spending 90% on education, with research becoming more of a hobby during the rest of their work and leisure time. However, the available time differs greatly from one faculty (and even department) to the next, depending on the teaching load.

Curiously, when the institutional evaluators looked at staff/student ratios, these were not so disadvantageous compared with other European competitive university research environments. However, further enquiry revealed that **university teachers in Slovakia have an unusually high teaching load because of the high number of contact hours, unusually high amount of exams and other performance controls around which courses are structured, as well as lack of synergies and common offer between faculties**. In contrast, at many other universities, especially in northern Europe where research or learning outcomes are reported to be very good, there is significantly more time for project and team work as well as independent learning, all of which require less grading and class preparation time (while presupposing enhanced coaching competences). However, exposure to other teaching methodologies and their effects as well as accompanying staff development measures would have to occur for local attitudes to teaching and learning to change.

Another less dramatic but still noteworthy competitive disadvantage which Slovak university researchers have to face concerns the comparatively **underdeveloped research support services** at their institutions, a problem which can still be found at many Southern and Eastern European universities. In well-staffed research management service units at some of the more research intensive universities in the UK, Netherlands, Finland, or Germany, academically trained administrators identify funding opportunities, help with grant proposals and accountability chores, even legal problems, or support innovation initiatives

with know how and contacts. Such services seem to be embryonic at most Slovak universities, with the exception of some very exciting new initiatives, such as the Innovation Service at one university.

The most powerful incentive that fosters research investment at Slovak universities, just as much as at universities elsewhere in Europe, is that research performance counts as a main criterion for academic advancement. In addition, there are incentives inherent in the funding mechanisms which determine institutional budgets according to which research performance (counting for 20%) can lead to increases in the overall institutional budget. Furthermore, in the last two years, PhD student positions have been distributed on the basis of research performance, which then go to the universities as a block grant (the internal distribution then differs among universities).

Some of the research indicators used for the funding formula, however, are more reliable than others: for instance, publication output is a key indicator but all publications seem to be treated indiscriminately, regardless of whether they are published in a higher impact international journal or at a local conference.

Moreover, in the funding formula the number of students is still the most highly weighted factor. Since a higher number of students implies less time for research, one could say that the **funding formula, at the moment, actually sets stronger disincentives than incentives for research**. Disincentives are also present for particular subject areas: The funding formula multiplies the student number by a subject area quotient (e.g. 2.43 for engineering, 1.5 for economics, 5 for medicine) which is supposed to relate to the number of people needed to teach a student in that subject area. However, this quotient takes no account of infrastructure or laboratory costs, with the paradoxical results that universities get less real cost coverage for engineering, for example, than they do for economics. Clearly, technical subjects suffer from this funding system.

A clear incentive culture has been developed in recent years by funding agencies through an increased attention to competitive funding mechanisms. The Slovak Research and Development Agency with its possibility of granting staff positions, offers clear incentives for energetic individuals to develop initiatives.

Some universities have even established an internal grant agency to set incentives: thus one university has a fund for young researchers (below 35), and money for PhD students (Young Science Project for PhD students which provides 6.4 million SKK for scholarships, language courses in foreign countries, participation in conferences, scientific literature).

Obstacles for research efficiency can also be seen in the rather cumbersome grant administration rules, with multiple restrictions on the way money can be spent, even to the point of prescribing airline companies (that may sell less expensive tickets!).

**Strategic Challenge 17:**

In order to improve the overall research performance and capacity of the country, the Slovak higher education system has to establish appropriate incentives for university research in terms of available time, financial support, research management support, as well as less bureaucratic grant regulations. Without these incentives, all of which imply a targeted use of additional resources, university researchers will continue to be dramatically disadvantaged in comparison to their competitors abroad and will be unlikely to achieve comparable results. Moreover, young researchers are likely to look for attractive research environments abroad.

Slovak higher education institutions will have to target more of their efforts on prioritising research resources and on providing the necessary qualified support staff to help researchers. For this, targeted staff development measures and benchmarking with institutions abroad will be vital. Since good practices

can also be found within the Slovak Republic, a more systematic exchange of such practice among rectors, vice-rectors for research and heads of technology transfer offices will be useful.

#### 4.1.4 Access to International Research Community and Competition

Since all research forms part of the free flow of ideas and information and thus part of an international community, access to international conferences and project is vital for full participation in competitive research. Many Slovak university researchers participate actively in international research but others do not. Three obstacles make such participation difficult for some.

First, evaluators found that at most higher education institutions (significantly less so in Bratislava) there seemed to be a majority of researchers of all ages whose English was insufficient for participation in an international research community. Publishing in English requires considerable language competence or excellent writing support by academically trained individuals who are familiar with the research field. But even conference participation presupposes sufficient speaking skills to be fruitful.

It should be mentioned in this context that young researchers and PhD students were often critical of the ability of senior professors including their supervisors to help them gain access to the international research environment.

##### **Strategic Challenge 18:**

Institutional evaluators observed a major need for improvement of English language skills across the country since proficiency in English has become a necessary condition for participation in international research activities. Especially for the next generation of researchers, care should be taken that they can gain access to the international community in their field as early as possible in order to provide them with the best possible chances to excel.

A second hindering factor consists in freeing up enough travel money to go to the meetings which European projects imply. Even preparing such projects will require some travelling. It seems that at Slovak institutions, travel money is not part of the annual funds of a professorial chair or institute, or at least only at very few departments. Thus researchers usually have to go through an application procedure to obtain travel funds, which seems an unnecessary waste of time and effort, considering that such travel is a normal part of an active research existence. As long as university academics have some internationally published research results, such travel money should be part of their normal operational budget. PhD candidates should also be able to apply, within their institute or faculty, for travel money to attend international conferences in their field if they actively participate with a presentation.

It should be emphasised that the European research arena is becoming increasingly competitive. Many networks have formed over considerable time with the result that it can be difficult for newcomers to gain entry. The Slovak research system, both through the Slovak Research and Development Agency as well as through its universities should pay considerable attention to facilitate such access. The support for preparing bigger European projects which the SRDA provides is an excellent step in the right direction. But some such support should also be available at institutional level, perhaps based on previous performance in order to ensure it ends up where it is truly needed.

**Strategic Challenge 19:**

Active participation in international conferences is a condition sine qua non for research success and impact. Researchers and PhDs should be provided with travel money to share their ideas and results with international peers. Without such opportunities to show research results and to receive additional stimulus, Slovak university research is unlikely to emerge from its relative seclusion.

Grant agencies and institutions should also (continue to) provide support for the preparation of larger international research cooperation projects.

A third most pressing problem, at least for the experimental sciences, lies in the often obsolete scientific infrastructure which makes it difficult to compete with western partners. Even though researchers noted improvements in recent years with grant schemes, there is still a long way to go before Slovak university researchers enter the realm of fair competition. While enthusiasm and good theoretical background may provide additional assets, it is impossible to enter a European or international research project in the experimental sciences without up-to-date equipment.

**Strategic Challenge 20:**

At national, regional and institutional level, more resources should be made available, on a rigorous and hard competitive basis, to maintain and renew scientific research equipment and infrastructure. Otherwise, the attractiveness of Slovak research for international and industrial partners is severely restricted. Within the next decade, the Structural Funds should allow a significant increase of resources for this purpose. Such use of the Structural Funds is likely to bring a high return on investment.

#### 4.1.5 Research Career Development and Renewal of Research Staff

Within the next decade, many Slovak universities will have to undergo a major period of renewal in human resources since many of their professors will reach soon retirement age. The ARRA report has pointed out that the average age of active professors in medicine ranges from 61 to 55 at different faculties. In the natural sciences one university has a professoriate with an average age of 63, while the average at most other institutions is over 56 years. Only one faculty (which is also the one with the highest number of citations in international journals in the country), is atypical with an average age of 46.<sup>15</sup> In agricultural sciences, the humanities and social sciences there is no faculty with an average age below 57. In the technical sciences only half of the faculties have an average age below 57 (only two universities have an average of 52). Hence the vast majority of professors will have to be replaced in the next decade. Moreover, in addition to the challenge of academic renewal in the coming years, there are two problems associated with this age distribution. As is well known internationally, researchers are usually at their most productive and innovative in their thirties and forties; thus, the ageing professoriate poses a serious problem to the university sector from the point of view of research production. Second, introducing innovative teaching approaches poses a particular problem since older professors tend to be less receptive to changes in this area. Thus it come as no surprise that undergraduate students, PhD students and younger researchers alike were quite critical of the didactic competences of a majority of professors.

The age distribution of academic staff is exacerbated by the fact that it is difficult to attract younger researchers into the university sector since they either find **more attractive opportunities abroad or in industry** where salaries can be three times higher for entry positions. Moreover, as pointed out above, there is an increasing need for scientifically and technically educated people in industry, which is an

<sup>15</sup> ARRA Report 2005, p. 107

equally pressing need. Hence, the Slovak government and the leaders of higher education institutions will have to invest considerable resources and care into making the university sector attractive for bright young people, both in terms of salaries and working conditions; these include the availability of sufficient research project grants and the possibility of obtaining up-to-date scientific infrastructure as long as applicants can show excellent performance and potential. It is also very important, as many researchers noted in the interviews (and evaluators in their reports), that **sufficient opportunities be made available for young researchers to excel and show their potential**. A young researchers programme, which distributes a percentage of the budget in free competition to postdoctoral students should be implemented at national level, analogous to the good practice at the Academy of Sciences (where 2% of the funds are set aside for research projects conducted by postdoctoral researchers) or at a couple of universities which have already put some of their own funds aside for its PhD candidates and young researchers. As of yet, however, such individual initiatives are necessarily limited and involve only small sums. At the moment, there are too many young researchers who feel that if they want to participate in a truly international research career they will have to go abroad. All universities and faculties with high research intensity should develop plans and be given the means to provide advantageous opportunities to young researchers to facilitate their access into an internationally visible research career in Slovakia.

In particular, a stronger **postdoctoral programme** will be needed to prevent losing the best researchers to other countries. In addition, the often discussed early independence of young researchers, for instance as independent assistant professors who do not have to rely on an established professor in order to be able to obtain grants or travel money, is critically needed and should be supported through special positions and start up funds. The young researchers' independence is even more limited when it comes to grant applications: reportedly, the bureaucracy and administrative details for grant applications requirements are so opaque and complicated, that they are forced to cooperate with older members to understand the process. Moreover, there seems to be a "new kids on the block" problem in that the grant money often goes with scientific titles. According to younger researchers interviewed, there were also too many older professors who are not supportive of the young generation.

In addition to salaries and scientific equipment, **sufficient and flexible laboratory space** is also a scarce resource at many places. As the number of professors who can be hired depends on the number of students, different faculties often have different working conditions, with the result that in some fields it is difficult to recruit staff since no place is physically available. Here, the independence of the faculties makes flexible institutional arrangements difficult. Institutional leadership should be given the power to take stronger action to enable flexible allocation of physical infrastructure according to need.

With respect to **hiring procedures**, one should note, firstly, that although professorships are advertised throughout the whole country, there is much "academic inbreeding" with most candidates coming from within the institution. Many PhD graduates reported that they "feel more welcome at this university for continuing their career" and felt their chances were not good to continue at other universities. This reduces the competition and talent pool considerably. The **lack of career mobility across universities** seems to be due to two factors. One is in the nepotistic concept of favouring those young researchers which were raised in one's own stock, another concerns the difficulties of going abroad without losing the possibility of re-entering the Slovak academic scene again later. Usually, researchers must finish their five-year contract with the university which cannot be interrupted for an international year abroad. Also, there are no programmes or other measures to attract people back after their research years abroad, even though such experience would be valuable to have.

Secondly, the *habilitation* procedure which still exists in Slovakia usually requires 50% working time to prepare. The procedure seems to be somewhat market dependent in its quality standards: researchers

report that it is not much of a hurdle if the faculty needs associate professors (for instance as guarantors for a programme) but that criteria are more strictly applied if fewer people are needed. International recruitment is practically unheard of since salaries and working conditions are not competitive for foreign researchers.

The status, recruitment and career prospects of a separate category of staff called “researchers” are unclear to the evaluators. They are not working on 100% research positions since they are often very actively involved in teaching. It is not clear what their development prospects are or what benefit the system derives from having “research” positions which do not actually involve full time research. If the title implies a permanent academic position below professor status with multiple tasks ranging from teaching, to academic administration to less independent kinds of research, than this profile should be clearly stated with appropriate measures of staff development in order to optimise the effectiveness of such potentially valuable staff. However, some discontent could be seen both from this group as well as from institutional leadership. Transparency and staff policy seem to be missing in this respect.

#### **Strategic Challenge 21:**

Given the need to renew a majority of university professors in the next decade, the Slovak government and the leaders of higher education institutions will have to invest considerable resources and care into increasing the attractiveness of the university sector for bright young people, both in terms of salaries as well as in terms of attractive working conditions and infrastructure (including buildings). National and institutional programmes or incentives are also needed to foster the independence of young researchers. Companies may be willing to support such programmes, given their vested interest in qualified labour. International and national mobility of researchers should be fostered systematically since it is known to contribute substantially to the innovative potential of individual researchers. Return schemes should be developed to make the return of young researchers from international stays attractive.

#### **4.1.6 Research Training and Doctoral Education**

With the increasing attention being paid to Europe’s competitiveness and to its research capacity (as the foundation from which such competitiveness would arise), there is also an increasingly urgent interest in the ways researchers are trained and supervised in order to adapt such research training to the economic and social needs of our knowledge economies and societies. In order to attract young people to university careers, the **PhD level** is clearly **vital**. Discussions on the quality and possible improvement of current graduate education, and on research training that prepares for diverse career paths (also outside of academia) form a central focus of Europe-wide reform debates. Like all European universities, Slovak universities are facing new institutional challenges in this context: from embedding the individual specialised research of a doctoral candidate in wider disciplinary and social contexts, to guaranteeing quality of supervision and creating common institutional structures of management, recruitment, funding, and marketing under the roof of graduate schools.

Evaluators have found **many motivated and open-minded PhD students** across the country, who appreciate the freedom to acquire more knowledge in academia, seek access to international projects and appreciate cooperation in international teams. Bratislava in particular seems to be appreciated as a good base from which such internationally connected research can take place. However, it seems that Slovak universities offer research training environments of widely varying quality and levels of supervision: some PhD candidates find themselves in highly supportive environments which also pay attention to their career development, while others feel entirely left alone in their quest for academic and professional success. This variability is, of course, a Europe-wide phenomenon which warrants significant attention and is

currently the central reform focus of many research systems. But there are some conditions which deserve particular attention in the Slovak Republic as they seem to pose particular challenges, especially if one thinks of PhD students as the decisive research labour and innovation force in the academia and industry of tomorrow.

The most urgent need for improvement concerns the current **level of stipends** which should be increased so as to allow at least the brightest and most promising to concentrate on their PhD thesis -- rather than having to work outside to survive. Evaluators found a considerable number of intrinsically motivated individuals who, though happy to pursue an academic career, felt they owed it to their families to look for a job outside of academia or outside of the country if they wanted to stay in academia. In addition to the extremely low salaries, the doctoral students receive no tax breaks or social security benefits.

A second problem lies in the **high teaching load** which many PhD students are subjected to. It seems that the rapid expansion of the higher education system in terms of student numbers and implicit lowering of student qualifications, has affected PhD students in particular since they are often the ones who have to teach the exercises and support seminars in which learning difficulties become most evident. Thus, many PhD students have reported spending a majority of their time on teaching and tutoring duties. The expectation that a PhD thesis can be completed in three years is clearly not adapted to this teaching load. This raises obvious questions of quality when comparison is made with some other European countries where PhD studies are essentially full time.

Another problem which deserves attention and which has indeed resulted in some policy changes in recent years is the **low correlation between research performance of a given research environment and the number of PhD positions**. Curiously, the ARRA analysis has shown that the research impact of the various faculties is not strongly correlated to the number of PhD students it attracts: the number of PhD students per professor varies comparatively little across institutions within the same faculty grouping even though research output and impact does. Indeed, some faculties which took lower ratings of quality showed the highest number of PhD students. Thus, while research intensity and output is highly differentiated between institutions and individual faculties, this does not translate as immediately as one would expect into greater attractiveness and corresponding flows for the next generation of researchers. One reason for this might lie in the limited mobility of PhD students who simply continue their PhD at the institution at which they have conducted their studies, with professors whom they know from their second cycle courses. PhD students interviewed at different institutions seemed to confirm this estimation. Access to other research institutions seems to be less open than in other university research environments, e.g. in the US, UK, the Netherlands, and Germany, where the best qualified PhD candidates tend to choose the best possible research environment for their research training and see mobility as a source of intellectual enrichment.

To address this issue there has been a recent policy change in Slovakia (since 2005) which can only be applauded, namely to base the number of PhD positions on the success of the research environments (in this case measured through success rate for grants and publication activity). Such a funding formula is a necessary step to steer the flow of PhD students in the direction of the most highly performing research environments. But another type of measure would be just as vital, namely the possibility of acquiring PhD and postdoctoral positions through competitive grants, as is practiced in western Europe. At the moment, most senior researchers who have been successful with a grant proposal still cannot offer qualified doctoral candidates a position. The advantage of linking PhD positions to research projects which is practiced widely by the German, UK, Dutch and many other research councils, lies in the link which is thus established between the most competitive research and the number of PhD positions. In this spirit, the SRDA started a new programme in 2006 for "human potential", with an overall sum of ca. € 2.5 million,

awarding grants to young researcher positions (doctoral and postdoctoral), granted on condition of being linked to an excellent supervisor. Such measures are vital, should be greatly applauded and taken further. In future, it would be important to associate these positions also to more lucrative scholarships (which are currently limited to € 350, with no student discounts granted on any expenditures), including an allowance for social security and health insurance. It should be noted that a welcome change has occurred recently: since January 2008 the scholarships for doctoral students are not taxed and the system of social security was changed as well. But the level of scholarships should also be raised to ensure that PhD positions would be competitively attractive also with industry. In addition, the Slovak grant agency should consider the good experience with Young Researchers Fund, which entitles the researchers to choose the position themselves and take the fund with them. This fosters quality, mobility and early independence and enhances competition between research environments. Even mobility to go abroad could be very positive for the Slovak research system if some measures are put in place to attract those researchers back so that they may build up their own research groups in the Slovak Republic, benefiting from the research experience and know-how accrued abroad. Thus, some other Eastern European countries such as Estonia, which initially suffered from severe effects of brain drain, are beginning to see the benefits of returning young researchers. Judging from the deep attachment to their home country which many young people expressed, it is likely that many would return if minimally attractive alternatives for internationally open research careers are created for them in Slovakia. In particular, apart from research grants, early independence to realise their own ideas is vital to attract them back to the country.

Without sustaining and increasing efforts in this area, the following comment heard repeatedly during the evaluators' site visits at different institutions across the country, will continue to resound: "We are not able to get the best students for our PhD positions: the talented ones with knowledge of English leave for foreign competitive environments where they can get more money and better research equipment."

Another challenge which many research training systems are facing concerns the **increased need to embed specialised PhD research in larger interdisciplinary horizons**. Currently, Slovak universities have great difficulty in organising interdisciplinary programmes and research projects across faculty boundaries, a weakness which should be urgently addressed. In some countries, graduate schools are being established to address common quality concerns and give PhD students, together with their supervisors, a common platform of academic exchange which is often interdisciplinary in scope. Such structures would counteract the strong vertical organisation of the universities. Funding agencies should develop grant support for competitive graduate schools which can show internationally competitive research training environments and critical mass. Ideally, these graduate schools could be organised together with the relevant institutes of the Academy of Science to create meaningful closer cooperation structures between university and academy researchers.

Another dimension of research training, which seems to have received little attention so far, concerns the **preparation of young PhD candidates for diversified career paths**. Since it is well known that many PhD graduates do not end up in academia and Slovak industry has a growing need for qualified workers especially in science and engineering, Slovak institutions (like many European institutions) would benefit from introducing some additional training measures that foster their PhD students' transferable skills. Many institutions across Europe are currently exerting great efforts to introduce meaningful and subject-adapted ways to foster PhD students' presentation and communication skills, time and project management skills, ability to write successful grant proposals, present posters and lectures at international conferences, improve their academic English and develop their entrepreneurial competences and disposition. During the institutional evaluations, evaluators came across some such support courses (e.g. on how to start your own business or on patent regulations) through PhD representative organisations or other bodies. But more could be done by universities, with the support of funding

agencies, to help produce professionally versatile PhD graduates. This would be an area in which business and regional agency support could probably be obtained more easily.

Since many PhD candidates tend to go into professional practice when they see good prospects, and some cannot finish because the money runs out and they have to find a job, the system would benefit from letting these highly qualified individuals make the best possible use of their expertise by complementing it with effective subject-specific professional skills. Moreover, **the mobility between industry and academia** which is increasing slowly but surely across Europe and which many young Slovak PhD candidates who were interviewed in the course of the evaluation visits said they would welcome, would be greatly fostered **if universities and non-academic employers cooperated more closely with respect to their assessment of the innovative potential and skills needed** in a competitive knowledge-based society. Co-funding and joint projects between industry and academia would be welcome in some subject areas. As yet, many university and some industry representatives reported that companies do not appreciate PhDs because they regard them as over-qualified. Examples in other countries have shown that these judgements can change if the interface between academic expertise and professional competences were explored and fostered more systematically between both partners.

**Strategic Challenge 22:**

The Slovak higher education system should urgently address the considerable challenges in research training, and in doctoral education in particular, since attractive conditions for PhD candidates are the number one condition for the future success of the Slovak research system.

From financial conditions (including more PhD grants for best qualified candidates and social security benefits) to incentives for mobility and merit-based young researcher awards, academic research careers must be made much more attractive, already in the first stage, in order to attract the most gifted individuals and prevent brain drain. While PhD students should be encouraged to spend periods of research abroad, institutions and grant agencies should join efforts to attract young researchers back to Slovakia by giving them the means and early independence to realise their research projects. In internationally competitive research environments with sufficient critical mass, graduate schools should be created with the help of national funding grants to create structures of high quality standards and interdisciplinary exchange. Where relevant these graduate schools should be common units between the universities and the relevant institutes of the Academy of Science.

Furthermore, greater attention should be paid to the diverse career paths which PhD candidates will follow, including research-based careers in industry, by fostering professionally relevant skills.

#### 4.1.7 University Innovation Activities and Research in Partnership with External Stakeholders

During the institutional site visits, evaluators were struck by the often vivid interchange and mutual support which universities seemed to share with their regional partners. Many cooperation projects and common initiatives reflect good will and mutual identification on both sides. At the same time, it is often noted that business investment in research in the Slovak Republic is particularly low, not only as regards R&D investment in-house but also with respect to public-private partnerships and cooperative research projects. Indeed, in recent years, business R&D investment has declined from 0.3% of GDP in 2000 to 0.2% in 2004. From 2003 to 2004 the business sector expenditures on R&D went from 3 873 million SKK to 3 420 million SKK.

What are the **obstacles which prevent the private sector from investing more in university research**? Among the university and industry representatives who were interviewed during the institutional and the national system site visits, there seems to be a large consensus on the obstacles for better interface between private applied research and research at universities. Some of these are specific to Slovakia; others are shared more widely across Europe:

1. Industry representatives point to the problem of the age structure of the research staff, namely that there are not enough younger people.
2. The poor quality of scientific equipment makes it difficult to develop state-of-the art technology. One solution would be to build joint labs.
3. Industry executives feel the need for university leaders who are able to profile the faculty, making its strengths apparent and convincing industry leaders that they are investing into a winning environment.
4. The traditional institutional fragmentation originating from pre-2002 and overly vertical organisation prevent universities from being able to work across disciplinary boundaries. This makes the solution of problems often impossible since the latter tend to be interdisciplinary and cannot be addressed by individual disciplinary teams.
5. The size of the research groups is often too small to respond to the industrial research challenges.
6. The slow response of universities.

These obstacles reflect the evaluators' assessment of problems already noted which hinder academic performance, and thus should be another reason why universities may want to rethink their internal faculty structures, incentives and decision-making processes in order to facilitate internal flexibility, interdisciplinary perspectives and cooperative spirit.

The unsatisfactory speed of response may also have to do with the **support services**. These should help **to identify the right expertise for given industry needs** and foster exchange in order to identify common interests more easily. Hence, it is all the more vital that the new definitions of the HE Act which lay down more clearly the definitions of incubators, technology centres and research centres for university cooperation with industry and business, be accompanied with some financial support for the establishment of technology centres, technology incubators, and industry/ university centres of excellence. A wonderful **opportunity to extend these interfaces is currently offered within the context of the EU's Structural Funds** which allow expenditures on structural aspects of the knowledge economy and should help very significantly in jump-starting university-industry cooperation through common projects, infrastructures and cooperative PhD platforms. It is to be hoped that the conditions for drawing funds from the Structural Funds (through the operational programmes), which are currently being developed by the Ministry of Finance, will be as flexible and unbureaucratic as possible and based on foresight in order to attract innovative measures which will smooth the interface between industry and universities. At the moment it seems that too much time is spent implementing the support schemes, with money for PhD positions coming eighteen months after having been granted or projects being finished without any of the promised money ever having arrived. Care should be taken to ensure that some **university experts, familiar with innovation activities, should be included among those who devise the guidelines**.

Individual initiatives already show the way, as for example the multiple measures taken by a few of the technical universities to increase information about university research and demonstrate its interest for

industry as well as encouraging start-up initiatives, which have been supported by several companies, thus proving that mobilising business support for university initiatives is possible.<sup>16</sup>

It should be added that the potential of exchange between industry and research (inter-sectoral support), and of direct collaboration with industry is important not just in its own right, but also in order to make academic environments more stimulating and thus more attractive for young researchers.

Of course, innovation activities of universities are not limited to cooperation with industry. Company spin-outs and university patents or licenses are an increasing dimension of university activity at many institutions abroad, although many European universities have come quite late to this dimension of activity. Experience shows that these activities require good support systems to grow. It should be emphasised that the innovation activities of Slovak universities are in urgent need of national incentives and support. National data shows an overall decrease of patent applications of rather significant dimensions (see also section 4.2.3), falling from 2040 applications for domestic and foreign patents in 2000 to only 453 in 2004<sup>17</sup>. While this is mainly due to the preference for European patents since 2002, no corresponding rise of submissions can be noted there. In the light of this low level of activity, it is clear that major **efforts also have to be made to mobilise individuals at universities**. As patent applications require investments of time and resources, one can hardly expect the severely under-funded Slovak universities to contribute their own funds to patent applications with low rates of return. However, more could be done at institutional level to **promote students' entrepreneurial skills** in order to help build a new generation in which commercialisation of research results becomes a natural part of researchers' activities. Other countries (e.g. Latvia) have reported that focussing on the next generation may well prove to be a more effective method of inducing dramatic change.

Finally, one should emphasise that the exchange between universities and external stakeholders from industry, other employers and public agencies is often promoted through dense **networks at regional level**. In recent years, increasing attention has been paid to such regional cooperation networks and clusters since they are known to contribute to the smoothness of tacit knowledge flows and the many immobile assets which regions can provide for a thriving knowledge economy. Knowledge regions are actively promoted e.g. in the Copenhagen/Malmø area, in Munich, Barcelona, Zurich, Manchester, and Brno to name just a few successful examples. In the Slovak Republic, evaluators encountered some such initiatives to improve regional and metropolitan networking, with the help of common platforms, infrastructure and cooperation projects. The importance of such initiatives should not be underestimated and they should receive as much public support as can be mobilised. In particular, during the window of opportunity which is offered by the EU's structural and regional development fund, the Slovak national, regional and municipal authorities should support and facilitate such initiatives, which often originate with universities (note, for example, the initiative admirably conducted in Brno). Encouraging examples of cooperative planning between universities and regional industry and other actors were initiated at a few universities. The national government should support such initiatives whole-heartedly, with funds and larger competences (to regional agencies). The importance of regional and metropolitan networking for increasing knowledge intensity and productivity, and the vitality of university initiatives in this context, cannot be emphasised enough. Commendable examples in this respect were observed at some places where common structures and mergers are being pursued.

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<sup>16</sup> In one of these incubator projects, for instance, young people with ideas can start a company, receive infrastructural support, or attend workshops and seminars on skills on how to convert ideas into products.

<sup>17</sup> Slovak Rectors Conference Working Group: Data and Information for EUA Sector Report. Bratislava 2006.

### **Strategic Challenge 23:**

In order to increase the attractiveness of university research for enterprises, universities should allow and encourage interdisciplinary research in their organisational structures, and university funding agencies should support universities in their efforts to develop and use state-of-the-art scientific infrastructure.

The conditions for drawing funds from the Structural Funds (through the operational programmes should be as flexible and unbureaucratic as possible with respect to the form of innovative measures which would smooth the interface between industry and universities. Some university experts who are familiar with innovation activities should be included among those who devise the Structural Fund guidelines.

Regional clustering initiatives or even mergers of universities, to create clearer research and innovation profiles with critical mass should be rewarded nationally and institutionally.

It is also vital that the HE Act's clear definitions of incubators, technology centres and research centres for university cooperation with industry and business, be accompanied with some financial support for the establishment of technology centres, technology incubators, and industry/ university centres of excellence, as well as for research and innovation service support at universities. The latter can also be shared between several institutions.

## **4.2 Research Capacity at National Level**

### **4.2.1 Institutional Structures**

A review of the research capacity of the Slovak higher education system should not ignore the fact that the primary location for research in the Slovak Republic is still the Academy of Sciences. As in other Eastern European countries, the Academy used to be the only institution where internationally oriented academic research was expected to be located. Structurally the system is compared by Slovak representatives to the Max Planck Institutes in Germany, the CNRS in France, or the Consejo in Spain, with the claim and ambition to provide superior performance and production of good scientific output, thanks to its fixed focus on research. The 56 research institutes are funded from a separate chapter of state budget. After the Velvet Revolution, 16 institutes were closed down and the number of staff was decreased to one half (from 6000 to 3000). Of these 3000, 1568 are research staff (it is unclear why there are so many non-research staff positions), 267 of these have a Doctor of Science (a higher research degree not to be confused with a PhD); 106 are also professors and 147 associate professors at universities. The research staff of the Academy makes up about 15% of research staff of the Slovak Republic, is able to win 35% of all grants, has published more than 1500 papers in high impact journals, and is involved in 100 participations in 6<sup>th</sup>FP, in addition to 3 centres of excellence, and 20 NATO supported projects. It claims to make best use of the public money by being more flexible than universities and able to respond to new demands.

It clearly goes beyond the scope of this evaluation to verify these claims and judge the quality of the Academy's research capacity, given that there was only very limited data about the structures, funding, and research performance of the Slovak Academy Research Institutes in the context of this evaluation (this having been the object of a simultaneous other evaluation). However, the evaluators would like to recommend that **more attention be paid to the interrelation and degree of complementarity of profile between the Academy's and the university sector's research, since both subscribe to the development of highly qualified academic research.**

There are several ways in which the Academy of Sciences and the universities are connected. First and foremost, and most obviously, all members of the academy were trained at universities since they require at least a PhD in order to hold positions at Academy institutes. Some (about 1/6) are university professors and thus were or are themselves involved in educating and training students at university, in addition to their research activities at the Academy. Furthermore, for several years, Academy and university researchers have been sharing the grant agency VEGA to which members from both categories of institutions apply. VEGA's 15 committees are composed of members of both types of institutions and the agencies chair and vice-chair are held by the two types of institutions respectively. Of the 500 projects which the academy has been granted to undertake through VEGA, 200 projects are undertaken jointly by an institute of the academy and university research groups.

Similarly cooperation has occurred in the context of projects funded by the Slovak Agency for Research and Development. When this Agency encouraged university research teams to form centres of excellence with a focus on special topics so as to foster scientific exchange as well as critical mass, many of these projects were formulated jointly by academy and university research groups. (At the moment, however, the fate of this instrument is unclear.)

A final important link between both types of institutions consists in joint PhD research training. With the 2005 Higher Education Law, the institutes of the Academy no longer have the right to admit students directly. PhD students have to be matriculated at universities even if their everyday research work is sometimes done entirely at the academy. If a university PhD study programme is accredited, it can make an agreement with an institute of the Slovak Academy of Sciences, so that the university admits the student, with the according rights and duties (including teaching duties of up to 4 hours a week), even though the student may do most of his or her everyday research at an institute of the Academy. The final degree awarding power also lies with the university, even though the doctoral committee consists of university and SAS researchers. Nevertheless, it should be emphasised that the SAS institute is reportedly most often the primary research environment and location of doctoral supervision. Hence one may say that the PhD training is often formally located at the universities but in reality takes place at the Academy. In those situations, the spill-over from the research training at the Academy to the universities consists in teaching benefits and administrative burden but not really in research spill-over effects. In this way, the Academy "hosted" 400 external students in 2007 (i.e. 4% of the 10 000 doctoral students, though at some institutions there are significantly more Academy PhD "guests"). It should be noted that the success-rate of PhD training at the Academy institutes is significantly higher than at universities (70-80%) which may have to do with tougher selection procedures, higher percentage of grant holders, reduced teaching loads (which would be conducted at the universities, of course) but also more time resources of the supervisors. It is unclear how much Slovak university research is positively influenced by the research strengths of related institutes. Between some individuals the links may be close, but in other areas there were reports of a lack of interest in scientific exchange on the side of the Academy. It appears that some PhD students could not gain access to institute library resources which are the definitive sources of information in their fields. It goes without saying that such closed doors are hardly acceptable in a public research system.

In conclusion, we can say that cooperative links exist between universities and Academy institutes but that these are still relatively loose if we compare them, for example, with the many joint labs of the CNRS and universities in France or the international research schools of Max Planck and universities in Germany.

Thus it is questionable whether the separation of academic research into a university and a research institute sector is advantageous in building the overall Slovak research capacity. Clearly, researchers at the Academy work under significantly better conditions in terms of time resources and scientific

infrastructure than their colleagues at universities and would thus have little interest in giving up these conditions for a career environment which allows little time for research and in which access to state-of-the-art equipment and other scientific resources remains difficult. Moreover, even under the more favourable conditions of the Academy institutes, researchers there are still significantly under-resourced compared to their western European colleagues. An unplanned rash merger of the two sectors which would make Academy researchers “descend” to the working conditions of university researchers would sell out the benefits of the acquired research experience of the Academy workforce. At the same time, however, the fragmentation of the Slovak system of research is far-reaching and, given the limited resources, implies many unnecessary double expenditures and wasteful fragmentation of financial resources.

**Strategic Challenge 24:**

In the light of the far-reaching fragmentation of the Slovak research system, the evaluators recommend that the Slovak government and funding agencies develop more forceful instruments which would favour a step-by-step integration between the Academy and the university research sectors. More permanent and forceful institutional links should also be built up, e.g.

- in the form of common professorships based at universities, with more research time than is currently available at the universities but with more influence on training the next generation than currently guaranteed at the Academy;
- common research training or graduate schools which would not just put the administrative burden on the universities but would build more integrated research environments between relevant units in both sectors;
- more far-reaching incentives for common project proposals;
- more possibilities for universities to differentiate the teaching duties between and within institutions, to the extent of different profiles for different professorial chairs;
- possible real mergers of individual Academy institutes with relevant partner universities especially at those places where the entities involved are small.

Generally, a greater proportion of competitive funding for larger research projects would foster cooperative structures both within universities but also between researchers of the universities and Academy institutes.

At a later stage, when structures have had a chance to integrate more and competitive research environments have had more chances to develop in the university sector one may consider merging the sectors, as has been successfully achieved in the Czech Republic for example.

It should be noted that in addition to the 57 institutes of the Academy there is a wide range of government dependent institutes which are directly financed within the budget of a particular ministry. Thus there are 15 research institutes under the aegis of the Ministry of Agriculture, for example. Some state institutes of ministries were privatised a few years ago and are now run as limited companies (e.g. in the areas of building and transportation) while others are still public agencies with considerable budgets and research staff. Both groups exert substantial influence on research policy, although it is not quite clear to outsiders through which channels of communication this influence is exerted. What is clear, however, is that research policy is not just influenced by the universities but rather, for basic research, by the Academy researchers and heads of the above-mentioned research institutes of the ministries or, for applied research interests, by directors of privatised limited companies with close ministry contacts. **The evaluation team would recommend also to incorporate these state research institutes in the analysis of the research structure in Slovakia and to develop a plan toward a gradual integration of the sectors.**

#### 4.2.2 Research Support and Funding: Scope and Instruments

As mentioned under 2.2 and 3.2, the Slovak Government, while having committed itself to the Lisbon Agenda and its 3% GDP expenditure on R&D, had to lower its targets, set in 2005 at 2,6%, when it became clear that the Lisbon objective could not be achieved in the medium term, neither by government nor by business. A new proposal of the government sets an even lower target of 1,8% by 2015 (rather than 1,8% by 2005 as was mentioned in the national Science and Technology Policy Concept for 2000-2005). However, even this new target is beginning to seem unrealistic if one considers that there was no increase in R&D percentage in 2005 or 2006, with expenditure on R&D currently at 0.51% of GDP, (or 0.39% of state budget). Of course, this stagnation should be put in some perspective, since it is due in part to the fact that the substantial increase in GDP made the Slovak government's considerable nominal increase of public expenditure on R&D in the period from 2002 to 2005 not result in an increase of relative GDP percentage. However, what remains particularly worrisome and contrary to the EU's call for government action, is the fact that business expenditure has decreased even in nominal terms, at the same time.

Thus there are **two major challenges to be tackled: first, increasing the overall expenditure on R&D further, in order to make up for major gaps in competitiveness in the Slovak research system. The second challenge consists in creating conditions in which businesses will be more prone to invest in private and public research.** Of course, in order to create such conditions, at least for the medium term until some first changes of attitude can be registered, the government will have to invest in appropriate measures to enhance the attractiveness of R&D investment through additional increases in public expenditure. Such a paradoxical step of increasing public investment in order to encourage businesses to increase investment in publicly based research has been frequently implemented in other national policy contexts. It serves to increase public confidence and jump start the process.

**The evaluators have not been convinced that government officials are aware of the urgency of both problems.** Indeed there seems to be a tension between those protecting the state budget, in view of Maastricht criteria of the European monetary union, and those who can see that the Slovak competitive position in knowledge intensive sectors is deteriorating rather than improving. The new government target of 1,8% of GDP for R&D by 2015, is supposed to be financed with two thirds from the business sector (which is currently among the most frugal R&D spenders in Europe). How this target with its ambitious business expenditure ingredient will be achieved, through which policies and programmes, remains to be seen and is still being debated in the context of the drafting of the New Innovation Policy. During 2007, the evaluators could not obtain information on concrete plans of individual measures to be launched. Clearly, tax and other investment incentives for business expenditures in R&D will be part of such measures, i.e. the highest degree of incentives will be given to investments with the highest value added of production so that knowledge intensive sectors will be able to benefit from more favourable conditions in the future.

A signal of greater national awareness of the key challenges regarding the research system was reflected in 2005 in the Country's Strategy for Competitiveness Development in Slovakia until 2010 (the Lisbon Strategy for Slovakia) and the new law on the Organisation of State Support to Research and Development (the Law No 172/2005) which provided major contributions to research and innovation policy debates in Slovakia, as discussed below.

The Competitiveness Strategy has two basic pillars: (I) Completing and maintaining positive results of the structural reforms in the field of macroeconomics, social care, health care and pension reform. (II) Development priorities for the knowledge based economy.

Four major priorities were identified for the second pillar of the strategy:

- (1) Human resources and education policy,
- (2) Information society policy,
- (3) Research, development and innovation policy and
- (4) Business environment policy.

These priorities are to be implemented via four Action Plans, i.e. including one on R&D and innovation. As the Commission commented in its Country Report Slovakia 2006, "the preparation of the 2006-2013 Innovation Strategy and the National Reference Framework (to allocate Structural Funds resources) were important steps towards a National Research Innovation Plan." The subsequently drafted *Action Plan for Research, Development and Innovations* was very positively received by the researchers since it recognised that innovative capacities of enterprises depend strongly on the availability and use of new knowledge generated in research development. The action plan includes 14 projects intended to create an internationally competitive system of research, development and innovation in Slovakia. The most important items include:

- (a) support to national network of Centres of Excellence (€32.5 million),
- (b) building a new central public agency to support R&D (€20.6 million),
- (c) a new system of national R&D programmes (€15.9 million),
- (d) support for doctoral and post-doctoral students (€5.0 million),
- (e) support of the mobility of human resources in the R&D sector (€2.3 million) and
- (f) support for technology incubators and innovative firms (€ 2.5 million).

At the moment, however, it is not quite clear what the current status of the Competitiveness Strategy or the National Action Plan is, whether they are still actively guiding policy or have become historical documents which will be replaced by entirely new policies. Clearly, some of the instruments introduced under the Action Plan, such as the centres of excellence, were critically viewed more recently. In March 2007, the new government adopted a new innovation strategy which established regional centres to support bridge building among research, universities and business, with first calls planned for autumn 2007. At the time of writing this report it was still unclear what the funding instruments and effects on universities would be, and how that strategy interfaces with the Science and Technology Policy mentioned above.

Equally unclear is the status, budgetary scope and funding instruments of the new Slovak Research and Development Agency which was introduced in 2002 with the main aim to allocate a substantial share of state aid for R&D activities and to work towards improved professional R&D capacities as well as a higher efficiency and more transparency in the R&D sector. This agency coexists with the government funding authorities VEGA and KEGA (see below) which is managed under the roof of the ministry of Education and for which only researchers from the universities or Academy institutes were eligible.

The Slovak Research and Development Agency (SRDA) can clearly be called the largest single innovation policy measure in Slovakia. It is important not only because, since its establishment in 2002, the SRDA's budget has increased significantly each year (e.g. from €4.825 million in 2004 to €12.567 million in 2005 and €19.310 million in 2006) but also because it introduced more far-reaching elements of competitiveness into the Slovak research community and provided significantly more support to good quality projects than any other scheme. The new statutes of the RDA were approved in Government Resolution 250/2006 of 22 March 2006 and provided for new programmes to be developed by the Agency, concentrating on the development of human resources in the R&D sector. This is a welcome step in the right direction as the current lack of availability of young and talented scientists is a major challenge

for Slovak innovation policies (as described in sections 4.1.5 and 4.1.6). The programme covers the period from 2006 to 2010. Measures to improve human resources in R&D include:

- creating an environment that is more favourable for postdoctoral workers in R&D,
- supporting mobility between industry and academia,
- improving cooperation between Slovak and international R&D facilities and
- improving education in R&D ethics.

The instruments that are available to achieve these goals include a new type of three-year employment contract for postdoctoral workers, re-integration grants for Slovak R&D workers employed abroad for at least two years, and grants for outstanding mentors in PhD education. The programme also contains plans for the creation of a database of Slovak scientists working abroad. In addition, there are measures to promote science and R&D in society. These include:

- making young people aware of the importance of R&D,
- promoting partnerships between research institutions and primary as well as secondary schools to generate an increasing awareness of science,
- promoting a better coverage of scientific topics in the media and
- promoting regional and national science competitions for talented young people.

The SRDA is expected to launch at least one annual call for expressions of interests related to this programme. The overall amount available for the programme depends on the annual national budget resources and is likely to vary from year to year. First calls were expected in 2007 but put on hold unexpectedly in the middle of the year.

On the part of university and Academy researchers the **introduction of the SRDA and its principle of free competition, working on a bottom-up principle of project formation, had very positive effects**, resulting in a proliferation of competitive spirit and initiative as well as in many applications from good university teams, including a growing number of common applications from academy and university researchers. With an increasing budget, there was an increasing amount of support to active groups, so that researchers with ideas and good performance records were beginning to develop a noticeable surge of competitive new initiatives.

For university and Academy researchers alike, the new agency brought major improvements since it distributed highly competitive full cost grants which any institution could apply for (universities as well as public and private research institutes, with a success rate of 30%). However, since the new government has cut down the budget of this agency (only 12% of the grants were financed in the last year), researchers at universities and in Academy institutes cannot even make plans, given the transitional situation. Negotiation of this year's and next year's budget was still ongoing in summer of 2007. A general call for grants was not planned by the government since the money was supposed to go to specific programmes which were more responsive to increasing applied research immediately. The fact that fundamental research and applied research are by nature intimately and unpredictably linked did not seem to be considered in governmental policy.

It is not clear to the evaluators why this extremely positive initiative and apparently even the mission and value of the agency seems to have been put into question again. To the EUA evaluators, **the support of competitive funding practice of best performing research groups is clearly sending the right signal to the research community**. Even from the point of view of the innovation capacity of the country, it is well known that a competitive basic research community is a necessary precondition for private sector investments as well. Moreover, **the evaluators recommend that the competitive part of the funding be increased further, to create more incentives for university researchers to compete on the market**.

This would encourage researchers to focus rigorously on their strengths and to seek advantageous collaborative structures. In this context, the SRDA's scope should be widened rather than restricted, on the condition that it follows competitive criteria and strictly selects peers from a sufficiently large scientific pool i.e. including foreign experts, to guarantee unbiased reviews of the proposals.

Before and after the establishment of the Slovak Research and Development Agency, two other funding agencies have been available for university research and cultural activity grants: VEGA (for research activities) and KEGA (for cultural and artistic projects, such as, e.g. for development of educational areas, modern e-learning methods, realisation of modern textbooks, or artistic projects). The VEGA Grant Agency was established in January 1996 as a funding and advisory body for the Ministry of Education and the Slovak Academy of Sciences in the fields of implementation of S&T policies, financing basic research and evaluation of research projects. VEGA is not an independent legal grant agency, but rather an agreement of competitive grant distribution (though at a lesser degree than the SRDA) between the university sector and the Slovak Academy of Science. Its purpose is to increase effectiveness of resource allocation of the ministry of education's research budget. Between 2002 and 2005, the Agency sponsored 1586 grants with €7.26 million in total. In 2005, the VEGA supported 450 new two- and three-year projects. The success rate is significantly higher than for the SRDA (between 70% and 80%) so that the competitive elements can be said to be less significant, even though grants are also distributed through peer review. Indeed, usually university researchers would submit smaller project proposals to VEGA and then apply for grants through SRDA for bigger more mature and competitive projects. One should add that, as the restricted overall sum suggests, the individual VEGA grants are very small, providing only additional cost money, with no salaries for research staff or PhD students. Usually VEGA grants are used for travel money or library resources etc. and other expenditures which, in other countries, would often be covered as annual operational costs of each institution or individual institutes. About half of all university academic staff benefits from some VEGA grant support.

The overall sum of 1 billion SKK crowns (35 million €) which is reserved for research and technology at higher education institutions is distributed in two parts: 54.5% is given to institutions for developing research infrastructure and as a contribution to the wages of full-time research staff. The second part (45.5%) is distributed through competitive research grants (17 million), either for basic research, distributed through the SDR or through the Ministry's of Education VEGA (€ 9 Million) or KEGA (€ 2 million), or as support for applied research (3 Million €) which is important for medical or technical faculties or programmes also involving business sector and commercialisation. A fourth channel of such grant support seeks to facilitate international scientific cooperation (800 000 €), so as to enable Slovak researchers to be equal partners in bilateral cooperation programmes or to prepare programmes within 7<sup>th</sup> FP of the EU.

As attractive as the idea of multiple sources of competitive funding may seem, it is **not clear to the evaluators that such small sums of money for basic operational costs as distributed by VEGA should really have to undergo the comparatively time-consuming and costly procedure of peer review.** For these types of expenditures, efficiency may well be improved significantly if these funds were simply given to the institution for its operational research budget, with the obligation to distribute the funds according to past research performance or research potential (for young researchers) to the researchers' or institutes' annual budgets.

In addition to the problem of fragmented funding schemes and overly small level of grants, the biggest problem lies in the restricted possibilities of obtaining PhD positions for promising projects (see also section 4.1.6). **If more PhD positions were directly linked to the competitive grant distribution, the system would have a greater assurance that research training occurs in the best research**

**environments.** The same applies to the post-doc level. In 2006, for the first time, a programme of grants for post-docs with 50 positions had finally begun but seems to be again under question. A research system without adequate post-doctoral support will have a difficult time competing internationally, and will run the risk of losing its best young researchers to countries abroad, unless excellent programmes for attracting these individuals back to Slovakia are set up.

There is also **room for improvement in the administration of grants.** It seems that considerable time elapses between the submission of the proposal and the selection and even more time often elapses between the approval of the grant and the flow of money from the funding agencies. In addition, the time for the use of the money is restricted, often to only one year so that a large portion of the money may have to be returned. In a system where so little research grant money is available such unnecessary complications and waste should be avoided at all cost.

Moreover, researchers have problems with the bureaucracy of the grant system: a good proposal requires cooperation with accountants and lawyers, not on the content but on the formalities of the proposal. As there are no units at the universities to support grant applications or management of the grants, complicated grant regulations and accountability rules lead to considerable waste of researchers' time. The bureaucracy also seems to hinder cooperation with other universities, since money for equipment goes only to the coordinators and the money flow between universities is difficult. Since it is only the main coordinator who gets money, there is a tendency for institutions or research groups to prefer their own project over cooperative structures, even though the latter could contribute to creating critical mass and stimulate new interfaces and ideas.

Also, the requirement of co-financing projects through the (under-resourced) institution means that the latter is not always able to cover the wages for the projects. A greater number of full cost grants should be made available to prevent universities from "bleeding out" if their researchers are successful in obtaining competitive grants.

Last but not least, it seems that there is some room for improvement with respect to the transparency of grant decisions, concerning criteria, average points and thresholds of averages below which grants will not be submitted to the review commissions.

The evaluators recommend that funding agency administrators consult some of the administrative practice and regulations of other well-known research councils in Europe in order to remove bureaucratic obstacles, increase efficacy and solve some of the afore-mentioned problems.

The evaluators were impressed with the multiple new initiatives and new momentum which the SRDA in particular seems to have developed and would urgently encourage the government to ensure continued support for these funding channels. The capacity to improve practice and build new funding instruments which would help competitive and cooperative structures is well developed and should be fostered further. The evaluators would also encourage some patience with the introduction of new funding instruments such as the centres of excellence. Even if a first round of calls does not lead to the expected applications or results, experience abroad shows that it often takes several rounds for the research community to adapt to the funding instruments and develop the right quality of proposals, especially in so far as larger cooperative projects are concerned. It should be remembered that the time span for changes and results in research culture and performance are never short term but medium term at best, so that governments and public authorities should try to think in longer periods if they are interested in sustainable changes.

### **Strategic Challenge 25:**

In order to buttress the system for the future, the Slovak Higher Education Research system is in urgent need of substantially increased funding. Recent increases point to the right direction but are insufficient to bridge the gap that has opened over the years between Slovak research and that of competing countries.

In addition to being still severely under-resourced, university research suffers from a high degree of fragmentation between the funding agencies and their funding instruments, a still insufficient degree of competitive performance criteria of grant distribution and unnecessarily high level of bureaucracy and delays in funding grant administration. If these adverse conditions are not removed, Slovak university research stands no chance to compete internationally.

#### **4.2.3 Research-based Innovation and Public-private Partnerships**

Already in 2005, the Slovak Ministry of Economy listed the main weaknesses detected in the Slovak innovation system:

- Lack of strategic and explicit innovation policies
- Weak applied research
- Low and decreasing R&D expenditure
- Low workforce mobility between industry and academia
- Low transfer rate of R&D results to business.<sup>18</sup>

As a consequence of these weaknesses, innovation intensity is very low in Slovak companies, as is underlined again by the European Commission, in its most recent country report (2006) where it comments:

“The Slovak Republic has failed to address some of the most serious problems in innovation performance, namely the shares of the business and public sectors in total R&D expenditure which are at 38% and 25% respectively of the EU-25 average. University R&D financed by the business sector only reaches 5% of the EU-25 average and early stage venture capital 6% of the EU-25 average. The poor financial basis of R&D system is reflected in very low commercial output. Patent activity only reached 3% of the EU-25 level.” [...]

“If the Government continues its efforts and is able to fully implement the Action Plans for the Competitiveness Strategy, Slovakia may escape a fate of low-cost, low-value added economy. Reasonable education levels combined with high innovation expenditure in manufacturing and high ICT expenditure can generate good opportunities to establish high-tech manufacturing industries. Of course, this would require an environment that is conducive to the commercialisation of the R&D results.”<sup>19</sup>

As already pointed out above, a particularly difficult issue is the limited interest of the private sector in research and innovation investments. Indeed, for the moment, the private sector seems to need money from the state budget to invest in research at all. Even though some sectors are rapidly developing, such as the IT and electro technological sectors, these are still the exception. In the field of pharmaceutical

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<sup>18</sup> Slovak Ministry of Economy, Proposal for the country's Innovation Strategy for 2006-2013, Bratislava, 2005.

<sup>19</sup> Annual Innovation Policy Trends and Appraisal Report Slovakia 2006, Brussels: European Commission, Enterprise Directorate-General 2006.

research, for example, there is practically no private sector research. Hence it comes as no surprise that the share of high-tech exports in its total exports is amongst the lowest in the EU-25: 3.4%. For now, the Slovak Republic is performing very well economically in terms of GDP growth but this is due mainly to low-cost labour and low value added manufacturing. The European Commission's country report points to this as a threat to sustainable success:

"The modest level of support for innovation activities contrasts sharply with very generous assistance granted to major foreign low- and medium-tech investors (car producers in particular). Low levels of R&D and innovation expenditure in Slovakia are also reflected in much lower productivity levels in the Slovak economy than in the EU-25. Inadequate financial resources allocated to R&D and innovation activities are major threats for the future development of Slovakia. Current trends in the R&D spending do not allow a knowledge-based economy to emerge. If these trends are not reversed, Slovakia will become the weakest member of the EU-25 area. This problem could hardly be solved with partial improvements in selected R&D sectors."<sup>20</sup>

As the national Competitiveness Strategy rightly underlines, since wages are increasing in the Slovak Republic and that other countries further east may soon become more competitive in terms of low cost labour, the Slovak Republic has to brace itself to compete more successfully in high value-added sectors. High labour cost countries are only able to compete in an increasingly globalised economy as long as they are specialised in industries that require a high content of knowledge, high qualification levels and expertise in the labour force. The Commission recommends that the Slovak Republic should focus more explicitly on R&D and innovation in SMEs (including early stage financing), on increasing the impact of the high level of foreign direct investment on R&D and innovation, on more and better leveraged public spending on R&D and innovation, and on a stronger emphasis on applied R&D, together with an improved patenting regime.

Under what conditions, however, can the university sector contribute to increasing such competitiveness, and thereby also to the competitiveness of the Slovak R&D system?

Some of the key obstacles which prevent universities from feeding more actively into the innovation pipeline are analysed very clearly by the Slovak Investment and Trade Development Agency (SARIO) as well as by the industrialists:

- The main problem lies in the fact that the funding incentives prevent universities from focusing on research and innovation challenges since they are funded predominantly on the basis of student numbers. More incentives are needed to reward research and innovation initiatives in universities and for activities with private sectors institutions.
- Although applied research is insufficient it should not be built up to the detriment of basic research which is also under-funded and is an important foundation for applied research.
- Entrepreneurial thinking is not rewarded enough within university activities and careers.
- There are too few technically educated graduates. Moreover, more diverse tracks of technical training are needed, including those below university level. Appropriate preparation is already needed at secondary schools, after which specialists with different levels of technical training are needed, from technical workers in mechanical training without university degrees to those who can design new systems.
- Salaries have to be increased to make careers in applied and basic research at university more attractive.

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<sup>20</sup> European Commission, Country Report Slovakia 2006, [http://trendchart.cordis.lu/reports/documents/Country\\_Report\\_Slovak%20Republic\\_2006.pdf](http://trendchart.cordis.lu/reports/documents/Country_Report_Slovak%20Republic_2006.pdf)

- Investment into technical and scientific equipment is greatly needed since it would also significantly increase quality and state-of-the-art teaching and research. Personal experience of different industrial representatives confirms that when some minor research was needed from universities, the latter were often not sufficiently equipped to solve these problems.
- Lack of funding is particularly dire in the technical subjects (the subject coefficient being too low to support infrastructural investment and maintenance) which means that technological universities have a great deal of problems with money so that they approach businesses when they need money rather than build long-term partnerships based on mutual interest, which are key to success.
- Last but not least, another obstacle to investors which should not be underestimated concern logistics and infrastructural connections which are in urgent need of improvement.

Because of the above obstacles, cooperation between industry and universities does not show signs of improvement. For business investment in university research or cooperation to take place, some return on investment has to be possible or expected for the medium or, even better, short term. Globally oriented companies, especially the bigger ones, usually have the expertise to identify conditions for profitability and decide when and where it would be advantageous to reallocate funds and staff.

For universities, several possibilities to obtain support or facilitation exist. As mentioned above, some support for applied research in cooperation with businesses can be obtained through the SRDA, or through the Ministry of Economy.

SARIO may prove to be advantageous when universities are looking for the right partners in a given field, since it could help develop innovative models of knowledge economy development in which university perspectives and regional development concerns are brought together. As a State Agency fostering foreign direct investment into Slovakia and supporting foreign trade of Slovak companies, SARIO primarily helps find and support investors (helping them find an environment in which human capital / recruitment potential can be found, but also with real estate and applying for state incentives). However, the agency also tries to foster private/public partnerships, in particular aiming to support investments of larger investors in common R&D centres and to shift the investors' attention away from universities as providers of cheap labour force to focussing more on their potential for R&D activities, thus fostering direct cooperation with universities. Given the fact that the main private players are foreign companies with their own R&D in their own countries, SARIO just uses a step-by-step approach, showing existing R&D investments and well-known investors. First successes have been achieved in the automotive, electro-technical sector and IT sectors, where there is now an increased demand for qualified labour.<sup>21</sup> With respect to university-business partnerships, SARIO could help create favourable conditions for public-private partnerships, e.g. through much-needed match-making at informal meetings where people from the same region can speak about issues of common interest to both parties. Representatives from SARIO, the universities and the chambers of commerce, trade and industry all agreed that people do not know one another's' institutional interests and cultures well enough. While investors usually first approach Slovakian sites as production facilities, this may be a first step to more knowledge intensive, high value added investments: if they find good conditions at universities they will use them. Multinational companies commission and conduct research where they can obtain best results at a moderate price. Of course, even some tax deduction incentives cannot influence the quality of the results which have to be ensured through the inner functioning of the research system and the competitive nature of its funding channels.

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<sup>21</sup> SARIO also helps with the use of structural funds, the creation of industrial parks, with support for business incubators, as well as with macroeconomic, sector and regional analysis, including implications for university education.

The difficulties of university-industry relations are of course even greater with respect to SMEs. Here there is very little opportunity for support. SMEs can obtain some support through the National Agency for the Development of SMEs, for instance by providing risk or venture capital<sup>22</sup>. However, in addition to a need for more support of SME-university relations, there is little facilitation in terms of an easier entry of SMEs into university research. It is internationally well known that SMEs may often need more facilitative support to be able to approach university research in a targeted manner. Furthermore, their concerns may not always be of scientific interest to universities. Other institutions may sometimes be better equipped to respond to innovation concerns or potential of SMEs. In the context of institutional differentiation, the **Slovak higher education system may also want to reflect on whether the second or third type of higher education institutions which are currently being introduced may have a special mission as well as receive targeted support for contributing to the innovation potential of SMEs.**

In addition to facilitation, venture capital for easier business start-ups are an important contributor for a smoother transfer of research results into commercial opportunities. While the Slovak Republic has been much admired for its tax reform in the form of a flat rate tax accompanied by the abolition of the dividend tax, this reform did not create the **required supportive environment for venture capital investments** (e.g. a pool of risk capital, tax treatment of venture capital, etc.). It appears, however, that there is awareness of this problem as well as a will to address it.<sup>23</sup> In its design of new support instruments, due consideration should be given to university research. Furthermore, those who have gained experience in start-up support at universities should be included in the design phase.

Generally, it should be noted that some **difficulties could be observed in the coordination between the ministries and their key experts**. Especially for those issues which reach across the domains of different ministries, such as innovation frameworks and support structures, there seemed to be insufficient exchange between the Ministries of Education and Economy. It is vital for the success of innovation policies that sufficient understanding of commercialisation of the R&D results comes together with sufficient understanding of universities and university research structures. The Ministry of Economy has been able to design and implement a number of particularly industry-oriented innovation policy measures, but **no coherent innovation policy framework was established which included measures for university-industry links**.

One may also learn from those university researchers who have already managed to establish close links with industry and let their analysis of possible improvements inform new innovation support measures. The evaluation reports showed that, particularly at the technical universities, many researchers often have cooperation contracts with private companies, Slovak and foreign, which could prove extremely helpful for future development of appropriate facilitation instruments.

#### **Strategic Challenge 26:**

The Slovak Government, the European Commission and Slovak industrialists and university representatives have presented clear analyses of the weaknesses of the Slovak innovation system and the role of the university in it. In particular, a large consensus exists in the identification of the obstacles that hinder university-industry relations. The two Ministries and relevant funding agencies should develop funding and facilitation instruments for university-driven innovation and university-industry links, making use of the experience of university researchers who have cooperated actively with the private sector, and with the help of European Structural Funds.

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<sup>22</sup> See [www.nadsme.sk](http://www.nadsme.sk).

<sup>23</sup> Annual Innovation Policy Trends and Appraisal Report Slovakia 2006, Brussels: European Commission Enterprise Directorate-General 2006

#### 4.2.4 Universities as Motors of Regional Development

Regional development has become a central concern of innovation policy. Increasingly, knowledge transfer and tacit knowledge flows are being recognised as vital assets of a knowledge economy. In this context, the role of universities is regarded as essential, both with respect to its research production and in its training and education of qualified knowledge workers for the regional economy. To foster the development in expanding or rising “knowledge cities or regions” abroad, such as Dublin, Manchester, Cataluña in Spain, or Oresund (South-western Sweden and Greater Copenhagen Area), or Brno in the Czech Republic, regional development plans are drafted across the institutional borders of different agencies, involving ministries, public agencies, universities and key private companies, in order to identify major regional strengths and opportunities, set priorities for cooperative actions and milestones, and specify resources to invest in the regional development. As these and other international examples show, the government’s role in regional development is usually one of facilitation rather than control.<sup>24</sup>

Naturally, such regional initiatives would be of major benefit also for the development of the Slovak Republic and should be encouraged through government actions, be they in the already more competitive Bratislava hub or in other regions with particular sector niches. However, up until March 2007, Slovakia has had no explicit national or regional innovation policies or councils. Issues related to innovation development were included in broader development plans. The central government played a far more important role in the design and implementation of regional innovation plans than the regional governments, mainly because it was much better equipped with both human and financial resources. There are no specific regional innovation strategies, with the exception of the Bratislava Region. Most regional governments try to incorporate innovation policies into their basic development documents and to link them to a National Development Plan (NDP), often in the hope of obtaining additional funding from EU sources as their own financial resources are fairly limited. (Each region is free to compete for innovation policy schemes launched by the central government and supported by the Structural Funds.)

The Bratislava Region seems to offer good practice with respect to strategic regional development awareness in general and to the role of knowledge development in particular. With a GDP per capita (in purchasing power parity) of over 119 percent of the EU average in 2003, the Bratislava Region is the second richest area in the new Member States and is therefore not eligible for financial assistance from most EU programmes. The region can participate, however, in Objectives 2 and 3 programmes. The development of innovation in the Bratislava Region is almost entirely financed from the European Social Fund on the basis of the human development strategy for the Bratislava Region (laid down in the Single Programming Document NUTS II – Bratislava Objective 3). The Bratislava Region is the only Slovak region to have its own Regional Innovation Strategy (RIS) which was initiated by the Bratislava Self-Governing Region (BSGR), co-financed and methodologically led by the European Commission, and implemented by the Business and Innovation Centre in Bratislava. The target group of the project included technology oriented SMEs with an innovation potential. The RIS-BSGR project conducted an analysis of the needs of enterprises and the supply of an ‘innovation infrastructure’ in the BSGR. The proposal for a Regional Innovation Strategy suggested three horizontal and three direct measures to support innovation development in the Bratislava Region, all of which include universities as partners:

- Horizontal measures: (a) communication and networking, (b) regional technology policy – regional foresight and (c) and implementing Single Programming Documents.

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<sup>24</sup> For a discussion of the processes of knowledge regions and the role of the universities, see Sybille Reichert, *The Rise of Knowledge Regions: Emerging Opportunities and Challenges for Universities*. Brussels: EUA Publications 2007.

- Direct measures: support of (a) innovation infrastructure development, (b) cluster creation in selected technology sectors and (c) financing system and creation of capital funds for innovation activities.

Such examples should be encouraged through national government support and may act as models of good practice also for other regions.

**Strategic Challenge 27:**

To facilitate regional strategic thinking and regional development initiatives, regional agencies should be given some strategic competences and resources for knowledge economic development. To develop forward-looking initiatives which would promote knowledge capital in the regions, governmental regional agencies should act in close alliance with universities and research institutes. Cluster policies and networking between universities, private companies and government agencies should be facilitated in order to act as motors of regional development.

## 5. Executive Summary of Recommendations

### *Funding*

The **gap between Slovak R&D expenditures and the rest of the EU, especially the most competitive Members States, is considerable and increasing further**. Recent increases (in absolute terms) of R&D and higher education expenditures by the Slovak government are commendable but insufficient to close that gap. Without urgent and forceful investments in research and innovation in the production of highly qualified labour and favourable framework conditions for research production and knowledge-intensive industries, the current growth of the Slovak economy is unlikely to be sustainable. While the Slovak Republic's Lisbon Competitiveness Strategy has recognised this, consequences in terms of government prioritised spending still remain to be seen.

As the pace of knowledge economy development is accelerating, the Slovak Republic should urgently redress the imbalance in research investments vis-à-vis its international competitors. In addition to **increasing the level of research funding significantly**, the framework conditions will have to be adapted to

- provide opportunities for rewarding performance and initiative,
- reduce the fragmentation of the research system, both in terms of funding streams and structures,
- foster institutional alliances, networking and creating critical mass,
- encourage private investments in public research
- provide adequate competitive infrastructure for research.

The Slovak Research and Innovation System should **use the Structural Funds as a unique window of opportunity** in the coming years by making full and effective use of these substantial means **for renewing the research infrastructure, networking and framework conditions for all actors in research and innovation in order to build their international competitiveness**. The central role of the universities as providing the research competences and research foundation for innovation should be recognised and supported. To allow for optimal use of the Structural Funds in this context, the **conditions for drawing funds from the Structural Funds** (through the operational programmes) **should be as flexible and unbureaucratic** as possible, leaving as much space as possible to develop innovative measures which would smoothen the interface between industry and universities. Among those who devise the guidelines, some university experts who are familiar with innovation activities should be included.

At national, regional and institutional level, **more resources should be made available, on a competitive basis, to maintain and renew scientific research equipment and infrastructure**. Otherwise, the attractiveness of Slovak research for international and industrial partners is severely restricted. Within the next decade, the Structural Funds should allow a significant increase of resources for this purpose. Such use of the Structural Funds is likely to bring a high return on investment.

### *Education and Quality Assurance*

While the Slovak Higher Education system may be applauded for the enormous effort to increase higher education participation and universities for their efforts in having expanded their teaching provision and building up research activities at the same time, **the quality of educational and research activities has suffered from the pace and insufficient financial coverage of that expansion**. The time has come to address the quality of educational provision and to allow for sufficient internal differentiation to cater for the wide range of diverse needs and student profiles.

While Slovak higher education has whole-heartedly adopted the Bologna reforms and has adapted legislation and curricula according to the new structural demands, institutional evaluation reports note that the deeper challenge of shifting **attention to the diverse needs of the learners, and the competences they need to excel in tomorrow's working environments** has not yet been addressed. Given the rapidly changing industrial and employment structure in Slovakia, the increasing mobility and international orientation of the country's key employment sectors, the time has come to take the challenge of competence orientation seriously, both in the dialogue between universities and employers as in the approaches to teaching and learning within higher education institutions.

To underpin the rising Slovak economy and to foster its knowledge intensity and productivity in key sectors, the Slovak Republic has to enable its universities and other higher education institutions to educate and train more graduates in natural and technical sciences. The ability to produce the needed number and quality of graduates is not only linked to the number and qualifications of professors but also to the provision of up-to-date scientific infrastructure and library resources.

As part of the Bologna reforms and for the benefit of its own overall improvement, Slovak higher education should introduce a more systematic responsibility and **a trust-based approach to quality assurance** of higher education Institutions, **away from methodologies of external control of minimal standards toward internal improvement-oriented processes of quality enhancement**. These processes require some resources, however, to address the need for improvement wherever it is identified.

The Slovak quality assurance system will have to realise its commitment to the European Standards and Guidelines. This will give the universities the possibility to establish **more coherent quality assurance and an underlying quality culture** while reducing the control mechanisms that are currently dominating the system.

#### *Institutional diversity, autonomy and governance*

The Slovak Republic should be commended for its efforts to promote the diversity of its higher education institutions in order to be able to cater to the growing diversity of its needs and student profiles. While the most recent efforts have concentrated on the definition of minimal thresholds for different types of institutions, systematic attention should also be paid to a differentiated set of financial and other incentives to promote the quality of teaching, research and innovation respectively. **Institutions and parts thereof should be free to decide on their preferred profile and on the weights they want to attribute to fostering the quality of teaching, research and innovation or entrepreneurial activities. Separate incentives are needed to allow for quality standards to be pursued in each of these dimensions.** Thus institutions which focus on first and second level education with fewer research activities and research training programmes should be allowed to pursue quality in their teaching and in their support of different student groups. Likewise, the most research intensive universities should be rewarded for their efforts to pursue the highest standards of quality in such research. If universities or other higher education institutions choose to focus most strongly on being particularly responsive in their contacts with business sectors and on actively promoting commercialisation of research results, such initiatives should also find a set of incentives in order to raise quality levels.

The Slovak higher education system would **benefit from being granted higher degrees of autonomy and responsibility with respect to the internal organisation and governance structures** of the higher education institutions. The national law goes into too much detail with respect to decision-making processes and internal bodies, preventing universities and other higher education institutions from

developing structures that fit their purposes and allow them to respond flexibly to their needs. Institutional profiling would also benefit from more freedom of institutional choice in this respect.

The Slovak higher education system would also benefit from **more reliable long-term legal conditions which are not dependent on party and coalition changes** but which transcend such ephemeral conditions to look at the longer-term development needs of the country's in research and education. University activities usually extend over several years and both research projects and educational programmes need several years of continuity to bear fruit. Hence universities need some planning security to be able to provide meaningful services. University policies should be designed, implemented and adapted within a long-term perspectives and vision. Non-partisan groups should be formed to ensure such long term stability and to allow for optimal development potential.

The governance of Slovak higher education Institutions is largely prescribed by law when they are organised in faculty structures. Decision-making is controlled at multiple levels by multiple bodies, with institutional and faculty leadership having very limited power to respond to new international and national challenges, thus resulting in most Slovak higher education institutions in a **lack of flexibility, insufficient interfaculty cooperation and too few strategic initiatives. The Slovak higher education system should provide more legal leeway for institutions to define and experiment with new internal structures and decision-making procedures**, adapted to the challenges and objectives of the institution. Slovak university members should understand and allow more initiative and leeway to their academic leaders on condition that the latter are selected on the basis of their institutional leadership competences and academic credibility.

If **academic senates** are to be taken seriously as decision-making bodies, they will have to pay more attention to the institutional development competences of their members and to play a pro-active institutional role as bodies that identify with the overall institutional development, in a manner commensurate with their legal powers. Otherwise the senates simply act as a brake on urgent developments.

Universities with faculty structures should pay **systematic attention to and provide incentives for cross-faculty initiatives, courses, research consortia**, and should bring more administrative functions to the central level to allow for economies of scale and concentrated competence. A more centralised administrative structure would improve the efficiency and effectiveness of administration, from co-ordinated IT-based course scheduling which allows students to take cross-faculty course options to a centralised information system with reliable data for effective strategic planning. Part of the budget should also be reserved for strategic initiatives at university level and perhaps also at faculty level.

Slovak universities and higher education **institutions should develop their strategic capacity further** by drawing consequences from their agreed institutional aims, setting resource priorities, defining realistic targets to be reached as well as concrete measures with specified responsibilities. In order to enable institutions to set real priorities, strengthen their strengths, help areas with high potential, and support urgent and promising development initiatives, strategic reserves have to be made available at institutional level. Since the money which can be freed through enhanced economies of scale is very limited and institutions are severely under-funded in comparison with the tasks they have been given by the state, the government should dedicate additional "fresh money" to institutions in order to enable them to build such strategic capacity.

#### *Research system, funding and performance*

In order to brace the system for the future, the Slovak higher education research system is **in urgent need of substantially increased funding**. Recent increases point in the right direction but are insufficient

to bridge the gap which has opened over the years between Slovak research and that of competing countries.

In addition to being still severely under-resourced, university research suffers from a **high degree of fragmentation between the funding agencies and their funding instruments**, a still **insufficient degree of competitive performance criteria of grant distribution and unnecessarily high level of bureaucracy** and delays in funding grant administration. If these adverse conditions are not removed, Slovak university research stands no chance of competing internationally.

In light of the far-reaching fragmentation of the Slovak research system, the evaluators recommend that the Slovak government and funding agencies develop more forceful instruments which would favour a step-by-step integration between the Slovak Academy of Science and the university research sectors. While the centres of excellence went in the right direction in this respect, more permanent and forceful institutional links should also be built up, e.g.,

- in the form of common professorships based at universities, with more research time than current at the universities but more influence on training the next generation than currently guaranteed at the Academy;
- common research training or graduate schools which would not just put the administrative burden on the universities but would build more integrated research environments between relevant units in both sectors;
- more far-reaching incentives for common project proposals;
- more possibilities for universities to differentiate the teaching duties between and within institutions, possibly with different profiles for different professorial chairs;
- even mergers of individual Academy institutes and universities.

While Slovak researchers should be commended for their increased efforts to publish their research in internationally visible journals, further efforts are needed to close the gap between overall research performance in the Slovak Republic and other European and developed nations. In order **to allow Slovak university researchers to compete with their international peers in their research production, there is a need for more research time, resources, up-to-date scientific infrastructure, and support for improved language competences in English**, as the lingua franca of international research.

The Slovak higher education landscape is highly diverse in its research performance and in the connectedness to international research environments. While individual faculties stand out in several institutions, a quarter of the institutions stand out as being significantly better placed in their international research competitiveness, although still positioned below the average performance level of their competitors in other European countries. In order to help these research environments to succeed in international competition, commensurate with their competitive potential, **concerted efforts should be made to support these high potential research environments**, so that they may act **as beacons for the Slovak research and innovation environment**.

In order to improve the overall research performance and capacity of the country, the Slovak higher education system has to establish **appropriate incentives for university research in terms of available time, financial support, research management support, as well as unbureaucratic grant regulations at all universities**. Without these incentives, all of which imply a targeted use of additional resources, university researchers will continue to be dramatically disadvantaged in comparison to their competitors abroad and will be unlikely to achieve comparable results. Moreover, young researchers are likely to look for attractive research environments abroad. Without these incentives the research-based teaching is threatened.

Slovak Higher Education institutions will have to **target more of their efforts on prioritising research resources and on providing the necessary qualified support staff to help researchers**. For this, targeted staff development measures and benchmarking with institutions abroad will be vital. Since good practices can also be found within the Slovak Republic, a more systematic exchange of such practice among rectors, vice-rectors research and heads of technology transfer offices will be useful.

Institutional evaluators observed a **major need for improvement of English language skills** across the country since proficiency in English has become a necessary condition for participation in international research activities. Especially for the next generation of researchers, care should be taken that they can access the international community of their field as early as possible so as to have the best possible chances to excel.

Participation in international conferences is a condition *sine qua non* for research success and impact. **Researchers and PhDs should be provided with travel money to share their ideas and results with international peers**. Without such opportunities to show research results and opportunities to receive additional stimulus, Slovak university research is unlikely to emerge from its relative seclusion.

#### *Research training and doctoral education and research career development*

In the next decade, the Slovak higher education sector will have to replace a majority of its academic staff. While this may be seen as a major opportunity for intellectual renewal, it will also require a **major investment to create competitive conditions for academic careers**. If such conditions are not created, Slovak higher education will be unable to produce the qualified labour it needs to underpin its economy and society and to increase its knowledge base and productivity.

Hence, the Slovak government and the leaders of higher education institutions will have to invest considerable resources and care into increasing the attractiveness of the university sector for bright young people, both **in terms of salaries as well as in terms of attractive working conditions**. National and institutional programmes or incentives are also needed to foster the **independence of young researchers**. Companies may be willing to support such programmes, given their vested interest in qualified labour. International and national mobility of researchers should be fostered systematically since it is known to contribute substantially to the innovative potential of individual researchers. Return schemes should be developed to make the return of young researchers from international stays attractive.

In the light of Slovakia's needs in industry and academia which imply a considerable increase in demand of doctoral degree holders for a wide range of different function, the higher education funding agencies, ministries and universities should ensure that sufficient attention is paid to attractive conditions for PhD candidates: from **improved financial conditions** (including more PhD grants for best qualified candidates and social security benefits) and **reduced teaching loads to incentives for mobility and merit-based young researcher awards**, academic research careers have to be made significantly more attractive, already in the first stage, in order to attract the most gifted individuals and prevent brain drain. While PhD students should be encouraged to spend periods of research abroad, institutions and grant agencies should concert efforts to **attract young researchers back to Slovakia by giving them means and early independence to realise their research projects**. In internationally competitive research environments with sufficient critical mass, **graduate schools should be created with the help of national funding grants to create structures of high quality standards and interdisciplinary exchange**. Where relevant these graduate schools should be common units between the universities and the relevant institutes of the Academy of Science.

Furthermore, more attention should be paid to the diverse career paths which PhD candidates will follow, including research-based careers in industry, by fostering professionally relevant skills.

#### *University-industry partnership and innovation*

In order to increase the attractiveness of university research for enterprises, universities have to make sure they allow and **encourage interdisciplinary research in their organisational structures**, and university funding agencies should ensure that universities can develop and use state-of-the-art scientific infrastructure.

Regional **clustering initiatives and even mergers of universities and other public and private research institutes should be rewarded nationally and institutionally** to help create clearer regional research and innovation profiles with sufficient critical mass.

It is also vital that the new definitions of the HE Act which lay down the definitions of incubators, technology centres and research centres for university cooperation with industry and business more clearly, be accompanied with some **financial support for the establishment of technology centres, technology incubators, and industry/university centres of excellence, as well as for research and innovation service support at universities**. The latter can also be shared between several institutions.

The Slovak Government, the European Commission and Slovak industrialists and university representatives have presented clear analyses of the weaknesses of the Slovak innovation system and the role of the universities in it. A large consensus exists as to the obstacles which hinder university-industry relations, in particular. The relevant **Ministries and funding agencies should coordinate their efforts to develop funding and facilitation instruments for university-driven innovation and university-industry links, making use of the experience of university researchers who have cooperated actively with the private sector**, and with the help of the Structural Funds.

To facilitate regional strategic thinking and regional development initiatives, **regional agencies should be given some strategic competences and resources for knowledge economic development**. To develop forward-looking initiatives which would promote knowledge capital in the regions, governmental **regional agencies should act in close alliance with universities and research institutes**. Cluster policies and networking between universities, private companies and government agencies should be facilitated so as to act as motors of regional development.

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- Akadémia ozbrojených síl gen. M.R. Stefánika v Liptovskom Mikuláši (The Military Academy in Liptovský Mikuláš)
- Akadémia umení v Banskej Bystrici (Academy of Arts in Banská Bystrica)
- Ekonomická univerzita v Bratislave (University of Economics in Bratislava)
- Katolícka univerzita v Ružomberku (Catholic University in Ružomberok)
- Prešovská univerzita v Prešove (University of Prešov in Prešov)
- Slovenská poľnohospodárska univerzita v Nitre (Slovak University of Agriculture in Nitra)
- Slovenská technická univerzita v Bratislave (Slovak University of Technology in Bratislava)
- Slovenská zdravotnícka univerzita v Bratislave (Slovak Medical University in Bratislava)
- Technická univerzita v Košiciach (Technical University of Košice)
- Trnavská univerzita v Trnave (University of Trnava in Trnava)
- Technická univerzita vo Zvolene (Technical University in Zvolen)
- Trenčianska univerzita Alexandra Dubčeka v Trenčíne (Alexander Dubček University of Trenčín in Trenčín)
- Univerzita sv. Cyrila a Metoda v Trnave (University of SS. Cyril and Methodius in Trnava)
- Univerzita J. Selyeho v Komárne (J. Selye University in Komárno)
- Univerzita Komenského v Bratislave (Comenius University in Bratislava)
- Univerzita Konštantína Filozofa v Nitre (University of Constantine the Philosopher in Nitra)
- Univerzity Mateja Bela v Banskej Bystrici (Matej Bel University in Banská Bystrica)<sup>25</sup>
- Univerzita Pavla Jozefa Šafárika v Košiciach (Pavel Jozef Šafárik University in Košice)
- Univerzita veterinárskeho lekárstva v Košiciach (University of Veterinary Medicine in Košice)
- Vysoka škola manazmentu v Trencin (School of Management in Trencin)
- Vysoká škola múzických umení v Bratislave (Academy of Performing Arts in Bratislava)
- Vysoká škola výtvarných umení v Bratislave (Academy of Fine Arts and Design in Bratislava)
- Žilinská univerzita v Žiline (University of Žilina in Žilina)

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<sup>25</sup> Univerzity Mateja Bela v Banskej Bystrici (Matej Bel University in Banská Bystrica) was evaluated later and has not been taken into account for this report.

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## **7. Annexes**

### **Annex 1: List of International Experts who participated in the Institutional Evaluations of Higher Education Institutions in the Slovak Republic in 2006 and 2007**

- Gerhard Ackerman, former President, Technische Fachhochschule Berlin, Germany
- Andris Barblan, former Secretary General, Magna Charta Observatory for fundamental university values and rights in Bologna, former Secretary General of EUA and CRE
- Jean Brihault, former President, Université Rennes 2 - Haute Bretagne, France
- Tove Bull, former Rector, University of Tromsø, Norway
- Kenneth Edwards, Cambridge University and former Vice-Chancellor, University of Leicester, United Kingdom
- Erdal Emel, Vice-Rector, University of Uludag, Turkey
- Üstün Ergüder, Director, Sabanci University, Turkey and former Rector, Bogazici University, Turkey
- Carmen Fenoll, Pro Vice Chancellor of Academic Affairs, Universidad de Castilla-La Mancha, Spain
- Malcolm Frazer, former Pro-Vice-Chancellor, University of East Anglia, United Kingdom
- Johann Gerlach, former Rector, Freie Universität Berlin, Germany
- Andy Gibbs, Director of International Relations, Napier University Edinburgh, Scotland
- Fatma Göktepe, Director, Graduate School of Natural & Applied Sciences, Suleyman Demirel University, Turkey
- Lee Harvey, Director of Research & Evaluation, The Higher Education Academy, United Kingdom
- Jiri Holenda, former Rector, University of West Bohemia in Pilsen, Czech Republic
- Aine Hyland, former Vice Rector, University College Cork, Ireland
- Maxwell Irvine, former Vice-Chancellor, Universities of Aberdeen and Birmingham, United Kingdom
- Hans Peter Jensen, former Rector, Technical University in Lyngby, Denmark
- Henrik Toft Jensen, former Rector, University of Roskilde, Denmark, former chair of the Institutional Evaluation Programme of the European University Association
- Edward Jezierski, Vice-Rector for Education, Politechnika Lodzka, Poland
- Inge Jonsson, former President, Rector of Stockholm University, Sweden
- Finn Junge-Jensen, President, Copenhagen Business School, Denmark
- Sokratis Katsikas, former Rector, University of the Aegean, Greece
- John Kelly, former Registrar, University College Dublin, Ireland
- Dionyssi Kladis, Professor, University of Peloponnese, Greece
- Jürgen Kohler, former Rector, University of Greifswald, Germany and President of the German Accreditation Council, as chair;
- Alojz Kralj, former Rector, University of Ljubljana, Slovenia
- Liudvika Leišytė, Research Associate, CHEPS, University of Twente, Netherlands
- Sérgio Machado dos Santos, Honorary Rector, Universidade do Minho, Portugal
- Patrick Masterson, former President, European University Institute, Italy
- Don McQuillan, former Chief Executive, Irish Universities Quality Board, Ireland
- Virgílio Meira Soares, former Rector, Universidade de Lisboa, Portugal
- Helena Jasna Mencer, former Rector, University of Zagreb, Croatia
- Les Mitchell, Head of School, Design and Applied Arts, Edinburgh College of Arts, United Kingdom
- Lázlo Muszbek, former Rector, University of Debrecen, Hungary
- Christos Nikolaou, former Rector, University of Crete, Greece
- Terhi Nokkala, Research Fellow, Research Fellow, United Kingdom
- Kerstin Norén, Rector, Karlstad University, Sweden

- Gheorghe Popa, former Rector, "Al. I. Cuza" University, Romania
- Sybille Reichert, Director, Reichert Consulting: Policy and Strategy Development in Higher Education, Switzerland
- Karin Riegler, EUA Senior Programme Officer, Belgium
- Régis Ritz, former President, Pôle Universitaire de Bordeaux, France
- Airi Rovio-Johansson, Gothenburg Research Institute, Göteborg University, Sweden
- Christina Rozsnyai, Programme Officer, Hungarian Accreditation Committee, Hungary
- Bent Schmidt-Nielsen, former Rector, Royal Veterinary and Agricultural University, Denmark
- Páll Skúlason, former Rector, University of Iceland, Iceland
- David Smith, former Principal, University of Edinburgh, United Kingdom
- Jacqueline Smith, former Deputy Head, OECD/IMHE, France
- Mollie Temple, former Vice Chancellor, University of Bolton, United Kingdom
- Öktem Vardar, Vice Rector ISIK University, Istanbul, Turkey
- Roland Vermeesch †, former Vice-Chancellor, Hogeschool West-Vlaanderen, Belgium
- Jarmo Visakorpi, former Rector, University of Tampere and former Chair of the Finnish Higher Education Evaluation Council FINHEEC, Finland
- Pádraig Walsh, Chief Executive, Irish Universities Quality Board, Dublin, Ireland
- Bertrand Weil, former Vice-President, Université Paris 12 Val de Marne, France
- Don Westerhijden, Research Associate, CHEPS, University of Twente, Netherlands
- Klaus Dieter Wolff †, former President, Universität Bayreuth, Germany
- Stavros Zenios, Rector, University of Cyprus, Cyprus

## Annex 2: Innovation governance SWOT overview of the European Commission's Country Report on the Slovak Republic

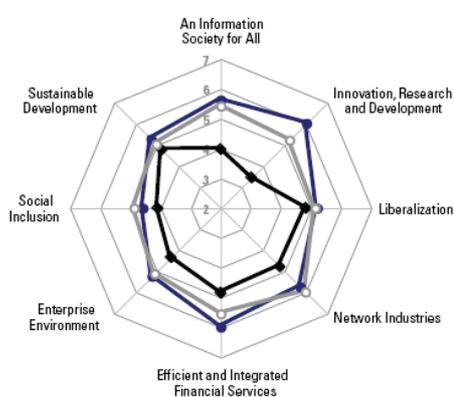
([http://trendchart.cordis.lu/reports/documents/Country\\_Report\\_Slovak%20Republic\\_2006.pdf](http://trendchart.cordis.lu/reports/documents/Country_Report_Slovak%20Republic_2006.pdf))

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• Strategy for Competitiveness Development in Slovakia until 2010 (The Lisbon Strategy for Slovakia), plus four Actions Plans</li> <li>• Preparation of the Innovation Strategy and National Reference Framework for 2007-2013.</li> <li>• Increasing spending on R&amp;D and innovation policy measures</li> <li>• Among the best performers in the EU-25 in terms of innovation expenditure by companies (purchase of equipment)</li> <li>• Reasonable levels of the tertiary graduates in science and technology per 1 000 of population</li> <li>• Increasing expenditure on ICT by Slovak enterprises.</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of National Innovation Plan</li> <li>• No central body for innovation policy design, implementation and management</li> <li>• Absolute and relative levels of the R&amp;D expenditure are one of the lowest in the EU.</li> <li>• Extremely low commercial output of the R&amp;D investments (e.g. in terms of the USPTO and EPO patent applications).</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>• Increasing innovation expenditure could significantly boost innovation levels in Slovak enterprises.</li> <li>• Reasonable stocks of educated labour force generate a good environment for generation of innovations and their adoption in manufacturing industries in particular.</li> </ul>	<ul style="list-style-type: none"> <li>• Innovation policies continue to overlap with S&amp;T policies. Low emphasis on the commercialisation of the R&amp;D results.</li> <li>• Current levels of R&amp;D expenditure do not enable Slovakia to catch up with the rest of the EU.</li> <li>• Most of the FDI coming to Slovakia exploits cheap labour and other production costs and is aimed at technology diffusion rather than the generation of innovations</li> </ul>

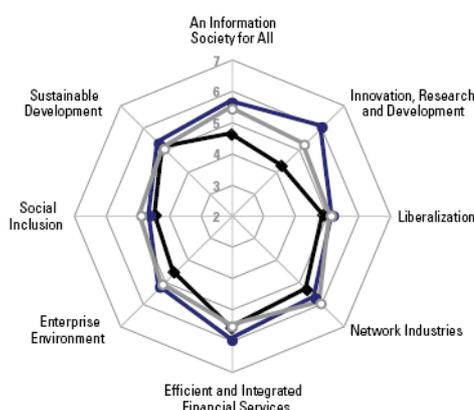
### Annex 3: The Lisbon Review of the World Economic Forum:

In another highly regarded review of success in terms of Lisbon relevant policies, the Lisbon Review of the World Economic Forum<sup>26</sup>, which takes 8 indicators with data from surveys and quantitative measurement, Slovakia ranks rather low amidst the less than glorious EU performance in Research and Innovation. When compared to the US and East Asian performance on the same indicators (blue line and grey lines respectively), Slovak performance show significant room for performance while some Northern European countries (such as Sweden, Finland, Denmark, the Netherlands and the UK) outperform the two comparator groups in a majority of indicators.

#### Slovakia Comparative Performance vs. EU 25 Comparative Performance (compared with US, blue line, and East Asia, grey line) according to the 8 Indicators of the World Economic Forum's Lisbon Review



**Slovakia's Performance**



**EU 25 Performance**

#### Methodology:

The Lisbon review is based on eight indicators all of which are weighted one eighth. They are calculated on the basis of the following data sets:

#### Information Society:

##### Survey data (weighted two thirds):

Information and communication technologies (ICT – computers, Internet, etc.) are an overall priority for the government: 1 = strongly disagree, 7 = strongly agree

Government programmes promoting the use of ICT are: 1 = not very successful, 7 = highly successful

In your country, online government services such as personal tax, car registrations, passport applications, business permits and eprocurement are: 1 = not available, 7 = extensively available

Laws relating to the use of information technology (electronic commerce, digital signatures, consumer protection) are: 1 = nonexistent, 7 = well-developed and enforced

Is there sufficient competition among Internet service providers in your country to ensure high quality, infrequent interruptions and low prices?: 1 = no, 7 = yes, equal to the best in the world

In your country, companies use the Internet extensively for buying/selling goods and services and for interaction with customers:

1 = strongly disagree, 7 = strongly agree

Internet access in schools is: 1 = very limited, 7 = extensive – most children have frequent access

##### Hard data (weighted one third):

Internet users per 10,000 inhabitants, 2005 (Source: International Telecommunication Union)

<sup>26</sup> *The Lisbon Review 2006* is published by the *World Economic Forum* within the framework of the *Global Competitiveness Network*, (under the guidance of Professor Klaus Schwab Executive Chairman, World Economic Forum. The methodology and exact description of the indicators used can be found in Annex 2.

Personal computers per 100 inhabitants, 2005 (Source: International Telecommunication Union)

## Innovation and R&D:

### Survey data:

Your country's level of technological readiness: 1 = generally lags behind most other countries, 7 = is among the world leaders

Companies in your country are: 1 = not able to absorb new technology, 7 = aggressive in absorbing new technology

Scientific research institutions in your country (e.g. university laboratories, government laboratories) are: 1 = non-existent, 7 = the best in their fields internationally

Companies in your country: 1 = do not spend money on research and development, 7 = spend heavily on research and development relative to international peers

In its R&D activity, business collaboration with local universities is: 1 = minimal or non-existent, 7 = intensive and ongoing

Government purchase decisions for the procurement of advanced technology products are: 1 = based solely on price, 7 = based on technological performance and innovativeness

Intellectual property protection in your country is: 1 = weak or non-existent, 7 = equal to the world's most stringent

Companies obtain technology: 1 = exclusively from licensing or imitating foreign companies, 7 = by conducting formal research and pioneering their own new products and processes

Scientists and engineers in your country are: 1 = non-existent or rare, 7 = widely available

### Hard data:

US Utility Patents granted per million population, 2005 (Source: USPTO)

Gross tertiary enrolment rate, most recent available year (Source: UNESCO)

## Liberalisation:

### Survey data:

Competition in the local market is: 1 = limited in most industries and price cutting is rare, 7 = intense in most industries as market leadership changes over time

Local suppliers in your country are: 1 = largely non-existent, 7 = numerous and include the most important materials, components, equipment and services

The quality of local suppliers in your country is: 1 = poor as they are inefficient and have little technological capability, 7 = very good as they are internationally competitive and assist in new product and process development

Standards on product/service quality, energy and other regulations (outside environmental regulations) in your country are: 1 = lax or non-existent, 7 = among the world's most stringent

Anti-monopoly policy in your country is: 1 = lax and not effective at promoting competition, 7 = effective and promotes competition

Corporate activity in your country is: 1 = dominated by a few business groups, 7 = spread among many firms

Foreign ownership of companies in your country is: 1 = rare, limited to minority stakes and often prohibited in key sectors, 7 = prevalent and

Encouraged in your country, rules governing foreign direct investment are: 1 = damaging and discourage foreign direct investment, 7 = beneficial and encourage foreign direct investment

Agricultural policy in your country: 1 = is excessively burdensome for the economy, 7 = balances the interests of taxpayers, consumers and producers

When deciding upon policies and contracts, government officials: 1 = usually favour well-connected firms and individuals, 7 = are neutral

In your country, government subsidies and tax breaks seriously distort competition by favouring specific companies, activities, regions or industries: 1 = strongly agree, 7 = strongly disagree

## Network Industries:

### Telecoms

#### Survey data:

New telephone lines for your business are: 1 = scarce and difficult to obtain, 7 = widely available and highly reliable

Mobile or cellular telephones for your business are: 1 = not available, 7 = as accessible and affordable as in the world's most technologically advanced countries

#### Hard data:

Cellular mobile subscribers per 100 inhabitants, 2005 (Source: International Telecommunication Union)

Main telephone lines per 100 inhabitants, 2005 (Source: International Telecommunication Union)

### Utilities and Transport

#### Survey data:

General infrastructure in your country is: 1 = underdeveloped, 7 = as extensive and efficient as the world's best

Roads in your country are: 1 = underdeveloped, 7 = as extensive and efficient as the world's best

Railroads in your country are: 1 = underdeveloped, 7 = as extensive and efficient as the world's best

Passenger air transport in your country is: 1 = infrequent and inefficient, 7 = as frequent, extensive and efficient as the world's best

The quality of electricity supply in your country (lack of interruptions and lack of voltage fluctuations) is: 1 = worse than most other countries, 7 = meets the highest standards in the world

## Financial Services:

### Survey data:

Property rights, including over financial assets are: 1 = poorly defined and not protected by law, 7 = clearly defined and well protected by law

The level of sophistication of financial markets in your country is: 1 = lower than international norms, 7 = higher than international norms

Banks in your country are: 1 = insolvent and may require government bailout, 7 = generally healthy with sound balance sheets

Raising money by issuing shares on the local stock market is: 1 = nearly impossible, 7 = quite possible for a good company

Financial auditing and reporting standards regarding company financial performance in your country are: 1 = extremely weak, 7 = extremely strong - the best in the world

Money laundering through the formal banking system in your country is: 1 = pervasive, 7 = extremely rare

## Enterprise:

### Business Start-up Environment

#### Survey data:

Starting a new business in your country is generally: 1 = extremely difficult, 7 = easy

How easy is it to obtain a bank loan in your country with only a good business plan and no collateral? 1 = impossible, 7 = easy

Entrepreneurs with innovative but risky projects can generally find venture capital in your country: 1 = not true, 7 = true

#### Hard data:

Number of administrative procedures to start a business, 2006 (Source: Doing Business, World Bank website)

Number of days required to register a business, 2006 (Source: Doing Business, World Bank website)

#### Regulatory Environment

##### Survey data:

Complying with administrative requirements (permits, regulations, reporting) issued by the government in your country is: 1 = burdensome, 7 = not burdensome

The level of taxes in your country: 1 = significantly limits the incentives to work or invest, 7 = has little impact on the incentives to work or invest

Are firms in your country usually informed clearly by the government on changes in policies and regulations affecting your industry?: 1 = never informed, 7 = always informed

##### Hard data:

Number of procedures required to resolve a contract dispute, 2006 (Source: Doing Business, World Bank website)

Number of days required to resolve a contract dispute, 2006 (Source: Doing Business, World Bank website)

### Social Inclusion:

#### Bringing People Back to Workforce

##### Survey data:

Pay in your country is: 1 = not related to worker productivity, 7 = strongly related to worker productivity

In your country, for similar work, wages for women are: 1 = significantly below those of men, 7 = equal to those of men

In your country, government-provided childcare is: 1 = non-existent or very limited, 7 = widely accessible

##### Hard data:

Unemployment rate, 2005 (Source: Economist Intelligence Unit and national sources)

#### Upgrading Skills

##### Survey data:

The educational system in your country: 1 = does not meet the needs of a competitive economy, 7 = meets the needs of a competitive economy

The public (free) schools in your country are: 1 = of poor quality, 7 = equal to the best in the world

Math and science education in your country's schools: 1 = lag far behind most other countries, 7 = are among the best in the world

Your country's talented people: 1 = normally leave to pursue opportunities in other countries, 7 = almost always remain in the country

The general approach of companies in your country to human resources is: 1 = to invest little in training and employee development, 7 = to invest heavily to attract, train and retain employees

#### Modernizing Social Protection

##### Survey data:

In your country, the government's efforts to reduce poverty and address income inequality are: 1 = ineffective, 7 = effective

### Sustainable Development:

##### Survey data:

How stringent is your country's environmental regulation? 1 = lax compared to most countries, 7 = among the world's most stringent

Environmental regulations in your country are: 1 = confusing and enforced erratically, 7 = stable and enforced consistently and fairly

In your country, companies that harvest or process natural resources such as food, forest or fishery products: 1 = rarely concern themselves with the degradation of ecosystems, 7 = frequently take steps to preserve the ecosystems they depend on

**Table 2: Ranking and Scores of EU Countries**

Country EU 25	Final Index		Subindexes															
			Information Society		Innovation and R&D		Liberalization		Network Industries		Financial Services		Enterprise		Social Inclusion		Sustainable Development	
	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score
Denmark	1	5.76	4	5.53	4	5.15	5	5.58	2	6.24	5	6.28	1	5.63	1	5.49	3	6.17
Finland	2	5.74	6	5.41	1	5.90	4	5.98	8	5.93	4	6.29	4	5.24	2	5.35	1	6.23
Sweden	3	5.74	1	5.93	2	5.73	6	5.43	5	6.14	3	6.36	7	5.07	3	5.09	4	6.15
Netherlands	4	5.59	2	5.63	5	4.82	2	5.62	6	6.01	6	6.23	2	5.48	4	5.06	6	5.87
Germany	5	5.53	10	4.98	3	5.31	1	5.71	1	6.38	2	6.39	12	4.69	10	4.53	2	6.23
United Kingdom	6	5.50	3	5.61	6	4.82	3	5.59	7	5.97	1	6.47	5	5.13	9	4.74	8	5.69
Austria	7	5.30	7	5.24	9	4.55	7	5.35	9	5.87	8	6.15	15	4.43	8	4.75	5	6.09
Luxembourg	8	5.29	9	5.05	12	3.96	9	5.26	4	6.16	9	6.14	8	4.91	5	5.05	7	5.82
France	9	5.21	11	4.91	8	4.66	11	5.17	3	6.18	7	6.19	9	4.87	15	4.25	10	5.44
Belgium	10	5.15	14	4.44	7	4.67	10	5.25	10	5.84	11	5.91	11	4.77	6	4.83	9	5.47
Ireland	11	5.09	12	4.55	10	4.47	8	5.34	18	4.95	10	6.13	3	5.35	7	4.82	11	5.10
Estonia	12	4.93	5	5.49	11	4.06	12	4.98	17	5.01	12	5.72	6	5.10	12	4.37	16	4.69
Portugal	13	4.64	17	4.06	17	3.81	15	4.74	12	5.37	13	5.66	14	4.50	17	4.10	14	4.90
Czech Republic	14	4.53	15	4.10	16	3.85	13	4.96	13	5.16	21	4.84	21	3.99	11	4.44	13	4.90
Spain	15	4.49	20	3.93	15	3.89	16	4.62	11	5.41	14	5.65	16	4.33	23	3.63	18	4.48
Slovenia	16	4.44	13	4.50	13	3.96	22	4.30	15	5.07	20	4.88	23	3.76	19	4.02	12	5.00
Hungary	17	4.40	23	3.74	14	3.92	17	4.55	21	4.80	17	5.22	19	4.18	16	4.16	17	4.61
Slovak Republic	18	4.38	19	3.97	23	3.44	14	4.82	22	4.76	22	4.84	17	4.33	18	4.09	15	4.76
Malta	19	4.38	8	5.22	25	3.23	19	4.46	23	4.64	15	5.44	22	3.83	13	4.35	25	3.84
Lithuania	20	4.31	18	3.97	20	3.69	24	4.18	19	4.86	19	4.96	13	4.57	20	3.95	21	4.26
Cyprus	21	4.28	21	3.90	24	3.30	18	4.46	16	5.02	18	5.12	18	4.25	14	4.30	24	3.86
Latvia	22	4.25	22	3.76	21	3.63	20	4.32	24	4.57	24	4.79	10	4.78	21	3.87	20	4.29
Greece	23	4.19	25	3.17	18	3.77	21	4.32	14	5.09	16	5.27	20	4.14	22	3.79	23	3.98
Italy	24	4.17	16	4.06	19	3.73	23	4.29	20	4.82	23	4.80	24	3.71	24	3.54	19	4.40
Poland	25	3.76	24	3.32	22	3.57	25	4.02	25	3.86	25	4.23	25	3.60	25	3.41	22	4.10
EU25 Average	--	4.84	--	4.58	--	4.24	--	4.92	--	5.36	--	5.60	--	4.59	--	4.40	--	5.05