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Why Invest in Science in South Eastern Europe?

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and High Level Round Table*

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Contents

Preface	9
Walter Erdelen, Assistant Director-General for Natural Sciences, UNESCO	
Foreword	11
Engelbert Ruoss, Director, UNESCO BRESCE	
Introduction	13
Iulia Nechifor, Slavo Radosevic	
List of Acronyms	15
PART I. Knowledge and Economic Growth: Challenges for South Eastern Europe	
1. <i>Science, Technology and Economic ‘Catching Up’ and ‘Falling Behind’ in South Eastern Europe</i>	21
Slavo Radosevic	
2. <i>Science and Innovation in the 21st Century: Lessons for European Core and Peripheral Economies</i>	38
Alasdair Reid	
3. <i>Science and Economic Development in SEE</i>	53
Milica Uvalić	
4. <i>Innovation Policy and Governance Capability: Experiences of New EU Member States and Lessons for SEE Countries</i>	61
Maja Bučar, Mekta Stare	
5. <i>Creative Reconstruction: Towards a Triple Helix Innovation Strategy in SEE Countries</i>	68
Henry Etzkowitz and Marina Ranga	
6. <i>Technology and Industrial Development</i>	73
Jaime Moll de Alba Cabot	
7. <i>Creating New Tools to Advance Research and Innovation. The Canadian Example</i>	79
Howard Alper	
8. <i>Fostering Scientific Cooperation for Dialogue and Peace Building. UNESCO’s SESAME and IPSO initiatives</i>	82
Walter Erdelen	

PART II: Analytical Perspectives on RTD in South Eastern European Countries

- | | |
|---|-----|
| 9. <i>Science and Research in Albania</i>
Eduard Sulstarova | 87 |
| 10. <i>Need for a Science Policy in Bosnia and Herzegovina</i>
Bozidar Matić | 92 |
| 11. <i>S&T Policy Guidelines for Bosnia and Herzegovina</i>
Pierre Papon and Stane Pejovnik | 96 |
| 12. <i>Bulgarian Science and Innovation System: Policy Challenges in the First Year of EU Membership</i>
Ruslan Stefanov | 99 |
| 13. <i>Croatia Innovation Policy Meets Reality</i>
Jadranka Švarc and Emira Bečić | 106 |
| 14. <i>Science and Research in the Former Yugoslav Republic of Macedonia</i>
Viktor Stefov | 114 |
| 15. <i>Europeanization of the Romanian S&T System: How Far Has It Advanced?</i>
Andreea Vass | 117 |
| 16. <i>Science and Technology System in Serbia: Between Survival and Restructuring</i>
Đuro Kutlača | 131 |
| 17. <i>Turkish Policy Focus on Science and Technology</i>
Sirin Elci | 140 |

PART III: Science, Technology and Innovation in South Eastern Europe: International Policy Actions and Assistance

- | | |
|---|-----|
| 18. <i>Towards the Introduction of the System of Innovation Concept in Official Development Assistance</i>
Klaus Schuch | 147 |
| 19. <i>Cooperation and Innovation Potentials of the Western Balkans</i>
Elke Dall | 163 |
| 20. <i>Research and Development Needs of the Western Balkan Countries</i>
Davor Kozmus | 167 |
| 21. <i>The EU-Balkan Countries Action Plan for S&T: Achievements, Weaknesses and Ways Forward</i>
George Bonas | 176 |
| 22. <i>From the EU-Western Balkan Countries (WBC) Action Plan to the Full Integration of the WBC into the European RTD Activities</i>
Manfred Horvat | 180 |

23. <i>Why Invest in Science in SEE?</i> Peter B. Mayr	188
24. <i>The Rationale for Business Sector Investment in South Eastern Europe</i> Rudy Kozak	193
25. <i>Strengthening Scientific Cooperation and Capacities in SEE: UNESCO BRESCE's Action</i> Iulia Nechifor	195

PART IV: National Science and Innovation Policies in South Eastern Europe: Current Policy Challenges

Addresses by Ministers or their Representatives in the High Level Round Table

Ammar Miraščija, representative, Minister of Civil Affairs, Bosnia and Herzegovina	205
Albena Vutsova, Director, Scientific Research Directorate, Bulgarian Ministry of Education and Science	208
Sulejman Rushiti, Minister of Education and Science, Former Yugoslav Republic of Macedonia	211
Christos Vasilakos, representative, Ministry of Development, Greece	212
Slobodanka Koprivica, Deputy-Minister of Education and Science, Montenegro	214
Milena Savovic, Ministry of Finance, Montenegro	216
Alexandru Aldea, Vice-President, National Authority for Scientific Research, Ministry of Education and Research, Romania	217
Jure Zupan, Minister of Higher Education, Science and Technology, Slovenia	219
Maja Vranicar, Ministry of Finance, Slovenia	221
Nüket Yetis, President, Scientific and Technological Research Council (TÜBİTAK), Turkey	222

Intervention by Janez Potočnik, Commissioner for Science and Research, European Commission	225
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Final Communiqué adopted by the High Level Round Table	231
---	-----

General Conclusions

Slavo Radosevic, Rapporteur	234
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Annexes

I. General Bibliography	239
II. List of Figures	245
III. List of Tables	247
IV. List of Contributors	249

Preface

Since the turn of the new millennium, the world has changed. New international dynamics asserted by the *UNESCO Science Report 2005* have shown that countries of the so-called 'newly industrialized Asian economies', together with China and to a lesser extent India, have become serious contributors to world GERD and to the production of scientific knowledge. In the USA, a country which is often cited as a model in terms of science and research investment, companies must run faster to succeed against global competitors in technology.

In South Eastern Europe, important changes have paved the way for the full integration of some countries into the European Union. Important progress has been made in the modernization of science and innovation systems, upgrading of scientific and research infrastructures and enhancement of regional and international scientific cooperation. However, for others, overall investment in science dropped to hitherto unimaginably low levels. If countries in South Eastern Europe want to play an active role in the production and dissemination of knowledge in the future, important overdue policy reforms must be enacted without delay. It is within this general context that I consider the Ljubljana Conference and High Level Round Table, as well as the present volume, the main outcome of these events, essential signals allowing science and technology to be higher placed on the agenda of national and regional policies in the South Eastern European region.

I take this opportunity to thank all those who responded affirmatively to our invitation to participate in the Ljubljana events and to contribute to this volume, and in particular: to Minister Yure Zupan for his participation, outstanding co-operation and hospitality during our stay in the beautiful city of Ljubljana; to the Austrian authorities for their active and fruitful co-operation, and to Mr Janez Potočnik, Commissioner for Science and Research at the European Commission, for his participation in the High Level Round Table. My special thanks go to the Italian Government which provided essential help to our Regional Office in Venice allowing UNESCO to boost its longstanding support in favour of science in Central and South Eastern Europe.

A famous scientist from South Eastern Europe, Nikola Tesla, once said: 'The practical success of an idea, irrespective of its inherent merit, is dependent on the attitude of contemporaries. If timely it is quickly adopted; if not, it is apt to fare like a sprout lured out of the ground by warm sunshine, only to be injured and retarded in its growth by the succeeding frost'. It is my strong hope that this publication is a timely one and that the sprout will grow up and succeed in making a significant contribution towards generating changes that are both necessary and desirable for the future of the South Eastern European region.

Walter Erdelen

Assistant Director-General for Natural Sciences, UNESCO

Foreword

Investment in science is one of the most important issues for the South Eastern European (SEE) countries. Although in developed countries, investment in science, technology and innovation (STI) is considered as key element of medium- and long term development, in many SEE countries, the field of science has received less consideration than other national priorities.

The merit of the Ljubljana Conference is that it addressed this issue in a very direct and provocative manner: 'Why Invest in Science in SEE?' When looking at the various contributions in this volume, I can see that there is a significant number of rationales for major action and involvement by all those responsible for STI in the SEE region. Another important aspect of this conference was the presence at it of high level officials, responsible for science and finance, from the countries in the area; this conference was the first regional gathering of this type to bring together the main actors involved in the development of the SEE region, the European Commission (EC), the Stability Pact for South Eastern Europe, the Central European Initiative, as well as other UN agencies (WIPO, UNIDO). The event confirmed UNESCO's important role in acting as a platform for sub-regional and international co-operation and partnership.

In my capacity as Director of UNESCO's Regional Bureau for Science and Culture in Europe (BRESCE), I am particularly pleased to be able to contribute to the implementation of the main findings and recommendations of this event which are included in the chapters in this volume. The BRESCE Office organized some follow up events to the Ljubljana Conference: a workshop entitled *Enhancing STI Policy in SEE: Statistics and Indicators Systems* (Skopje, March 2007), a major Conference of Academies of Sciences from South Eastern Europe: *Global Science and National Policies. The Role of Academies*, (Chisinau, Republic of Moldova, May 2007), and the 1st SEE Science Policy Forum *Science for the Future, Science for Society. The Parliamentary Perspective* (Romania, June 2007). These two conferences again underlined the crucial role of science, education and innovation for the development of the countries of the region. The outcomes of these events will be published in forthcoming issues of the Science Policy Series.

I want to take this opportunity to thank my staff, and the partner institutions and individuals who contributed to the organization of these events and the putting together of this volume. It is my firm belief that BRESCE will continue to be a key institution for enhancing scientific capacities and strengthening scientific cooperation in the region.

Engelbert Ruoss
Director, UNESCO BRESCE

Introduction

This volume is an outcome of the international Conference and High Level Round Table ‘Why Invest in Science in South Eastern Europe?’, held on 28 and 29 September 2006 in Ljubljana, Slovenia. The conference was organized by the UNESCO Office in Venice, the Slovenian Ministry of Higher Education, Science and Technology and the Austrian Science and Research Office in Ljubljana. It gathered together ministers and representatives responsible for science and finance from Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Former Yugoslav Republic of Macedonia, Greece, Montenegro, Romania, Serbia, Slovenia and Turkey, as well as a number of international experts and representatives from international organizations active in South Eastern Europe (SEE). Both events acted as an excellent platform, on the basis of which it was possible to evaluate current and potential initiatives in the SEE region in the field of science, research and innovation policies.

This volume provides the reader with a wealth of insights and analyses from the Conference regarding the state of S&T and innovation policy in SEE. Edited contributions of the speakers who participated in the conference sessions were submitted subsequent to the conference and are the bases for the papers in this volume. The book is structured into four parts based on the main topics of the conference, namely: science, innovation and growth; analytical perspectives on RT&D in SEE; international policy actions and assistance; and national policy challenges.

Entitled *Knowledge and Economic Growth: Challenges for South Eastern European Countries*, Part I of the volume reviews the key findings in the academic literature on the relationship between S&T and economic growth and provides a series of valuable rationales in an attempt to answer the question addressed by the title ‘Why Invest in Science in SEE?’ It includes recommendations based on analytical data as well as on previous experiences and good practices undertaken in the EU and in other parts of the world for harnessing science and knowledge for dialogue and peace.

Part II, *Analytical Perspectives on RTD in SEE Countries*, provides insights on the state of the art at national level of the science and research systems in South Eastern European countries and offers in depth reviews of these systems, including comparative data as well as prospective analysis.

Various initiatives at European level and by the international community for the enhancement of the S&T and innovation potential constitute the essence of Part III of the volume, *RTD in South Eastern Europe: International Policy Actions and Assistance*. The section includes references to opportunities and programmes for scientific cooperation and perspectives for strengthening science and innovation capacities through regional and international cooperation.

Part IV, *National Science and Innovation Policies in SEE*, contains some of the addresses from Ministers or representatives at the High Level Round Table and the Statement by Janez Potočnik, Commissioner for Science and Research at the European Commission. It offers relevant information concerning measures undertaken for reforming funding systems for research and innovation at national level. This part ends with the text of the 'Final Communiqué' that was adopted by the High Level Round Table, which provides a clear and synthetic agenda for further action needed at national and regional levels in this area.

Due to the outstanding contributions by the various authors, the volume represents an important step towards a better understanding of the interrelation between investments in science and knowledge and socio-economic development, both in general and in the specific situation in the SEE countries. It equally provides a knowledge base for policy-makers to improve allocation of funds for investments in science and research and to identify accompanying measures to promote enhanced socio-economic development in the SEE countries and other parts of the world.

We thank all distinguished participants in the conference and the High Level Round Table, and the contributors to this volume for their collaboration and their patience in respecting the various deadlines. We would like to express our gratitude to colleagues from the Ministry of Higher Education, Science and Technology of Slovenia, and the Austrian Science and Research Liaison Office in Ljubljana for their valuable cooperation and high levels of competence in the co-organization of the events, as well as the production of the DVD which contains the integral audio-video recordings of all the interventions made during the events and the Power Point presentations. Special thanks go to Cynthia Little for copyediting of the English version.

The Editors

List of Acronyms

ALLEA	All European Academies
ARC	Applied Research and Communications Fund (Bulgaria)
ASA	Albanian Academy of Sciences
BERD	Business Expenditure on Research and Development
BES	Business Enterprise Sector
BICRO	Business-Innovation Centre of Croatia
BRESCE	Regional Bureau for Science and Culture in Europe
BTYK	Supreme Council of Science and Technology (Turkey)
CA	Coordination Actions
CARDS	Community Assistance to Reconstruction, Development and Stabilization
CEE	Central and Eastern Europe
CIP	Competitive Industrial Performance
CIS	Community Innovation Survey
COBISS	Cooperative Online Bibliographic System and Services
CSA	Cooperation and Support Actions
EBRD	European Bank for Reconstruction and Development
EC	European Commission
ECCPT	European and Developing Countries Clinical Trials Partnership
EFA	Education for All
EIB	European Investment Bank
EIS	European Innovation Scoreboard
ERA	European Research Area
ERKIA	European Research, Knowledge and Information Area
EST	Environmentally Sound Technology
EU	European Union
FDI	Foreign Direct Investment
FYROM	Former Yugoslav Republic of Macedonia
GCI	Global Competitiveness Index
GCR	Global Competitiveness Report
GDP	Gross Domestic Product
GERD	Gross Expenditure on Research and Development
GOVERD	Government Expenditure on Research and Development
GSIF	Global Science and Innovation Forum



List of Acronyms

HERD	Higher Education Expenditure on Research and Development
HITRA	Croatian Programme for Innovative Technological Development
IAEA	International Atomic Energy Agency
IAP	Inter Academy Panel
ICPC	International Cooperation Partner Countries
ICTP	'Abdus Salam' International Centre for Theoretical Physics
ICSU	International Council for Science
ICT	Information and Communication Technologies
INCO	International Cooperation programme
IPA	Instrument for Pre-accession Assistance
IPR	Intellectual Property Rights
IPSO	Israeli-Palestinian Science Organization
IPTS	Institute for Prospective Technological Studies
IST	Information Society Technologies
IT	Information Technology
KEF	Austrian Academy of Sciences
LURE	Laboratoire pour l'Utilisation du Rayonnement Electromagnétique
MAPs	Multi-Actor/Multi-Measure Programmes
MDGs	Millennium Development Goals
MELE	Ministry of Economy, Labour and Entrepreneurship (Croatia)
MHR	Medium- and High-Tech
MLMA	Multi Level Multi Actor
MSES	Ministry of Science, Education and Sports (Croatia)
MVA	Manufacturing Value Added
NASR	National Authority for Scientific Research
NATO	North Atlantic Treaty Organisation
NCPs	National Contact Points
NGO	Non Governmental Organizations
NIC	National Innovation Capacity
NMS	New Member States
ODA	Official Development Assistance
OECD	Organisation for Economic Cooperation and Development
PE	Private Equity
PPS	Purchasing Power Standard
R&D	Research and Development
RDI	Research, Development and Innovation
RT&D	Research, Technology and Development
RTD	Research, Technological Development and Demonstration
SLAC	Stanford Linear Accelerator Centre



S&E	Science and Engineering
S&T	Science and Technology
SAA	Stabilization and Association Agreements
SCI	Science Citation Index
SECI	South East European Cooperative Initiative
SEE	South Eastern Europe
SEE-ERA.NET	Southeast European Era-Net
SESAME	Synchrotron-light for Experimental Science and Applications in the Middle East
SICA	Specific International Cooperation Activities
SII	Summary Innovation Index
SME	Small and Medium Sized Enterprises
SREAC	Sub-Regional European Astronomical Committee
SSA	Specific Support Actions
STI	Science, Technology and Innovation
SWOT	Strengths, Weaknesses, Opportunities and Threats
TARAL	Turkish Research Area
TFP	Total Factor Productivity
TTE	Tertiary Technical Enrolments
TÜBİTAK	Scientific and Technological Research Council of Turkey
UK	United Kingdom of Great Britain and Northern Ireland
UN	United Nations
UN-CSDT	United Nations Commission on Science and Technology for Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
USA	United States of America
USPTO	United States Patent and Trade Mark Office
UVO	UNESCO Office in Venice
VC	Venture Capital
WBC	Western Balkan Countries
WCS	World Conference on Science
WEF	World Economic Forum
WTO	World Trade Organization

PART I

**Knowledge and Economic Growth:
Challenges for South Eastern
European Countries**

1. Science, Technology and Economic ‘Catching Up’ and ‘Falling Behind’ in South Eastern Europe¹

Slavo Radosevic

1.1. Introduction

South Eastern Europe (SEE) is the most complex region in contemporary Europe in several respects. Its complexity originates from the Cold War era when this area was primarily a geographic notion and did not exist as an economic region. Ex-Yugoslavia, Romania and Bulgaria, Albania and Greece were neighbouring countries, but for a long period of the 20th century did not communicate either economically or politically, which, given their proximity, might have been expected. At a time when the countries of central Europe were embracing the opportunities offered by European Union (EU) accession this area was held back by the bloody break up of Yugoslavia, and this continues today in the uncertainties regarding the status of Kosovo and the very complex institutional system in Bosnia and Herzegovina. The outcome of various factors places part of the region (Greece, Slovenia, Bulgaria, Romania) in the EU, with the remainder having candidate status (Croatia, Turkey, Former Yugoslav Republic of Macedonia) or uncertain prospects (Albania, Bosnia and Herzegovina, Serbia and Montenegro) regarding EU membership. As a result of historical legacies as well as the developments that occurred in the 1990s, differences between SEE countries in terms of levels of development as well as the role of science and technology (S&T) are very large. Also of significance are the socio-institutional characteristics of the SEE countries in terms of quality of life, demographic indices and the prevalence of the rule of law.

In a Europe that aspires to become ‘the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion’ (European Council, Lisbon, March 2000) SEE may continue to be the backward periphery it has been for the major part of its modern history, within a globalized world economy whose prosperity and stability is increasingly dominated by the Asian countries. For those SEE countries that are outside the EU, European integration represents the only viable project and objective to ensure social and political coherence. For the SEE countries that are EU members, prosperous neighbours are the best guarantors of stability and economic growth.

These two aspects – stability and economy – are essential for understanding why S&T in SEE are generic developmental and not sectoral issues. S&T are essential for sustainable long-term growth which is the foundation for a stable and prosperous region. The papers in this volume

¹ I am grateful to Maja Bučar and Milica Uvalić for useful comments on an earlier version of this paper.



1. Science, Technology and Economic ‘Catching Up’ and ‘Falling Behind’ in South Eastern Europe

shed light on a variety of policy related issues, all of which are important for improving the level of S&T and thus the stability and economic success of the SEE region. This introductory paper provides a broad discussion of the relationship between S&T and economic growth in SEE, which should give context for the contributions that follow.

The first part of this paper reviews the key findings in the academic literature on the relationship between S&T and economic growth. We briefly address the issues implied by the title ‘Why Invest in Science in SEE?’, which are discussed in more detail in the papers that form this volume. The second part of the paper presents the variety of competitive positions among SEE countries and the differences that follow from this in terms of S&T in each country. The third part of the paper briefly reviews the transformation of research, technology and development (RT&D) systems in SEE and the last section outlines some policy options and the role of international assistance.

1.2. S&T and economic growth, or why support science in SEE?

An economic argument traditionally used to justify public support for S&T is market failure. By this economists mean that the market is not the best allocator of resources for S&T because those that are S&T producers cannot enjoy all benefits of their investment due to ‘leakage’ of knowledge. A solution to this problem is public subsidy for research and development (R&D), and an intellectual property rights (IPR) regime that excludes the use of new knowledge by those that have not paid for it. In accordance with this perspective, which focuses on the public–private nature of knowledge, ‘catching up’ or growth behind the technology frontier is perceived as an almost automatic process given the right incentives. Due to the public nature of knowledge, countries that are behind the technology frontier can enjoy the advantages of free knowledge through imitation and import at reduced prices.

However, this argument reduces the rationale for public R&D as a useful source of codified information. It overlooks a variety of other benefits that science contributes to the economy, which go beyond support, and which increase the stock of useful knowledge. Science is essential to the training of skilled graduates, the creation of new scientific instrumentation and methodologies, the formation of networks and social interaction between individuals involved in R&D, the capacity of firms to solve technological problems, and the creation of new firms through spin-offs (see Salter and Martin 2001 for an elaboration of this argument). In short, the way S&T is generated cannot be explained by ‘right incentives’ or ‘market failure’ frameworks.

‘Latecomer advantages’, which purportedly arise from imitation of already available technologies whose knowledge bases are free, are rare. Catching up is not a process of mere imitation, but requires adaptation and innovation (Fagerberg and Verspagen 2003). Successful catch up has historically been associated not merely with the adoption of existing techniques in established industries within a different environment, but also with innovation, particularly of the organizational kind, and with inroads into nascent industries (Fagerberg and Godhino 2005).

1. Science, Technology and Economic ‘Catching Up’ and ‘Falling Behind’ in South Eastern Europe

If the scope for imitation were so huge there would have been many more instances of convergence and catch up with developed economies. As Fagerberg and Srholec (2005) demonstrate, the potential for diffusion (imitation) in developing countries is more than counteracted by the better financial systems, better governance and faster growth of knowledge in other countries. As a result, technology gaps can be exploited through imitation, and also created through innovation. Hence, the capability to innovate and thus the importance of science for catching up are critical.

Along similar lines, Salter and Martin (2001: 512) argue that no nation can ‘free-ride’ on the world scientific system:

‘In order to participate in the system, a nation or indeed a region or firm needs the capability to understand the knowledge produced by others and that understanding can only be developed through performing research. Investments in basic research enable national actors to keep up with and, occasionally, to contribute to the world science system’.

Mowery (2005: 29) argues that public investment in R&D has been a central component of economic catch up strategies in the last 125 years and it seems that the importance of public R&D will increase in the future. As Mowery (2005: 30) states:

‘Economic catch up in the 21st century is if anything likely to place greater demands on the knowledge related capabilities of developing economies, reflecting the faster growth of output and exports of knowledge intensive products, the more prominent role of basic scientific knowledge in the innovation process and the importance of stronger national absorptive capacity to exploit a much richer body of global S&T knowledge’.

Richard Nelson (2005: 19) also argued that ‘the role of indigenous public research is more important today than it was in the 20th century’. He points to the changing conditions for catch up, which primarily reside in the increased importance of indigenous capabilities in R&D and, in particular, the increasingly important role of indigenous universities and public laboratories as vehicles for technology transfer.

An important lesson from historical analyses of catching up is the overwhelming significance of the institutional context and specific conditions over policy principles. What matters is implementation (see Bučar and Stare in this volume) and an institutional system that ensures autonomy and relevance of R&D for the economy. In the current World Trade Organization (WTO)-dominated institutional regime the need for public R&D investments to complement market-oriented development strategies has actually increased (Mowery 2005). An institutional system that nurtures openness, but which also fosters technology based competition, is crucial. In terms of policy, this extends our initial concern with the market failure rationale to support science, to a variety of new types of failure, which are endemic in systems of innovation. As hinted by Reid in this volume, these are capability failures in the business sector, failures in institutions, network or system failures, and framework failures or failures in regulatory systems.



1. Science, Technology and Economic ‘Catching Up’ and ‘Falling Behind’ in South Eastern Europe

This brief overview of the arguments for investment in science shows that building strong S&T systems linked to private and public users is essential for economic growth and catch up by the SEE countries. Research also shows that there are no quick fixes in terms of building S&T systems that are unrelated to the economy, or building efficient market mechanisms on their own. A dynamic system of innovation must be historically specific and the evolutionary outcome of a variety of complementary advantageous factors and solutions, which compensate for disadvantages, or missing or inhibiting factors. A public system of support for science is important, but only one aspect of that process. In the next section we provide a broader picture of the SEE economies and the different roles of S&T in each country.

1.3. Competitiveness and S&T in SEE

Where do SEE countries stand in terms of the key pillars of competitiveness as defined by the World Economic Forum *Global Competitiveness Report 2006-07*? These pillars are the factors of competitiveness that constitute the new Global Competitiveness Index (GCI) and include institutions, infrastructure, the macroeconomy, health and primary education, higher education and training, market efficiency, technological readiness, business sophistication and innovation. Each of these pillars is based on a large number of mainly subjective responses to questions relating to different aspects of the local economy. These responses are assessed on a 1-7 scale, with hard data rescaled to this range. As they are subjective indicators they have undeniable weaknesses, but do enable insights into a variety of qualitative aspects of the economy not facilitated by hard types of data.

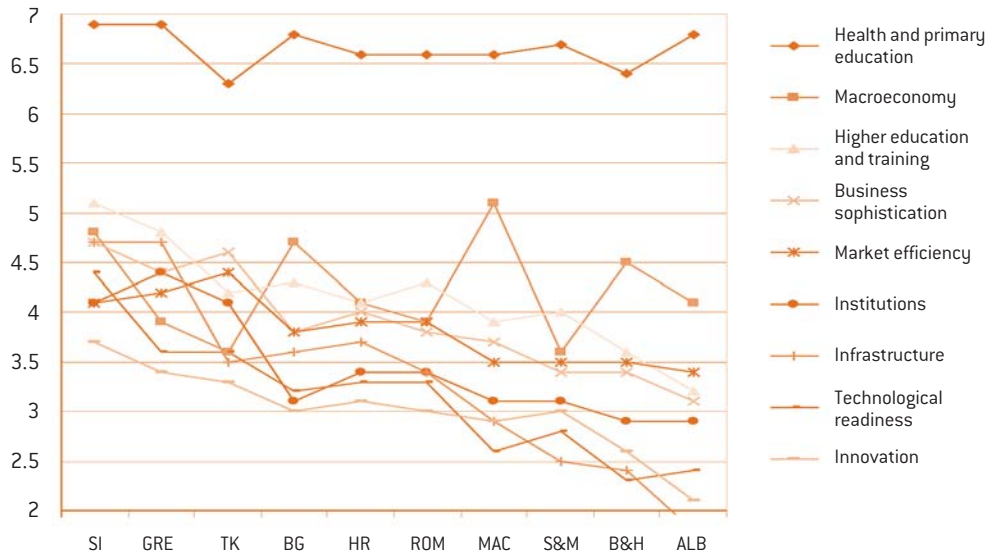
Figure 1.1 ranks these pillars based on the estimated average levels of the ten SEE countries. SEE countries rank highest for health and primary education, which is in part due to the Global Competitiveness Report (GCR) methodology, which includes health problems that either do not exist in the SEE, such as malaria, or are not acute, such as tuberculosis and HIV. The macroeconomy is also reasonably well ranked. This is a cyclical dimension and reflects the specific situations of individual SEE countries, which are not necessarily related to their levels of competitiveness, but reflect their governments’ determination to stabilize the economy.² In terms of higher education and training the ranking of SEE countries corresponds to their levels of development. The biggest difference among SEE countries is in terms of infrastructure. This reflects not only the lower levels of development in Albania and Former Yugoslav Republic of Macedonia, but also the effects of the war in Bosnia-Herzegovina, which for this item is ranked lower than Albania.

The lowest rankings are for innovation and technological readiness. Technological readiness is the degree to which a country is able to absorb foreign technology; innovation indicates the degree to which it is able to generate new knowledge. When compared to external conditions for innovation and technology absorption (business sophistication, market efficiency and infrastructure) SEE countries score better on average than for capabilities to innovate and

² This applies not only to SEE, but also to other countries.

1. Science, Technology and Economic ‘Catching Up’ and ‘Falling Behind’ in South Eastern Europe

Figure 1.1: Quality of pillars of competitiveness of SEE Economies (ranking on scale 1-7)



Source: Based on WEF (2006)

absorb technology. External conditions for innovation, such as institutions, market efficiency and business sophistication, are variables that have shown improvement since the early 1990s, as a result of institutional changes in the SEE transition economies. However, these changes have not necessarily been accompanied by changes in the capabilities of firms to absorb new technology and to innovate. Similar to the new EU Member States, the ex-socialist SEE countries have realized that so far policies have been insufficient to promote growth in the absence of strategies that directly address S&T and training. There are also major intra-regional differences in terms of technological readiness. Figure 1.1 suggests that Former Yugoslav Republic of Macedonia, Bosnia and Herzegovina, Serbia and Montenegro, and Albania have very low absorptive capacities, which will hinder the progress of competitiveness despite their better performance in terms of external institutional and business conditions.

In summary, our analysis clearly shows what the careful observer would intuit: that SEE countries are very diverse in terms of their levels of competitiveness. Although innovation and technological readiness are the worst dimensions of their competitiveness, differences in levels across these dimensions suggest that the role of S&T and training varies widely across SEE countries. This is confirmed by the papers in this volume, which provide evidence of a variety of different situations in the RT&D systems of the countries of SEE. The very poor situations in Albania, Former Yugoslav Republic of Macedonia, Bosnia and Herzegovina, and Serbia and Montenegro in terms of infrastructure affect their abilities to absorb new technologies and thus to innovate.

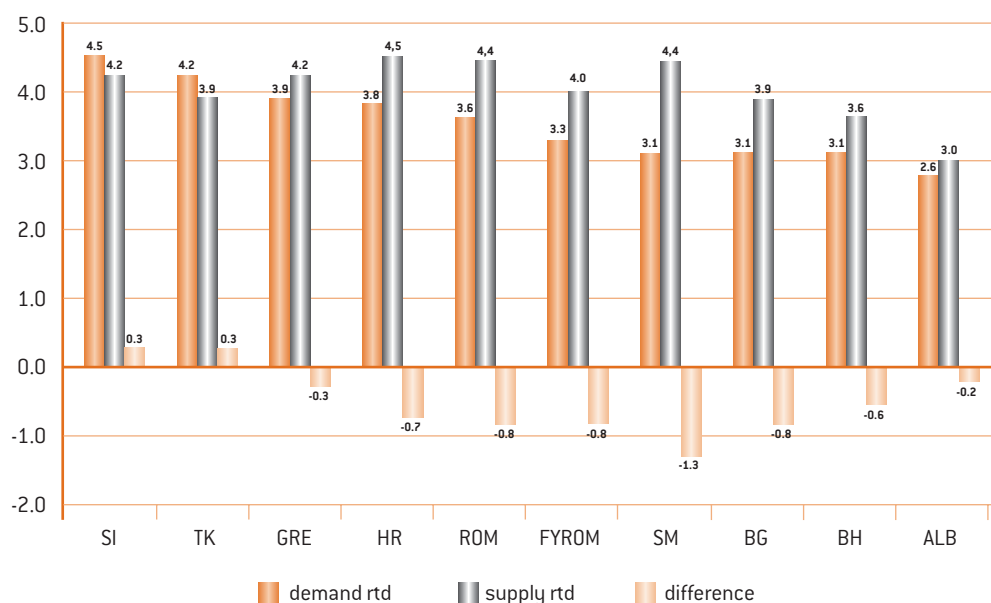
We need to probe more deeply into the issue of demand and supply for RT&D in SEE countries. We take advantage of the GCR data. Tables 1.1 and 1.2 present the variables that can be con-

1. Science, Technology and Economic ‘Catching Up’ and ‘Falling Behind’ in South Eastern Europe

sidered as proxies for quality of RT&D supply and demand in SEE. Figure 1.2, based on simple averages of each of these groups, provides an assessment of ‘aggregate’ demand and supply for local RT&D in SEE. In interpreting these data it is necessary to bear in mind that they are based on the local business communities’ assessments of demand for and supply of RT&D from the perspective of their economies, not some objective external benchmark. Hence, we should not expect a positive relationship between levels of income per capita and levels of demand and supply for RT&D. These should not be confused with macroeconomic aggregates of supply and demand.

From this simple analysis two things emerge. First, all SEE countries except Slovenia and Turkey are ranked higher for supply of RT&D than for demand, i.e. most SEE countries have a demand gap. This basically means that although RT&D capacities are limited, the major constraint is limited demand for local RT&D. On the other hand, Slovenia and Turkey show signs of a RT&D supply gap, i.e. limited RT&D capacities or possibly types of capacities, given their demand for RT&D. In the case of Turkey, this could be expected given its level of development; in the case of Slovenia it is related more to the structure of the RT&D system than its overall size given its 1.6% GERD/GDP (Gross Expenditure on R&D/Gross Domestic Product) share.

Figure 1.2: Assessment of demand and supply for local RTD in SEE



Source: Author based on WEF 2006 data

Similar to other Balkan States, Greece suffers from weak demand for RT&D, probably due to its industry structure, which is dominated by small firms in traditional industries.

The small RT&D demand–supply gap in Albania is mainly a sign of very low levels and low quality of demand and supply for RT&D. This, as economists would describe it, ‘low level equilibri-

1. Science, Technology and Economic ‘Catching Up’ and ‘Falling Behind’ in South Eastern Europe

um’ is more a symptom of developmental gaps than of a situation that could be considered optimal from a growth perspective. The bigger RT&D gap in the case of Bosnia and Herzegovina should be interpreted similarly, taking account also of its specific post-war situation.

Six SEE economies have a noticeable RT&D demand gap, meaning that they are not able to employ their RT&D capacities effectively. This may be due to several factors, including low level businesses processes, which do not exploit new technologies, and inappropriate structure or quality of RT&D capacities. This problem is by far the worst in Serbia and Montenegro, which has the biggest demand–supply gap probably due to the low sophistication of business processes in Serbia, which do not generate enough demand for local RT&D, and extensive RT&D capacities, which, in conditions of limited international cooperation, are not matched by local demand.

These results confirm previous research, which indicates that poor demand for RT&D is the greatest weakness of the new Member States in the enlarged EU (see Radosevic 2004).

Figure 1.2 shows that according to the local business communities quality of supply for RT&D seems to be highest in Croatia and lowest in Albania. The high assessment of RT&D supply for Serbia and Montenegro (4.4) stands in stark contrast to the very poor assessment of quality of demand for RT&D (3.1.) Also striking is the low estimate of RT&D quality for Bulgaria (3.1), which, given its EU membership, also ranks poorly in terms of supply of RT&D (3.9).

Tables 1.1 and 1.2 show what underlies the aggregate rankings. One of the positive legacies of socialism is the high quality of mathematics and science in schools, evident in the assessments of Romania and Serbia and Montenegro. The assessments for availability of scientists and engineers are relative to the size of countries as well as investments in RT&D. Supply data should be seen in relation to demand for RT&D, which perhaps explains the very high assessment for availability of scientists and engineers for Greece (5.5) and low ranking for Slovenia (only 3.8).

Table 1.1: Factors of supply for RTD in SEE countries

	Quality of education	Quality of math and science teaching	Local availability of specialized research and training	Quality of public (free) schools	Quality of scientific research institutes	Availability of scientists and engineers
Slovenia	3.8	4.6	4.4	4.5	4.2	3.8
Bulgaria	3.1	4.4	3.5	3.7	3.7	4.7
Croatia	3.8	4.9	4.5	4.6	4	4.9
Romania	3.8	5.5	4.3	4.4	3.7	4.9
FYROM	4	4.6	3.3	4.1	3.4	4.7
Serbia and Montenegro	3.9	5.1	4	4.4	4.1	4.9
Bosnia and Herzegovina	3.5	4.5	3.6	3.4	2.9	3.8
Albania	3.1	3.9	2.5	3.1	2.2	3.3
Greece	3.6	4.5	3.9	3.7	3.7	5.5
Turkey	3.2	4.3	4.3	3	3.9	4.8

Source: WEF 2006.

1. Science, Technology and Economic ‘Catching Up’ and ‘Falling Behind’ in South Eastern Europe

On the demand side, Slovenia ranks first followed by Turkey. The range of rankings for the demand side is much wider than for the supply side (1.2 points vs 0.7), which again highlights that the main weaknesses are on the demand side.

Table 1.2: Factors of demand for RTD in SEE countries

	Extent of staff training	Firm level technology absorption	Production process sophistication	Buyer sophistication	Customer orientation	Company spending on R&D	Govt procurement advanced technical products	Capacity for innovation
Slovenia	4.4	4.6	4.4	5	5.3	4.1	3.6	4.8
Bulgaria	2.6	3.5	2.5	3.2	4	2.7	3.2	2.9
Croatia	3.6	4.4	3.6	3.9	4.4	3.3	3.7	3.3
Romania	3.3	4.6	3.3	3.8	4.2	3.1	3.6	2.9
FYROM	3.5	3.6	3	2.9	3.9	2.6	3.4	3.1
Serbia and Montenegro	2.3	3.8	2.7	2.8	3.6	3	3.9	2.6
Bosnia and Herzegovina	3	3.5	2.7	2.9	3.8	2.9	3	2.7
Albania	2.7	3.7	2.9	3	3.9	2.1	2.1	1.9
Greece	3.8	4.4	4.1	4.4	4.7	3.1	3.6	3
Turkey	4.2	5.4	4.1	4.2	5	3.2	3.8	3.5

Source: WEF 2006.

These results show that innovation policy should take account of both supply and demand side factors of RT&D. Weak innovation demand at firm level and weak innovation support systems (external conditions for firm level RT&D) are the biggest bottlenecks to a stronger contribution of S&T to growth and social development in the SEE countries. Constraints on the demand side are reinforced by supply side constraints through the still very present processes of external and internal brain drain (see below) and the ageing of the R&D sector. We discuss some of these issues in the next section.

1.4. Restructuring of SEE RT&D systems

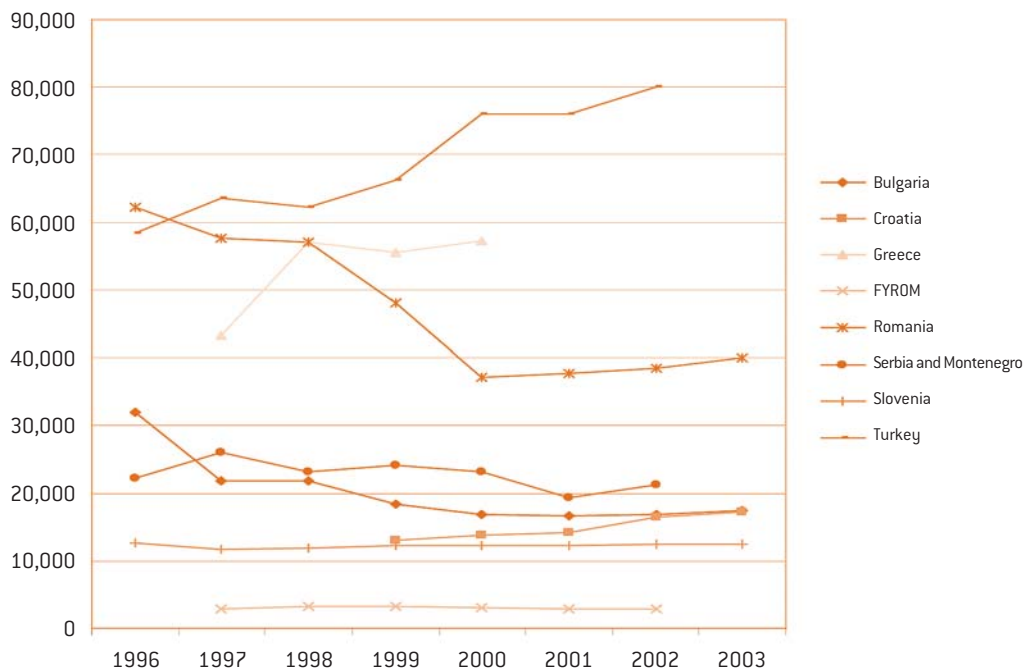
The military and political conflicts of the 1990s had a significant impact on RT&D capacities in SEE, in addition to a variety of other factors that caused the implosion of the RT&D system in the majority of the SEE economies. The sudden change from being exclusively state directed economies and research capacities, to market economies in Albania, Romania, Bulgaria, introduced a degree of uncertainty in the RT&D systems of these countries that led to an erosion in terms of quantity and quality of R&D. The exceptional reductions in national expenditure on RT&D in most post-socialist SEE countries driven by economic crises and the related collapse in demand for local R&D, provoked a brain drain. The loss of critical mass due to the formation of new States (ex Yugoslav States) led to additional restructuring. However, Turkey, Greece and partly Slovenia were unaffected by these changes. In effect, this led to a prolongation of historically inherited polarizations and incoherences in the RT&D systems in the region.

1. Science, Technology and Economic 'Catching Up' and 'Falling Behind' in South Eastern Europe

The review of the changes that have occurred in individual SEE countries, provided in this volume, shows very large differences in the degrees of development and pace of restructuring of these countries' R&D systems. R&D in Bosnia and Herzegovina, Albania and partly Former Yugoslav Republic of Macedonia is the most disadvantaged. These countries are still trying to establish functioning R&D systems and are addressing primarily science policy issues. Reforms in other countries range from still very initial and limited changes, as in the case of Serbia and Montenegro, to very much EU driven and inspired changes in Romania, Bulgaria and Croatia. In these latter three countries and Turkey there has been a visible attempt to shift the focus from conventional science policy towards innovation policy. Individual national plans, such as the Turkish 2005 National S&T initiative, have created a new momentum, which, if it continues, could provide examples of good practice for other countries in the region.

Figure 1.3 shows the divergent trends in R&D employment. On the one hand, Bulgaria and Romania have suffered significant declines amounting to 7.3% and 5.4% annually. On the other hand, Greece, Croatia (for the years that data are available) and Turkey have seen continuous expansion of their R&D employment. Serbia and Montenegro and Former Yugoslav Republic of Macedonia have recorded a quite gradual, but continuous decline in R&D employment while employment levels in Slovenia have remained virtually unchanged.

Figure 1.3: R&D personnel employed in R&D in SEE Europe, in head counts

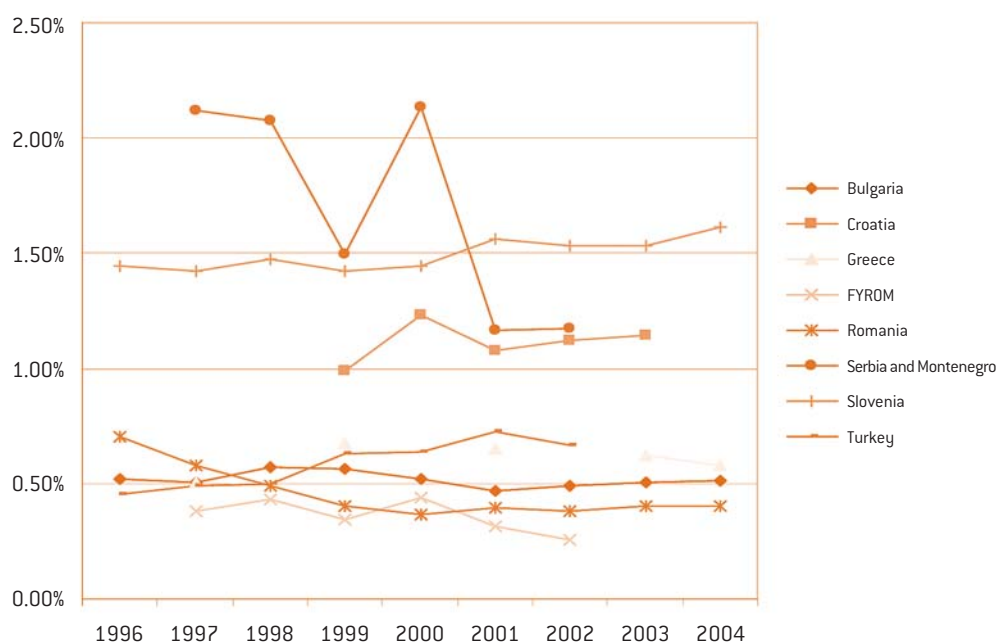


Source: UNESCO S&T statistics database.

1. Science, Technology and Economic 'Catching Up' and 'Falling Behind' in South Eastern Europe

In the EU, R&D expenditure as a percentage of total GDP has been stable and was around 1.9% in 2003 (target objective is 3%). SEE shows three trends in this respect. First, a collapse in R&D funding in Serbia, where it has declined from very high levels of above 2% in the early 1990s to levels of just above 1% (see contribution by Kutlača in this volume). Second, the gradual increase in relative funding in Slovenia, Croatia and Turkey is compatible with either increased employment or increased capital intensity in this system. Third, relative funding in other countries has either stagnated or has been continuously declining. Bulgaria and Romania have experienced a turnaround in relative funding since early 2000 and we can expect it to rise. The relative stagnation of GERD in Greece is inconsistent with its increased employment, which suggests either statistical problems or an increasing shift in R&D towards less costly types of research (see Figure 1.4.).

Figure 1.4: GERD as percentage of GDP in SEE countries



Source: UNESCO S&T statistics database

The general conclusion concerning funding of R&D activities in SEE is that relative GERD is quite low in all countries except Slovenia, Croatia and Serbia. In the Western Balkan countries R&D is poorly funded, undervalued and underpaid, and lack of funds has a major impact on the development of the science and research infrastructure and therefore the quality of research (see contribution by Kozmus in this volume). As these countries have not been full beneficiaries of EU Framework Programme funding the share of foreign funding in the past has been very low. This situation should change significantly with the accession of Bulgaria and Romania to the EU and the full member status of other countries in the EU 7th Framework Programme.

1. Science, Technology and Economic ‘Catching Up’ and ‘Falling Behind’ in South Eastern Europe

Table 1.3 ranks countries based on the role of the business enterprise sector (BES) in funding and performing R&D. Only in Slovenia’s R&D system does the BES play a dominant role in terms of both funding and performance of research. In Romania, Croatia, Turkey and to an extent in Greece, BES is important in terms of funding, but, with the exception of Romania and in part Croatia, it plays a much smaller role in the performance of R&D. Funding and performance of R&D in Bulgaria (and probably in Serbia and Montenegro and Former Yugoslav Republic of Macedonia) is dominated by the government sector. There are no comparable data for Bosnia and Herzegovina and Albania, which suggests that the R&D systems in these countries are marginal in the economy. There is no firm R&D in these countries (see contributions by Matić, and Pejovnik and Papon in this volume). In Bosnia and Herzegovina this is mainly the result of war which has devastated previous relatively developed BES R&D.

Table 1.3: Dominant sectors in R&D funding and performing

Funding	Country	Performing
Business Enterprises sector (59%); Government (35%)	Slovenia	Business Enterprises sector (60%); Government (22%); Higher education sector (16%)
Government (48%); Business Enterprises sector (45%)	Romania	Business Enterprise sector (55%); Government (34%); Higher education sector (10%)
Government (56%); Business Enterprises sector (42%)	Croatia	Business Enterprise sector (43%); Higher education sector (35%); Government (22%)
Government (51%); Business Enterprises sector (41%)	Turkey	Higher education sector (64%); Business enterprise sector (29%)
Government (47%); Business Enterprises sector (31%)	Greece	Higher education sector (49%); Business enterprise sector (30%); Government (21%)
Government (67%); Business enterprise sector (27%)	Bulgaria	Government (67%); Business Enterprises sector (24%)
???	Serbia and Montenegro	Higher education sector (52%); Government (44%)
???	FYROM	Government (76%)
???	Bosnia and Herzegovina	???
???	Albania	???

Source: author based on UNESCO S&T database

Another area that could be seen as a bottleneck to technology based growth in SEE is the university sector. Its importance stems from the historical experience of the catching up economies, which suggests that an important element of catch up is the design of the higher education and research systems according to emerging knowledge and skills needs related to industrial development (see Mazzoleni 2005).

Twenty-first century universities are developing in the direction of entrepreneurial institutions, which nurture expanded links with large firms and local small and medium sized enterprise (SME) networks. Their restructuring is based on the triple helix model (see Etzkowitz and Ran-



I. Science, Technology and Economic ‘Catching Up’ and ‘Falling Behind’ in South Eastern Europe

ga in this volume). However, the emergence of this model in the SEE region is being constrained not only by weak universities, but also by weak firms and very poor local demand for local RT&D and innovation. The third pillar in this model – governments – is engaged in establishing innovation governance and often in restructuring R&D institutes.

SEE universities have so far been unable to respond to these new challenges. The capacity required to grow local spin-offs is quite complex and, in the context of the small and semi-developed research systems of the SEE countries, requires several factors. Partnerships among universities and R&D institutes through consortia may be a specific SEE response to enhance local research and innovation capabilities.

Another entity that could contribute significantly to the restructuring of SEE universities is firms – both local and foreign. Top ‘blue chip’ companies in the region are aware that they will not be able to sustain the inflow of new staff unless they support local universities. The joint Hewlett Packard-UNESCO project on alleviating the brain drain in SEE is a good example of initiatives that should be replicated on a much larger scale (see contribution by Kozak in this volume). Such measures, however, will alleviate, but not resolve the brain drain problem, which is extremely significant in the West Balkan countries. If we take the perceptions of the business community as objective, then it would seem that this problem is severe in Bulgaria, Serbia and Montenegro, Romania, Albania, Bosnia and Herzegovina and former Yugoslav Republic of Macedonia (Table 1.4).

These countries are ranked from 109th to 121st place in the list of 125 countries. With the accession of Bulgaria and Romania to the EU we can expect the emergence of significant new diasporas in the ‘old EU’ as happened after Poland’s accession. Brain drain seems a significantly smaller problem for Croatia, Turkey, Greece and Slovenia. However, we may expect that in the majority of the SEE countries the Europeanization of their RT&D and education systems will actually aggravate the brain drain problem. The Bologna process will speed up the rate of brain drain through increased mobility, as the diplomas of young graduates and researchers are recognized in other parts of Europe.

Whether the old and the newly created diasporas will contribute to technology based growth or to growth more generally will depend on whether they are seen as adjuncts to or adversaries of the domestic elites, on the ability of these groups to connect with the domestic and the world economies, and on opportunities in the global economy (see Kuznetsov and Sabel 2006b). In the past diasporas from SEE were constituted of low skilled workers; the newly emerging diasporas are increasingly high skilled. This increases the probability that they can become intermediaries between global firms and local markets. For the time being, most SEE countries (excepting Greece, Slovenia and Croatia) do not recognize expatriate talent abroad as an opportunity, and even those that do have not managed to fully exploit their skilled expatriates. However, diasporas cannot substitute for weak domestic institutions; they can only complement the activities of home country organizations and be instrumental in strengthening them (Kuznetsov 2006).

To summarize, therefore, the size of the R&D system is important, but can be considered secondary to restructuring towards improved quality, increased relevance and international inte-

1. Science, Technology and Economic ‘Catching Up’ and ‘Falling Behind’ in South Eastern Europe

Table 1.4: Relative problem of brain drain in SEE compared to other countries

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

RANK	COUNTRY	SCORE
33	Hungary	4.0
34	Spain	4.0
37	Estonia	3.9
40	Portugal	3.9
41	Slovenia	3.9
44	Czech Republic	3.8
49	Greece	3.6
52	Russian Federation	3.5
58	Turkey	3.3
61	Croatia	3.2
62	Poland	3.2
63	Latvia	3.2
64	Slovak Republic	3.2
71	Lithuania	2.9
87	Ukraine	2.6
109	Former Yugoslav Republic of Macedonia	2.3
111	Bosnia and Herzegovina	2.2
112	Albania	2.2
114	Romania	2.2
119	Moldova	2.1
120	Serbia and Montenegro	2.1
121	Bulgaria	2.0
122	Zambia	1.9
123	Zimbabwe	1.7
124	Lesotho	1.6
125	Guyana	1.3

Source: WEF (2006), GCR report, p. 488.

gration of RT&D. The contributions in this volume show that there are quite divergent trends in the SEE countries, some of which have been highlighted in this section.

The actual patterns of restructuring are the result of complex interactions among domestic demand, the willingness of government to undertake R&D restructuring, and the EU accession process, which plays an important role in terms of the Europeanization of RT&D systems. In Serbia, a process of spontaneous transformations is taking place in which R&D organizations are searching for all possible sources of income, performing activities often with no R&D content (see Kultača in this volume). This stands in sharp contrast to changes in the R&D system in Turkey and new trends in Romania. Bosnia and Herzegovina and Albania, which are quite specific in the sense that their R&D systems have to be built (Albania) or re-built (Bosnia and Herzegovina).

However, despite their differences a common feature of most SEE countries (with the exception of Slovenia) is that improvements are largely related to research activities and are reflect-



1. Science, Technology and Economic ‘Catching Up’ and ‘Falling Behind’ in South Eastern Europe

ed in publishing activity. This trend will strengthen further through the Europeanization of SEE R&D systems, which will enable the best R&D groups to be ‘plugged in’ to the EU research networks. We can expect improvements in the balance between incentives (selection through project funding) and stability (share of institutional funding). However, the key bottleneck – weak domestic demand for RT&D – is likely to remain a major structural weakness of R&D systems in SEE.

1.5. Searching for a broader framework for S&T policies in SEE

Section 1.2. pointed out that a public system of support for science is important, but is only one of the ingredients in a catching up process. Investing in RT&D is essential for long-term growth, but it is not sufficient given the very high unemployment, low levels of investment and generally poor competitiveness of the majority of SEE economies, and especially the Western Balkan countries. The key activity in this process is entrepreneurship, or the act of innovating (see Reid in this volume). In this process, RT&D is an important component, but its links to innovation and growth are multiple and complex.

In order to maximize the contribution of local RT&D to growth and catch up it is essential that the Western Balkan countries embark on an active search for ways out of their current unfavourable situations. In our view, the solutions do not lie with academia; solutions to the problem can only be found by practitioners undertaking trial and error processes of experimentation and active search. However, analysis is needed to define the problems and develop frameworks for how to approach these developmental problems.

We want to highlight three key areas for policy action: broadening the focus of S&T policy; building public R&D linked to countries’ industrial, agricultural and medical care sectors; and better use of international assistance to integrate RT&D in SEE into the European Research Area (ERA) and to facilitate linkages within local systems of innovation. We discuss these three areas in more detail below.

A key message, implicit in several of the papers in this book, is that there are limits to traditionally defined S&T policy as sectoral activity. This is not to deny the importance of S&T systems, but the role of S&T to growth cannot be confined to the R&D sector.

A key challenge for all SEE countries is to abandon their R&D-only frameworks for science and innovation policy, and expand their policy focus to include other elements of national innovation capacity, such as absorption capacity, diffusion, and transfer and demand for RT&D (see Radosevic 2004). The ability of individual countries to do this will vary, and differences between countries in this respect are substantial.

Hence, the key issue is not how the R&D budget should be shared, but to initiate a process of search for growth opportunities based on the coupling of domestic and external knowledge. This will induce demand for local RT&D, which today is lacking (see section 1.2. above). It is essential to go beyond the traditional focus on background conditions and improvements to

1. Science, Technology and Economic ‘Catching Up’ and ‘Falling Behind’ in South Eastern Europe

the investment climate, which are represented in World Economic Forum GCR reports and World Bank *Doing Business* reports. These provide useful benchmarks, but they do not take into account that growth and catch up factors are always specific. Hence, it is important to understand the policy implications of ‘binding constraints’ to growth (Rodrik 2004). Policy should rely on the ‘islands of excellence’ that exist in (almost) every country in order to achieve these reforms.³

As no one, government included, can have complete knowledge of the opportunities and constraints to growth, it is essential to create private-public partnerships and programmes that bring together the better performing segments of the public sector and the better performing segments of the productive sector, in an attempt to relax and unblock binding constraints (Kuznetsov and Sabel 2006a; Sabel 2005).

In the area of S&T policy proper, it is essential to promote RT&D as a ‘non-political issue’ i.e. to try to isolate it from the daily politics of government. Lack of real long-term commitment to S&T combined with the instability of government organizational sets ups, hinder normative commitments towards increasing the role of R&D in economic development. Rather than lobbying for more R&D it would be more fruitful to work towards an effective system of public research and training linked to countries’ industrial, agricultural and medical care sectors in a way that supports technological development in these sectors (see Nelson 2005).

Analysis of S&T and innovation policies in the new EU Member States and candidate states suggests that benchmarking and continuous monitoring and evaluation are essential for the development of capacity for research and innovation policy. There is a need for national as well as regional initiatives in this respect. However, SEE countries should not be blinkered by the ‘best practice’ perspective, which too often will inhibit the search for country specific solutions. Europeanization of S&T and innovation policies is inevitable and will undoubtedly bring a large number of benefits to SEE. Equally, it is not a panacea and may often block the search for local solutions (see Bucar and Stare in this volume).

The conference participants agreed that even though the benefits are sometimes quite long term, increased R&D funding is essential if the SEE countries, and particularly the Western Balkan countries, are not to fall even further behind in terms of economic development. However, this increased funding should be accompanied by a strong focus on financing excellent, but also **relevant** research. This will require fair competition, setting of priorities, transparency and international experts.

S&T and innovation systems in SEE, especially in the Western Balkan countries, are extremely weak and fragmented and international assistance for S&T in the region has been very limited. Most donors do not have a single home for their RT&D and innovation investments. Many actors work across different networks with little coordination, which creates segmentation and dupli-

³ This approach is behind the so called new industrial policy developed by the World Bank. See <http://web.worldbank.org/WBSITE/EXTERNAL/WBI/WBIPROGRAMS/KFDLP/0,,contentMDK:20753860ffpagePK:64156158ffpiPK:64152884fftheSitePK:461198,00.html> [accessed 18.6.07].



I. Science, Technology and Economic ‘Catching Up’ and ‘Falling Behind’ in South Eastern Europe

cation and there is a lack of overall purpose and strategic direction. However, with the establishment of the Southeast European ERA-NET (SEE-ERA.NET), whose aim is to integrate EU Member States and SEE countries in the ERA, the situation has already changed significantly.

There has been limited progress on integration of the Western Balkan countries into the ERA. International stakeholders are aware of the need to support S&T in the SEE region to enable integration into the ERA and also to provide tools for economic growth. However, huge improvements will be needed in the S&T infrastructure if these systems are to be restructured. Internal factors have contributed to the current unsatisfactory state of the system as well as limited and inadequate sources of external funding, such as framework programme funding, INTER-REG, NATO funds and more especially lack of support from CARDS (Community Assistance to Reconstruction, Development and Stabilisation). It is essential that the RT&D component of CARDS activities increases.

Several papers in this book make it clear that there is a real understanding of the region’s RT&D needs. These primarily concern infrastructure, human potential, institution building, joint research and funding. It is clear that there is huge scope for individual country initiatives at bilateral levels. Several Slovenian initiatives, including six-month fellowships, bilateral projects, information services and joint referee systems, could be used as examples of good practice. In addition, new approaches to international assistance must be initiated, focused on improving the interfaces within local innovation systems. A good example of such an approach is developed in the paper by Klaus Schuch in this volume.

Finally, although it is to be hoped that open conflict in the region is now a thing of the past there is still scope for Science for Peace initiatives whose success elsewhere has been based on the package of different elements which involve a variety of stakeholders being brought together to act for the collective benefit.

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2. Science and Innovation in the 21st Century. Lessons for European Core and Peripheral Economies

Alasdair Reid

2.1. Introduction

This paper explores whether the concepts of science (or research) and innovation are fully and coherently understood in policy-making circles. These issues may seem overly epistemological, but clarity on the concepts underpinning specific policy objectives and the extent to which such objectives are based on justifiable facts as opposed to popular opinions, are crucial. The paper outlines a number of recent trends in performance and policy, differentiating between trends related to research policy and those that can be distinctly identified as innovation policy.

While target setting and policy instruments differ between the two policy fields, the inter-linkages in policy terms imply a necessary search for coherence and synergies. This is particularly true given the increasing complexity of managing such policies, with trends towards the internationalization of research and decentralization to the regional level of policy design and implementation. Accordingly, the growing emphasis placed on 'good governance' of research and innovation policies is explored and this somewhat vague concept is explained in operational terms.

As a consequence of recent trends and the need for improved governance of research and innovation policies, it is argued that policy makers need to be equipped with appropriate tools, which can be grouped under the concept of 'strategic intelligence'. Two such tools at European level, the European TrendChart on Innovation and the ERAWATCH platforms, are discussed along with their applicability for national and regional policy makers.

The paper concludes by drawing a number of lessons for the South Eastern European (SEE) countries in terms of policy challenges and policy options.

2.2. Research and innovation in Europe: talking the same language?

Since the Lisbon Strategy was launched in 2000, the press, politicians and other stakeholders have increasingly latched onto the 'research and innovation' or 'knowledge economy' paradigms. Yet, often they appear to use concepts or make grand declarations of intent without grasping the 'empirical', not to mention the theoretical, underpinnings of the objectives they are setting or the consequences in terms of policy funding and implementation which such objectives imply.

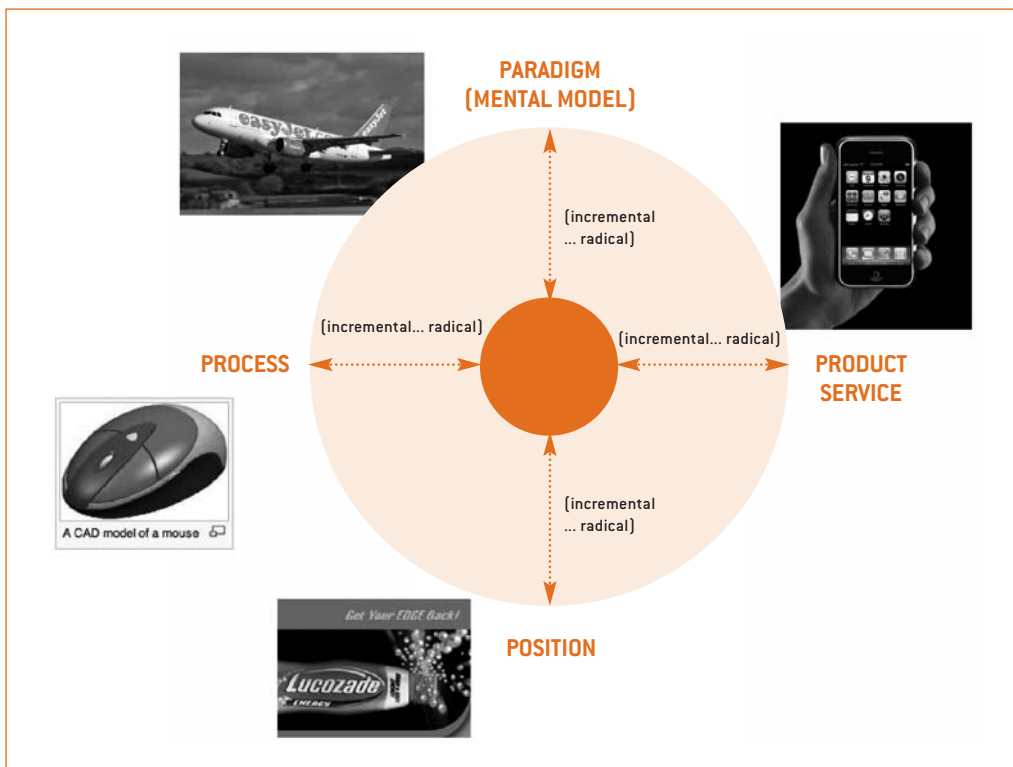
2. Science and Innovation in the 21st Century. Lessons for European core and peripheral economies

Scientific research is a well-defined concept (see, e.g. the definitions in the Frascati (OECD 2002) and Oslo (OECD 2005) Manuals) which may, but does not necessarily form part of a process of innovation. On the other hand, entrepreneurship, or the act of making innovations, is not something related to science and research; it is about changing the rules of the game in economic competition.

Indeed, innovation is fundamentally an economic rather than a scientific process, and can be categorized by what Tidd et al. (2005) have labelled the 4Ps (see Figure 2.1):

- 'product innovation' – changes in the things (products/services) that an organization offers;
- 'process innovation' – changes in the ways in which they are created and delivered;
- 'position innovation' – changes in the context in which the products/services are introduced;
- 'paradigm innovation' – changes in the underlying mental models which frame what the organization does

Figure 2.1: The Four Ps



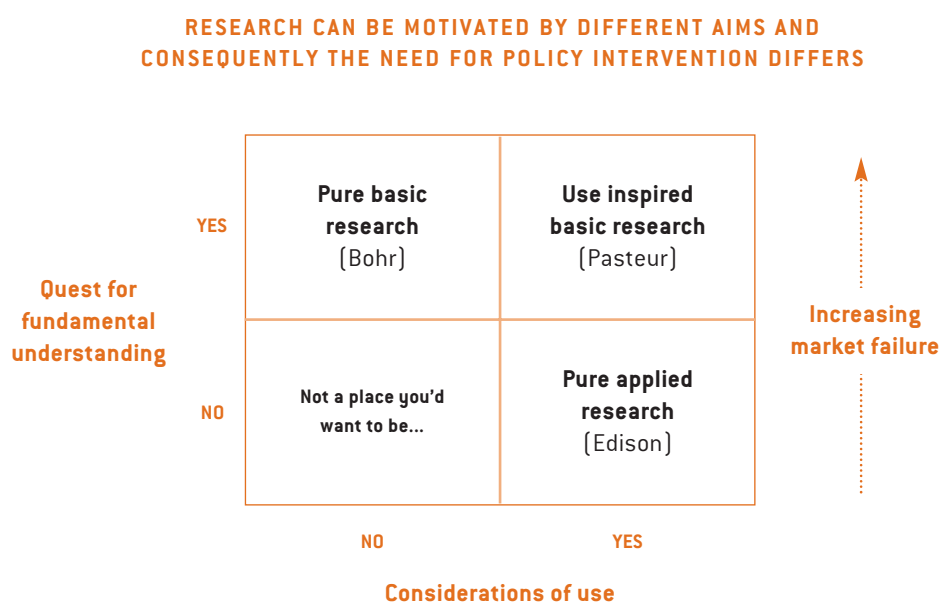
Source: Adapted from Tidd et al. (2005)

Equally, innovation can be anything from incremental (doing what we do better), to new to a firm, to radical (new to the world). In most cases, scientific research contributes essentially to the latter two forms of innovation. Scientists or technicians on the other hand are often involved in more hands-on or practical work in less radical innovations.

2. Science and Innovation in the 21st Century. Lessons for European core and peripheral economies

If innovation is a multi-faceted and potentially complex phenomenon (i.e. when a new technology has effects at system level, such as the information technology (IT) 'revolution' or the bio-economy), the reasons why governments should intervene in favour of research and innovation are also more complex than the classic market failure or 'public good' argument for funding scientific research. As Figure 2.2 suggests, the activity of conducting research can be motivated by different aims and consequently the need for policy intervention differs.

Figure 2.2: Pasteur's quadrant and the rationale for policy intervention



Source: Adapted from Pasteur's Quadrant: Basic Science and Technological Innovation, Stokes 1997

The degrees of policy intervention and public funding required obviously differ depending on the type of research. The top right quadrant in Figure 2.2 is where there is increasing pressure to ensure a share of private funding and where innovation and research policy instruments often start to merge in terms of objectives. However, bridging type mechanisms, such as 'competence centres' often span research activities involving both pure applied research and use-inspired basic research. Moreover, if we keep in mind the diverse types of innovation proposed by Tidd et al. (2005) and integrate the possibility that the system of innovation itself may not function in a way that fosters innovation, then the rationale for innovation policy becomes broader. Four categories of 'failures', all requiring the attention of policy makers, can then be identified:

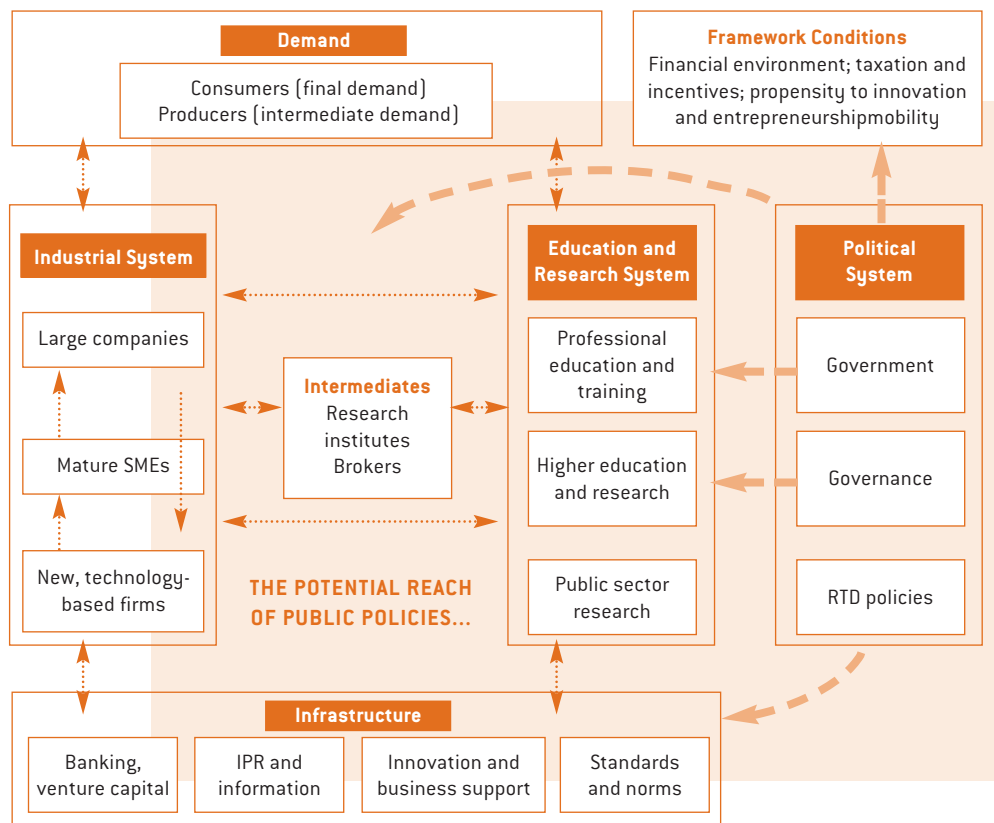
- *capability failures in the business sector*: managerial deficits, lack of technological understanding;
- *failures in 'institutions' in the national innovation system*: universities, patent offices, financial system, etc.;

2. Science and Innovation in the 21st Century. Lessons for European core and peripheral economies

- *network or system failures*: lack of interaction among actors in the ‘innovation system’, etc.
- *framework failures* : regulatory framework, health and safety rules, etc., and also consumer demand, and cultural and social barriers to innovation.

The first of these failures underlines that the market failure approach assumes away the internal deficiencies of real companies. The other three underline that even if an enterprise manages to overcome the internal barriers to innovation, the system in which it operates may impinge on its ability to innovate successfully. Given this observation, it is apparent that in a systems world, it is necessary to be realistic about the scope of public intervention in favour of research and innovation policies (see Figure 2.3).

Figure 2.3: National innovation system concept

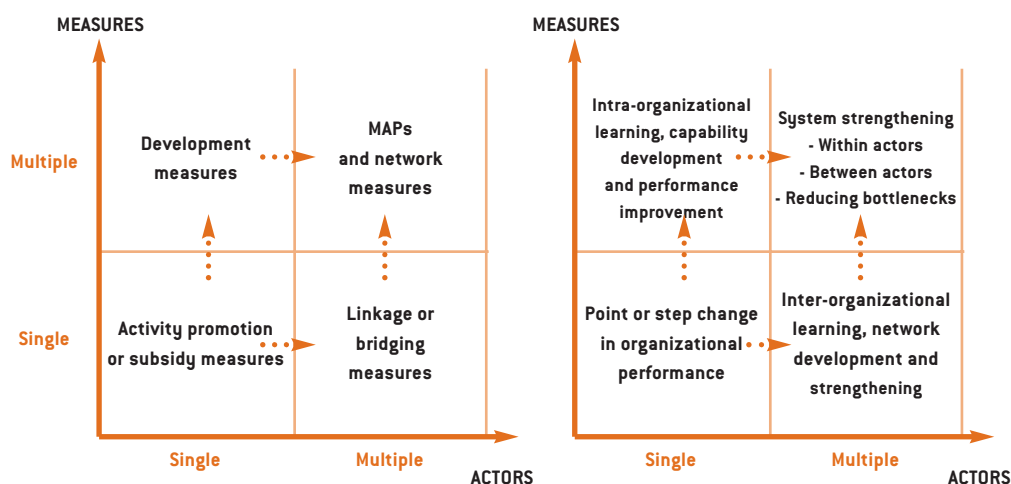


Source: Arnold, E., Kuhlman, S. (2001), ‘RCN in the Norwegian Research and Innovation System, Background Report No 12’ in *Evaluation of the Research Council of Norway*, Royal Norwegian Ministry for Education, Research and Church Affairs.

In this context, it is worth underlining that research and innovation policies are starting to overlap and to become more systemic, in line with the theoretical focus and empirical evidence on the importance of system failures. Figure 2.4 summarizes recent trends in the development of so-called multi-actor/multi-measure programmes (MAPs).

2. Science and Innovation in the 21st Century. Lessons for European core and peripheral economies

Figure 2.4: Recent trends in the development of MAPs



Source: Arnold, E., based on STRATA-MAP Thematic Network, see http://www.technopolis-group.com/downloads/reports/311_Handbook.pdf

The left hand side of the figure explains the shift from a more classic single-actor/single-measure approach (e.g. a subsidy to a company to carry out an internal product development project), to MAPs or network measures where a combination of different measures (grants to partnerships of companies/research organizations, funding for cluster or network managers, actions to remove system failures such as access to finance, etc.) are brought together within a policy framework. The right hand side of the figure explains the type of results or impacts expected from the different types of measures/MAPs. Again, this reflects a shift in policy-makers' interest in fostering a rather traditional step-change in a single organization to a more systemic target to reduce bottlenecks or change the behaviour of a broader group of actors in the national innovation system.

2.3. Research and development and innovation in Europe: Recent trends in performance and policy

2.3.1. Challenges for boosting research and innovation

As noted above the principal quantitative objective set by the EU relates to an objective of achieving 3% of gross domestic product (GDP) for research and development (R&D) by 2010 – the so called Barcelona objective. Despite this, trends in R&D intensity in the EU25 have improved little since 2000. Indeed, if current trends continue China will be spending as much as the EU on R&D in absolute terms by 2010. While policy makers have a rather direct influence over how much money is spent on public and generally higher education research, a key issue is the difficulty involved in influencing business R&D expenditure. This is firstly because the economic structure of many European regions and countries makes it difficult to imagine a rapid and significant increase in business R&D expenditure. And secondly, because an expenditure

2. Science and Innovation in the 21st Century. Lessons for European core and peripheral economies

target and related (often promised, but still minor) commitments to increase public expenditure on R&D ignores other significant bottlenecks in most national innovation systems.

The most obvious and pressing problem is the declining or, at best, stable interest of young people in pursuing scientific education and scientific careers. So the human dimension of spending 3% of GDP on R&D (estimates suggest up to 1.2 million additional researchers will be required by 2010 to match the targets for increased expenditure) is only partly on the policy radar, despite a number of calls for European wide actions. This human dimension influences both the public and private sector potential to increase the intensity of the R&D and innovation effort.

Finally, another important issue that is high on the policy agenda is the internationalization or 'off-shoring' of R&D units and competition to attract top scientific performers. The work of analysts such as Richard Florida has highlighted the 'spikiness' of the world map in terms of concentrations of research potential (essentially human capital, but also increasingly financial flows) and outputs. Hence, the importance of a stronger reflection on the distinction between the need to 'innovate everywhere' versus a number of arguments for concentrating excellence in specific research fields in a limited number of top locations in Europe, which can compete with the Bostons, Singapores and Silicon Valleys of the wider world. The real challenge for Europe is to continue to encourage improvements in the quality and relevance of higher education across its entire territory (to continue to drag upwards all 'second-zone' centres of higher education and research), while investing adequately in those centres that allow Europe to gain dominance in specific existing and emerging fields of strategic research. Understanding this implies that the 'second-zone' (and this should not be considered pejoratively) centres of research need to focus on niches of excellence, which over time may emerge to become new 'first-zone' hotspots, and this in turn implies a need to co-operate across national or regional boundaries to access knowledge and resources.

2.3.2. EU research policy trends

Recent EU research policy documents underline the convergence of conceptual approaches (the above mentioned systems approach) and the increasing complexity of the policy mix. The existing range of long standing instruments is expanding with additional financial instruments and links to complementary policies (regulatory, education, etc.). There also tends to be a Europeanization of policy focuses with a concentration of funding in certain technological fields, with only minor variations between countries. In most EU Member States, biotechnology, nanotechnologies, new materials and information and communication technologies (ICT) are priority target areas.

The types of programmes tend to be similar and fall into three broad categories:

- programmes to foster industry-science interactions;
- actions to improve the framework conditions for R&D (intellectual property rights (IPR), etc.);
- efforts to strengthen the public science base.

2.3.3. Innovation challenges for the wider Europe

The European Innovation Scoreboard (EIS) (2005) divides Europe into four groups in terms of innovation performance (Figure 2.5).

2. Science and Innovation in the 21st Century. Lessons for European core and peripheral economies

The results of the EIS suggest that it will be extremely unlikely that convergence in innovation performance will occur in the short-term. Indeed, none of the catching up countries is expected to reach the EU25 average by 2010; at best Hungary, Slovenia and Italy will catch up by 2015. The European level trend shows, respectively, a stable and an increasing gap, with the United States and Japan, implying that even reaching the EU25 average will do little to reduce Europe's competitive disadvantage with respect to other industrialized economies.

Figure 2.5: European Innovation Scoreboard country groupings, 2005.



Source: http://www.proinno-europe.eu/extranet/admin/uploaded_documents/EIS_2005.pdf

The EIS background analysis indicates the benefits to be derived by countries achieving balanced innovation performance across the five key dimensions of innovation into which the 26 EIS indicators are grouped: innovation drivers, knowledge creation, innovation and entrepreneurship, application of innovation, and intellectual property. On some indicators, less advanced economies perform relatively better, e.g. innovation and entrepreneurship. Not all countries perform at the same level in each of these dimensions, and some countries are especially weak in one or several dimensions of innovation. According to the EIS there is evidence that an even performance on these five dimensions fosters innovative performance, and that countries that demonstrate below average performance in one of these dimensions compared to that country's overall performance, might find that the future innovative performance is hampered. This has strong implications for the design of a policy mix.

2. Science and Innovation in the 21st Century. Lessons for European core and peripheral economies

2.3.4. Innovation as a political priority: Hot topic or fudge?

The European TrendChart on Innovation has been monitoring innovation policies in Europe since 1999. The most recent annual report (EC 2006) highlights that the definition of innovation policy objectives is very ambiguous in most EU countries:

- a majority of countries do not set clearly defined objectives and link them to measures expected to lead to the achievement of objectives (but the Lisbon reporting process is forcing Member States to be more explicit);
- quantitative targets are limited to the mantra of '3% of GDP on R&D with business providing two-thirds'. An input target that says little about the quality of the output and which ignores a large body of evidence that R&D intensity is closely linked to an economy's sectoral composition (OECD 2007: Ch. 5).

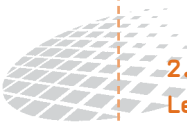
However, some countries do use output type indicators as targets: the Netherlands is a good practice case in terms of target setting. But this positive evolution is also evident in newly introduced strategies and action plans in 'less-advanced' innovation systems. such as those of Portugal and Latvia.

Looking across developments in individual European countries, a number of common trends in innovation policy design and implementation can be identified:

- a significant effort to increase the availability and competencies of skilled innovative people: to strengthen linkages and knowledge flows both nationally and internationally;
- a growing regional role in the implementation of many recent initiatives, fuelled by the Structural Funds in the new Member States: corresponding need for coordination between national targets and initiatives;
- a push to increase the overall intensity of innovation activity through stimulating private enterprises to invest more in R&D specifically, and other forms of innovation more generally;
- an emphasis on the role of regulations, public procurement and other 'business environment' factors influencing the performance of the innovation systems of the Member States;
- partnership based initiatives to create linkages aimed at improving the functioning of innovation systems: triple-helix, clusters, competitiveness poles, etc. and new platforms for policy design and delivery.

2.4. Research and innovation policies in Europe: Governance as a key issue

Given the above trends, can we talk about a European research and innovation system? In practice a gap exists between the increasing internationalization of basic and applied research activities, and the dynamic nature of business innovation (international, trans-sectoral, interdisciplinary) and the degree of fragmentation, stratification and duplication in the research funding and innovation policy-making bodies in Europe. This has led, *inter alia* to the concept of a European Research Area (ERA) and to an increasing emphasis on sectoral innovation systems at European level (see www.europe-innova.org).



2. Science and Innovation in the 21st Century. Lessons for European core and peripheral economies

Governance in innovation policy is challenging because the innovation process itself is very complex. On the one hand, innovation is interconnected with other policy areas such as research, education, internal market, etc., but on the other it remains important to distinguish innovation policy from other policy areas to ensure that specific innovation issues are addressed in a timely manner. Involvement of and real commitment from stakeholders at regional and national levels to cooperate and learn from each other are important to improve innovation policies and competitiveness.

In Europe, there may be three major ministries involved in policy design and implementation, along with parliamentary committees, advisory councils and executive agencies. While innovation governance structures are very diverse, they may be classified under a taxonomy based on the type and degree of hierarchies and co-ordination (however these are ideal types and most countries have elements of more than one system):

- a broader number of actors with strong inter-organization co-ordination throughout the policy cycle. In general this model is accompanied by active stakeholder involvement, though of differing types and intensities. The Nordic countries, the Netherlands and the UK and Ireland culture are good examples of this practice. However, it is necessary to identify the 'natural' ceiling in the creation of co-ordination mechanisms, to avoid their proliferation and additional bureaucracy;
- strong co-ordination based on hierarchical relations with other policy making and implementation organizations/agencies. The German and French systems, and Israel and Italy are examples of this type, but the same model can be found in less mature innovation governance systems such as Romania and Latvia;
- fragmented systems with more actors following individual agendas, some of them efficiently, but with limited synergies and potential friction. The majority of countries are in this category; however, in most cases visible efforts are being made to improve co-ordination through the establishment of advisory boards and agencies adopting a coordinating role.

The relations between the national and the regional levels constitutes an additional layer of co-ordination. Self-governance of the regions ranges from full autonomy of the three Belgian regions, to very centralized structures in Greece, Portugal and some of the new Member States, and different degrees of statefederal interaction in others.

Regarding the share between design and implementation in many Member States, the governance structure foresees a division of labour between one or more ministries on the one hand, and one (or more) agencies on the other. A traditional agency form is the mono-principal, i.e. an agency, that works for one 'boss' or ministry (e.g. Enterprise Ireland, TEKES). An alternative model is the 'multi-principal', which acts as an intermediary for several sponsoring ministries.

In an ideal model, the division of labour between ministries and agencies is a split between policy design, the responsibility of the ministry following political decisions taken by government, and policy implementation dealt with by the agencies under the instructions of the ministry. The argument often put forward in favour of outsourcing programme management to an exter-

2. Science and Innovation in the 21st Century. Lessons for European core and peripheral economies

nal organization is that this improves efficiency. However, in practice the border lines between policy design and policy implementation are not always clear cut and, in addition, in many countries the agencies also have an explicit or implicit role in policy design.

Figure 2.6: Innovation governance system in selected EU countries

Country	Policy design	Programme design	Programme management	Programme administration tasks
Latvia	Full Responsibility Ministry		Shared responsibility	Full responsibility Agency
France	Full Responsibility Ministry	Full responsibility Agency		
Portugal	Full Responsibility Ministry	Shared responsibility	Full responsibility Agency	
Ireland	Full Responsibility Ministry	Shared responsibility	Full responsibility Agency	
The Netherlands	Full Responsibility Ministry	Shared responsibility	Full responsibility Agency	
Luxembourg	Full Responsibility Ministry	Shared responsibility	Full responsibility Agency	
Finland	Shared responsibility	Full responsibility Agency		
Flanders	Shared responsibility		Full responsibility Agency	
Estonia	Shared responsibility		Full responsibility Agency	
Austria	Shared responsibility		Full responsibility Agency	
Slovenia	Shared responsibility		Full responsibility Agency	
Slovakia	Shared responsibility		Full responsibility Agency	

Source: European Innovation Progress Report 2006, <http://www.proinno-europe.eu/docs/Reports/Documents/EIPR2006-final.pdf>

The border lines and responsibilities between policy makers and agents differ from country to country. In 57% of European countries (or 12 out of the 21 surveyed) an implementation agency exists and has some role in policy implementation. In the remaining nine countries another organization has the responsibility for programme management and administration. In six out of these nine the Ministry itself has responsibility for programme management and administration. Countries such as Germany and the UK have no permanent agencies, but out-source specific programme implementation to different public or private sector contractors. Figure 2.6 shows the responsibility sharing among ministries and implementing agencies.

In fact, the effectiveness and efficiency of the governance system is not related to the type of model adopted. Neither are bottom-up (collection of initiatives from practitioners providing innovation services) or top-down (providing strategic direction from high level policy makers) governance models to be encouraged. The former are important since the environment should determine which services, if they do not already exist, should be introduced. But good top-down governance is also needed, as exemplified by the USA, where top-down is often combined with considerable freedom for researchers and clear societal goals. Moreover, it can be argued that there is no time for a real bottom-up approach. Strong governance is not necessarily top-down governance: both bottom-up and top-down models are needed, as well as the 'middle field'.



2. Science and Innovation in the 21st Century. Lessons for European core and peripheral economies

2.5. Strategic intelligence for research and innovation policy governance

In the context of a systems approach and complex governance structures and mechanisms, policy makers increasingly need access to 'strategic intelligence':

- to understand the underlying determinants of R&D and innovation and their function in the knowledge economy and society at large;
- to furnish answers to immediate policy questions (e.g. nature of the science and engineering skills shortage, most effective ways to fund business R&D);
- to anticipate trends and future developments related to innovation policy;
- to monitor progress in policy areas, particularly those related to the Lisbon objectives;
- to understand the impact of policy measures and in the shorter term the efficiency and effectiveness of public spending;
- to adapt agencies and other institutions over time to changing forms of policy measures.

A number of strategic intelligence tools exist and increasingly are becoming embedded in policy-making practices across Europe:

- foresight and strategy development - notably participative models;
- strong base of 'innovation indicators' - national/regional and internationally comparable;
- well-managed and systematic evaluation cycle (ex-ante, on-going, ex-post);
- regulatory impact assessment;
- quality assessment or peer review of research and innovation policy;
- exchange of experiences and 'good practices' in innovation policy: '*trans-national policy learning*';
- benchmark and compare countries/regions on certain topics (open method of co-ordination).

At EU level, two specific 'strategic intelligence' platforms for policy makers have been developed over the last five to six years from the innovation and research policy perspectives – the European TrendChart on Innovation and ERAWATCH.

2.5.1. European TrendChart on Innovation

The European TrendChart on Innovation (www.trendchart.org) is the longest established European policy intelligence portal and has been running since 1999. It is built around three complementary pillars:

- the EIS: more than 20 indicators based on available statistics;
- a network monitoring and analysing innovation policy developments in 33 European countries plus major competitors and emerging industrialized nations from the rest of world. The network's outputs include: a database of more than 1,300 policy measures updated live on the web; a policy information/news service; country reports and an annual European Innovation Policy Progress report;
- workshops with national policy makers including peer reviews of specific themes. Drawing on the first two pillars plus concrete expertise from policy makers, etc.

2. Science and Innovation in the 21st Century. Lessons for European core and peripheral economies

Policy monitoring is enabled by a categorization of measures according to an innovation policy framework currently (2004-2007) structured around five key objectives (with 26 sub-categories):

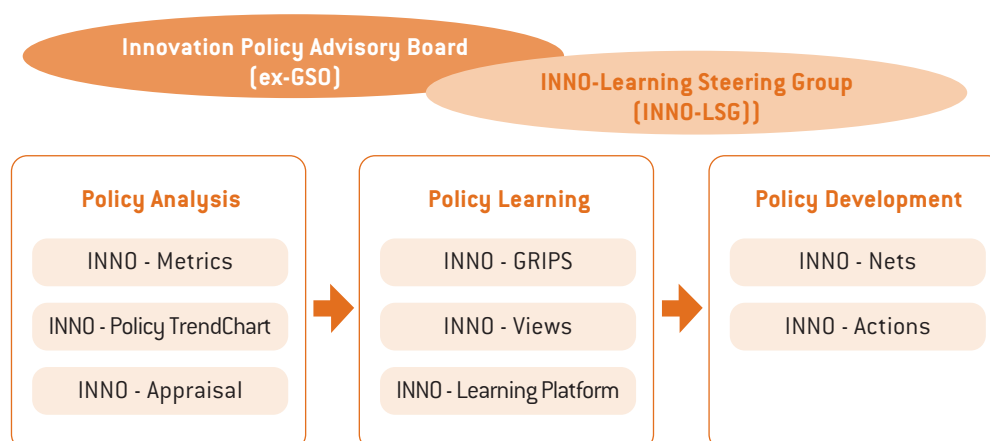
- improving innovation governance and strategic intelligence for policy making;
- fostering an innovation friendly environment;
- encouraging technology and knowledge transfer and the development of innovation poles and clusters;
- promoting and sustaining the creation and growth of innovative enterprises;
- strengthening entrepreneurial innovation, including the protection and commercialization of intellectual property.

In terms of the policy impact of this work, the annual publication of the EIS results is relatively well covered by the media, and notably in those Member States considered to be 'falling behind'. The results tend to spark debate about the need for further investment in innovation, especially allied to policy analysis, which draws on the EIS to identify challenges for each country. The TrendChart policy monitoring activities are accessible to a largely 'technocratic' audience rather than a wider public, but the usefulness of the database of policy measures and for informing the design of new policy is well recognized.

As of 2007, the EIS and TrendChart activities have become part of a larger package of EU level activities aimed at boosting the evidence base and quality of policy developments. The Pro-Inno initiative (<http://www.proinno-europe.eu/>) includes three sets of actions covering policy analysis, learning and development activities, as summarized in Figure 2.7 (the EIS comes under the Inno-Metrics label and the TrendChart workshops are now called Inno-Views).

This packaging of the actions clarifies the link between the analytical (evidence base) and the translation of this knowledge into practical and operational measures in Member States or regions.

Figure 2.7: PRO-INNO Europe initiative: structure of activities



Source: <http://www.proinno-europe.eu>



2. Science and Innovation in the 21st Century. Lessons for European core and peripheral economies

2.5.2. ERAWATCH⁴

ERAWATCH (www.cordis.europa.eu/erawatch), twin initiative to TrendChart, was launched in 2006 following a prototyping phase in 2004 to assess tools, methods and procedures. It focuses on the research policy agenda and aims to provide an integrated service to support research policy-making in the context of the ERA. A network of country experts is responsible for completing and keeping up to date a policy inventory for all European countries plus a number of key 'competitors' from the rest of the world. The aim is to support evidence-based policy-making in the research field and contribute to the realization of a ERA by providing better knowledge and understanding of national and regional research systems and of the environments in which they operate.

Currently 37 countries are covered and the service's regional and other coverage is expected to increase over time. ERAWATCH is a joint initiative of the European Commission's Directorates General for Research and Joint Research and the Institute for Prospective Technological Studies (IPTS).

The inventory is built on the systematic collection and classification of five main categories of information at national (and progressively regional) level:

- country research profiles, including basic characterizations of national and regional systems, main actors, debated issues and future policy developments;
- research policy documents, providing the overall contexts in which policies operate;
- research programmes, relevant instruments and schemes being developed and applied, including the role and impact of programme evaluation;
- organizations, i.e. policy-making bodies and other organizations with significant influence on policies, funding organizations and research performers in both the public and private sectors, and the interactions between them and the structures in which they operate and interact;
- sources of information and data: some key indicators are reproduced in the inventory.

An ERAWATCH Intelligence service aims to provide regular and ongoing analyses of issues relevant to research policy making. These analyses will be in large part based on the inventory. A key feature of the intelligence service is a unique combination of qualitative policy information and quantitative data (including indicators) within a Multi Level Multi Actor (MLMA) perspective, which is the core characteristic of the ERA.

2.6. What lessons can we draw for the SEE countries?

This paper has discussed a series of trends in theoretical thinking, policy and governance and strategic intelligence initiatives for research and innovation policy in Europe. The author does not pretend to offer a ready-made solution for the SEE countries as a whole or individually.

⁴ ERAWATCH Network ASBL is a non-profit organization established under Belgian law grouping 16 of Europe's leading companies and institutes in the field of policy research and advice, see www.erawatch-network.eu (accessed 19.06.07).

2. Science and Innovation in the 21st Century. Lessons for European core and peripheral economies

However, simply applying the European TrendChart on Innovation approach of identifying key challenges and possible policy options leads to some broad suggestions.

Consideration of how the national innovation systems of SEE perform using the EIS framework of five sets of indicators, enables the following conclusions:

- Innovation drivers: still broadly low levels of investment in education but a relatively stronger science and engineering emphasis in higher education;
- Knowledge creation: investment levels in public and particularly business R&D remain very low. So, even if investment intensity increases, there will be a need to adopt a highly focused approach in one or two fields where critical mass and quality research can be developed, to compete and participate in the ERA;
- Innovation and entrepreneurship: surveys along the lines of the Community Innovation Surveys (CIS) suggest that Bulgaria, Romania and Serbia have poor rates of enterprise innovation and essentially incremental forms of technology adoption. This is consistent with the level of development in most economies and sectors.
- Application (and diffusion): ICT expenditure levels are often high, and this in part captures a catching up phenomenon and diffusion of enabling technologies; SEE countries are trailing badly in terms of high-tech exports, but here increased foreign direct investment (FDI) can be a mechanism for technology diffusion and a longer-term shift to higher value added activities;
- Intellectual property: patent and trademark data show that the SEE countries are a long way behind the European average; but this should be seen as an outcome not a factor to focus on at this stage.

In many respects, low demand for innovative products and a lack of creative cultures in education are the biggest bottlenecks to longer-term improvements. The potential for boosting business R&D and innovation activities is constrained by weak innovation support systems and fragmented research capacities as noted previously. In this context, what would be the favoured policy response of SEE countries? Five main policy messages stand out:

- improving governance systems: building capacities in public sector, public-private partnership, surveys and studies;
- developing the innovation capacities of existing enterprises: industry-science mobility, recruitment of 'innovation managers, innovation awareness and management tools;
- gradual boosting of targeted public investment in knowledge creation: competitive grants for centres of excellence, returning researchers;
- linking policies: FDI as means of technology/knowledge transfer; life-long learning policies tailored to skills gaps for innovation and research;
- greater focus on stimulating demand and markets for innovation [see 'Aho report'⁵]: looking at the impact of regulations, public perception of science and innovation, promotion of 'innovators', etc.

⁵ See http://ec.europa.eu/invest-in-research/action/2006_ahogroup.en.htm [accessed 18.6.07].



2. Science and Innovation in the 21st Century. Lessons for European core and peripheral economies

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3. Science and Economic Development in SEE

Milica Uvalić

3.1. Introduction

This paper aims to provide a comparative overview of the situation in the science and technology (S&T) sector in South Eastern Europe (SEE). It is based on two recent studies conducted for UNESCO (Uvalić 2005) and the Slovenian Ministry for Higher Education, Science and Technology (Uvalić 2006), as part of the SEE-ERA.NET consortium. The SEE countries considered are the six Western Balkan countries: Albania, Bosnia and Herzegovina, Croatia, Former Yugoslav Republic of Macedonia, Montenegro, and Serbia.

To provide a basis for the argument as to why it is important to invest in science in SEE, the principal economic constraints on science and technology (S&T) in SEE are discussed (Section 3.2). The main features of the national systems of S&T in SEE countries are discussed in Section 3.3 and some additional, more general reasons why it is important to invest in science in SEE are discussed in Section 3.4. The paper concludes with some policy recommendations (Section 3.5).

3.2. Economic constraints on S&T in SEE

The transition to a market economy in SEE started in 1989, but was interrupted in several countries by the break-up of the Socialist Federal Republic (SFR) of Yugoslavia in mid-1991 and the extreme political and economic instability that followed. During the 1990s, the creation of independent states was accompanied by military conflicts, the introduction of trade and other barriers, and the consequent decade-long international isolation of most SEE countries. In the early 1990s, the SEE countries suffered hyperinflation and deep recession, and the implementation of radical economic reforms was delayed. The events of the 1990s have had long-lasting consequences for the SEE economies, some of which are being felt even today. The economic features of the SEE countries pose severe constraints on the development of S&T. It should be stressed that the SEE region, even in the narrow definition of the Western Balkan countries, is very heterogeneous: the SEE countries are at different stages of transition to a market economy, at different phases of EU integration, and at very different levels of development. Nevertheless, the six SEE countries that are the focus of this paper have some common features and face some similar challenges.

Most SEE countries are characterized by a low level of economic development. Economic recovery after the deep recession of the early 1990s has been slow and, with the exception of Bosnia and Herzegovina, these countries suffered additional economic crises in the second half of the 1990s. From 2000 onwards, although gross domestic product (GDP) growth rates



3. Science and Economic Development in SEE

have been exceptionally high in most countries, this has been largely insufficient to make-up for their poor growth record in the 1990s. By mid-2005, real GDP in Bosnia and Herzegovina, Serbia, and Montenegro was still only 60-70% of their 1989 levels. Most SEE countries in 2005 had a GDP per capita (at market exchange rates) of US\$2,000-3,000, or about 30% of the EU25 average. The exception here is Croatia, the most developed of the six countries, with a per capita GDP of US\$8,200. The present low levels of development in the Western Balkan countries are also reflected in the structure of their economies. During the 1990s, these economies experienced a process of de-industrialization: with the closure or restructuring of large industrial enterprises, and many redundant workers returning to subsistence agriculture.

While the low level of economic development is in itself a direct constraint for the development of the S&T sector, there are additional factors that have further limited the possibilities for major improvements. Macroeconomic stabilization, one of the most important economic objectives for all SEE governments during transition, has required the application of restrictive monetary and fiscal policies. These macroeconomic policies have usually involved very severe budgetary cuts, and substantial limits on or reductions in various types of public expenditure, with R&D and education being among the sectors that have been worst affected.

The Western Balkan countries have also been facing high and rising external account deficits. Among the reasons behind high trade deficits are the still non-diversified export structure, limited competitiveness, high dependence on imported intermediate goods, and policies directed to strong national currencies. The possibilities of significantly increasing imports of modern technology and know-how from abroad are directly limited by these high trade deficits, and will expand only with improved export performance. The SEE countries have lost a whole decade of technological progress in many industrial branches and in the future will be forced to rely on imported modern technology.

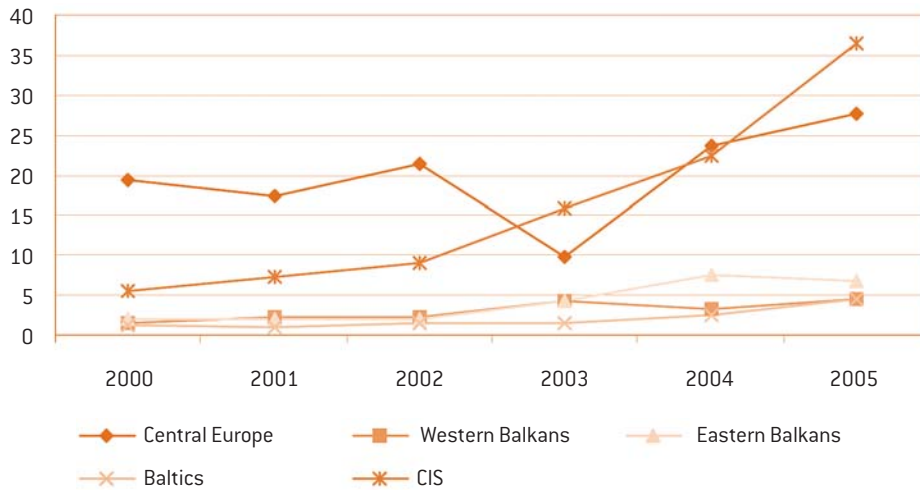
National savings and investment rates have remained very low throughout most of the years since the mid 1990s, and much lower than in the more advanced transition countries. Since 2000, these low rates have been only partially compensated for by capital inflows from abroad, primarily international donor financial assistance and workers' remittances, since, until a few years ago, foreign direct investment (FDI) was at very low levels.

This poor level of FDI is another serious constraint to faster development of the S&T sector in SEE. During the 1989-2002 period, the five Western Balkan countries attracted only 6.1% of total FDI inflows into the 27 transition countries. FDI levels have begun to increase, particularly since 2003. Nevertheless, in 2005, the Western Balkan countries still attracted less than US\$ 5 billion, less than the Eastern Balkans, i.e. Bulgaria and Romania (see Figure 3.1).

It is not necessary to stress how important it is for the Western Balkan countries to attract more FDI in the future. In the more advanced transition countries, which are EU members, FDI has been the main transmitter of modern technologies, know how and increased investment in R&D.



Figure 3.1: FDI in transition countries, 2000-2005 (US\$ billion)



Source: Based on data from the Economist Intelligence Unit

3.3. National systems of S&T

The national S&T systems in the Western Balkan countries cannot be properly evaluated without taking account of their starting conditions in 1989. These starting conditions and the levels of their S&T sectors, were very different across individual SEE countries, based on their very different historical backgrounds. Conditions in SFR Yugoslavia were more favourable than in Albania in terms of institutions, human capital, universities (Zagreb University dates back to 1669, and Belgrade University to 1889), international openness, scientific cooperation and international exchange. Albania had pursued a rather traditional model; it was the most closed economy in Europe, and the first university in Albania was established only in 1957. These differences continue to be important in relation to S&T sectors.

Reforms have been underway in all the Western Balkan countries, including the S&T and higher education sectors, though at different times and at variable speeds. Many new laws on science (S&T, R&D) and higher education, have been enacted in these countries. Various government documents have been prepared, including national strategies for the development of S&T, which define programmes, specific tasks, and multiple objectives to be achieved over the short and medium terms. Nevertheless, in most SEE countries there is no clear orientation regarding key priorities (e.g. balance between basic and applied research) and no clear and realistic longer-term national strategy for R&D (e.g. balance between innovation and imitation). There have been delays in implementing many of the changes, and the new laws have frequently been important only on paper. It is generally considered that S&T is overshadowed by other priorities, as there is a general lack of understanding of the importance of science.

The ongoing reforms have led to major institutional differences among the Western Balkan countries. Bosnia and Herzegovina currently has a highly fragmented and decentralized sys-

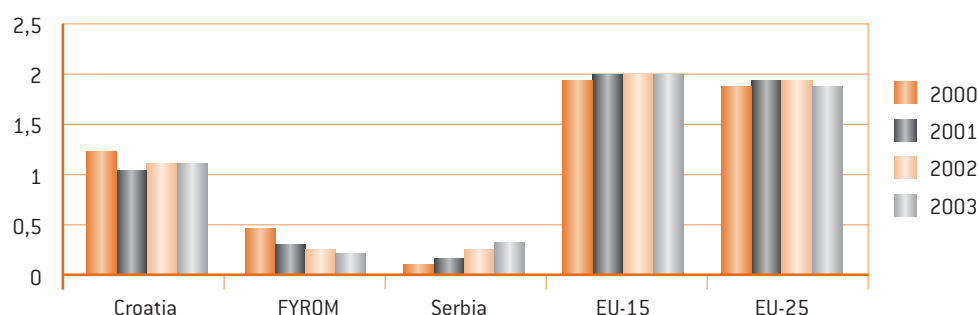
3. Science and Economic Development in SEE

tem and there is no R&D policy at State level. In Serbia, the R&D system is also rather decentralized, and there are separate S&T and higher education institutions and government policies. In Montenegro, due to the country's size, the S&T and education systems are more centralized. In Croatia, following the adoption in 2003 of one law encompassing both the science and higher education areas, and the merging of the previous two ministries into one organization, the system is very centralized.

Investment in R&D in most SEE countries declined substantially during the 1990s, and science, research and higher education are generally poorly funded. R&D expenditure remains low in most of the Western Balkan countries, but there are no official statistics for Albania, Bosnia and Herzegovina and Montenegro. For Serbia, estimates were recently provided by the Ministry of Science and Environmental Protection, but the data are partial, as they relate only to government spending on R&D.⁶

In 2003 Croatia, with 1.14% of GDP spending on R&D had the highest gross expenditure on R&D (GERD) among the Western Balkan countries (see Figure 3.2), a level higher than most new EU Member States (except Czech Republic and Slovenia) and even some older Member States (e.g. Italy). In contrast, in Serbia, government expenditure on R&D in 2003 was only 0.32% of GDP, although it has been continuously rising since 2001 and government plans to increase its R&D spending to around 1.4% by 2010. In Former Yugoslav Republic of Macedonia in 2003 GERD was even lower – 0.22% of GDP (see Figure 3.2). In Bosnia and Herzegovina, GERD is estimated at 0.03 – 0.05% of GDP. For Albania and Montenegro no data on GERD are available.

Figure 3.2: Gross domestic expenditure on R&D (% of GDP), 2000-2003



Source: Uvalić (2006).

Government is the main source of finance in all SEE countries, with business enterprise funds very limited – in Croatia 40% and in Former Yugoslav Republic of Macedonia 12% of overall R&D spending. This is substantially lower than the average for the EU15, which in 2003 was around

⁶ The data for Serbia are based on Ministry of Science, Technology and Development of the Republic of Serbia (2002), *The State of R&D activities in the Republic of Serbia and the Measures for their improvement*, Serbia: Ministry of Science, Technology and Development.



54.6%. For the other four countries there are no official statistics, but percentages are likely to be even lower, due to delays in privatisation - notably in Serbia and Bosnia and Herzegovina, where the private sector share in GDP in 2005 was around 55%. Links among universities and research institutes and business enterprises are limited, which is a major problem in all SEE countries.

The science infrastructure in the SEE countries has suffered greatly from the poor financial situation of R&D institutions. There have been relatively few possibilities for infrastructure modernization, new equipment purchase, new laboratory and library facilities, ICT systems, databases and Internet access upgrades. Generally, the inappropriate treatment of R&D and insufficient investment in the science infrastructure represent serious obstacles to more intensive research, although there are enormous differences among the Western Balkan countries. The richest country, Croatia, is in the best situation and has recently invested heavily in S&T equipment.

Human resources in the Western Balkan countries were severely affected by the break up of SFR Yugoslavia, the various wars in the region, and recurrent economic crises. The most dramatic effects are two parallel processes directly related to human resources and R&D potential: (i) a massive and continuing brain drain which has resulted in the loss to these countries of experts who have left to seek new employment opportunities abroad; and (ii) brain 'waste' from scientists leaving R&D for better paid jobs in the private or informal sector. R&D jobs continue to be unattractive because of low pay, lack of social status, limited incentives and poor employment opportunities. The degree of brain-drain has been quite dramatic in many of the Western Balkan countries. Tirana University in Albania lost 40% of its academic staff in the 1990s, 90% of whom were less than 40 years old. There has also been massive brain-drain from Bosnia and Herzegovina, Former Yugoslav Republic of Macedonia, Serbia and Kosovo, though we do not have accurate statistics. These countries have seen the departure of their most expert and highly qualified young people, which is resulting in a deficit of researchers of middle age.

In the early 1990s, all SEE countries experienced a decline in R&D personnel, but the trend has been reversed in some countries in recent years. Thus, since 1997, in Albania and Croatia, numbers of researchers and scientists have been increasing. This is not the case, however, in Former Yugoslav Republic of Macedonia and Serbia, where R&D personnel numbers have been stagnating or declining; for Bosnia and Herzegovina there are no statistics on total R&D personnel (only on university professors; see Uvalić 2006).

Indicators on S&T output show an upward trend for most SEE countries. In Croatia, Former Yugoslav Republic of Macedonia and Serbia, number of patents as the main indicator of technological output, has been increasing in recent years. In mid 2006, Albania, Bosnia and Herzegovina, and Montenegro had no national patent offices, so no statistics are available. In most SEE countries the number of scientific publications has been increasing. However, evaluating scientific research is dogged by various problems, both general and specific. The general problems are linked to the evaluation methods, the non-existence of a single database, and the fact that some fields (e.g. engineering) are difficult to evaluate. The specific problems in SEE derive



3. Science and Economic Development in SEE

from the fact that these countries for many years have been internationally isolated, which implies the non-inclusion of national journals in international databases, limited international exchange and limited participation in international conferences. It should be stressed that all SEE countries have taken steps to improve their systems of evaluation of scientific output, for instance by introducing peer review.

3.4. Why invest in science? Some further arguments

This overview of S&T systems in the Western Balkan countries illustrates the poor conditions that presently exist there. Without additional investment in R&D, the situation cannot improve. Increasing investments in R&D and information technology (IT), implementation of measures to facilitate innovation and the development of S&T, are all important because these factors can make a crucial contribution to long-term economic growth. The importance of innovation as the driver of economic growth has been suggested by recent economic theory and confirmed by growing empirical evidence from many countries worldwide. These objectives need to be fully acknowledged by all SEE countries.

Economic theory, from Joseph Schumpeter onwards, has stressed innovation as the driver of economic growth. Modern growth theory, notably the works of Romer, put emphasis on technological progress as a factor of endogenous growth. Many other recent contributions to economic theory stress innovation and competition in R&D as the driving force of growth, providing strong arguments for why it is important to invest in science (for an overview, see Trumbić 2006). At the same time, there is growing empirical evidence on the importance of innovation for economic growth - Brazil, China and India being the prime examples. The more difficult question is what actually drives innovation - GDP levels, trade openness, human capital, government spending, or protection of IPR? Some answers to this question can be found in an empirical study by Trumbić (2006): the most significant innovation variables for the OECD (Organisation for Economic Cooperation and Development) countries are R&D spending, and education, while for the non-OECD countries they are GDP per capita levels and investment in R&D.

There are some additional reasons for investing in science in SEE, associated with the present EU integration process. In the EU, R&D is perceived as a key resource for competitiveness and long-term growth. The transition to a knowledge-based economy, set out at the Lisbon and Barcelona European Councils, envisages an increase in R&D spending to 3% of GDP by 2010, with industry-financed R&D comprising two-thirds of the total. The European research and higher education areas need to be strengthened, and priority given to the development of innovation and IT. These EU objectives are especially relevant for the Western Balkan countries since they all aspire to join the EU, although currently only Croatia is negotiating entry. And despite the great uncertainty about future EU enlargement, it should be stressed that these objectives are important irrespective of whether and when the Western Balkan countries will effectively be able to join the EU, because of the importance of the link between investment in science and economic development.



3.5. Some policy implications

Much progress has been achieved in the S&T sector in the Western Balkan countries in recent years, but clearly there is a lot more that could be done. More appropriate policies are needed to prevent an increase in the S&T gap between the SEE and the more developed countries, at both national and international levels.

National policies need to be designed to raise public awareness about the knowledge-based economy and the key role of innovation and technological progress for economic growth. Within their national strategies of economic development, the governments of the Western Balkan countries must recognize the important role of science for economic growth, and consequently should consider more appropriate treatment of, and increased expenditure on R&D. Western Balkan countries' governments should adopt measures that would facilitate links between industry and universities and encourage the creation of appropriate networks. Without concrete government measures in these areas, substantial progress cannot be expected in the S&T sectors of SEE countries.

Governments must find the right balance between restrictive macroeconomic policies and those with long-term effects, which could raise economic competitiveness in the long run, and encourage more investment in human capital, education, life-long training, and re-qualification. In order to attract more FDI, which remains essential for the Western Balkan countries in forthcoming years, progress needs to be made on improving the business environment and decreasing the risks. Improvements in recording statistics also remain a top priority, including data collection on some key R&D indicators.

In terms of international policies, the constant renewal since 2000 of links between the Western Balkan countries and the international community at large, and donor support from international, regional, and national sources, have clearly produced good results overall, and especially in the S&T sector. These include participation of the Western Balkan countries in the EU 5th, 6th and 7th Framework Programmes, COST, EUREKA, IST (Information Society Technologies) and TEMPUS, and their gradual integration into the European Research Area (ERA).

Nevertheless, much more could be done, particularly since donor assistance to the Western Balkan countries remains very important in the medium run. For example, all the Western Balkan countries should be eligible to participate in the EU programmes currently reserved for candidate countries (cf. the European Investment Bank's Innovation 2000 Initiative). The resources for funding longer-term research in the Western Balkan countries, or researchers' mobility continue to be very limited. Donor aid is often short-term, interest in investing in certain key areas, such as S&T infrastructure and modernization of laboratories, is small. There is an urgent need to better match financial assistance from donors, with the national priorities of the Western Balkan countries.

The achievements regarding the setting up and development of regional networks in R&D within the SEE region have been modest. In our view, there is an urgent need to develop a longer-term strategy on S&T in SEE in a regional context. Each country in the SEE must address the



3. Science and Economic Development in SEE

question of innovation versus imitation, within its own S&T national strategy, in order to identify whether there is potential for innovation and specialization in specific sectors, or whether it is desirable to import technology from abroad (perhaps via FDI). International support in this regard is important, as learning from the experience of western countries could prove useful.

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4. Innovation Policy and Governance Capability: Experiences of New EU Member States and Lessons for SEE Countries

Maja Bučar and Metka Stare

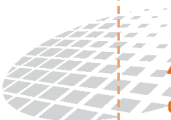
4.1. Introduction

Development of a national innovation system and, within this a pro-active innovation policy, is receiving increased attention recently at national and EU levels. A well co-ordinated and structured EU innovation policy can contribute to better performance of EU actors and increase their competitiveness in a globalized world. It is also one of the prerequisites for the implementation of the Lisbon Strategy goals, to which both the European Commission (EC) as well as EU member countries attach significance.

This paper examines innovation policy and governance capability in the new Member States to draw some lessons for the South Eastern European (SEE) countries. For the new Member States⁷ innovation policy has not been an area of special attention during the period of transition or accession to the EU, but the process of accession has had a positive impact on raising awareness about the importance of innovation. Innovation policies have been designed, and measures and instruments to support research and development (R&D) and innovation in the business sector introduced by states, and the monitoring of innovation indicators and evaluation of the impact of policies are being developed gradually. But assessments of the impact that innovation policies have had in new Member States suggest that it is not only the existence of innovation policy documents, or the number of innovation support measures that is important, but also the efficiency of the implementation process, and successful implementation is determined by governance capability.

In this paper we try to evaluate the governance capabilities of new Member States in the area of innovation policy and identify key experiences that may be relevant for potential new members. First, we define the concept of governance in relation to innovation policy, where the horizontal elements of innovation and the need for coordination and coherence of different policies are of particular importance. Through analysis of the data obtained from the European Innovation Scoreboard (EIS) and the various Innovation TrendChart Country Reports for the new Member States from Central and Eastern Europe (CEE), we try to assess innovation capacity and innovation governance. Analysis of the shaping of the processes and patterns of inno-

⁷ In this paper the term 'new Member States' refers to 10 CEE countries: Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. Although these countries differ in terms of levels of economic development, history, culture and location they have characteristics in common relating to their past institutional set up, R&D policy, business environment, etc.



4. Innovation Policy and Governance Capability: Experiences of New EU Member States and Lessons for SEE Countries

vation policy in new Member States may have significant policy implications for the governance of innovation policy, and carry useful lessons for the SEE countries.

4.2. Governance capability

Innovation governance includes a broad set of mechanisms, instruments and institutions in the field of R&D, education and entrepreneurship. It focuses on the interplay between the various actors, which together determine the priorities, strategies, activities and outcomes of innovation (Boekholt 2004). Successful governance, among other things, requires coordination and interaction across different organizations and affects their innovation capabilities. Horizontal and vertical coherence of innovation policy are important. A horizontal innovation policy, in practice, means that all the measures introduced in other policy areas (e.g. fiscal and education policies) are checked for their impact on innovation (EU 2004). Vertical coherence relates to the coordination of policies among different levels of actors (national, regional) in the field of innovation. The concept of good governance in accordance with the EC White Paper on Governance (EC 2001) is that it assumes openness, participation, accountability, effectiveness and policy coherence among the different participating actors (stakeholders). This implies that governance capability in the area of innovation policy is crucial for success in the further design and implementation of publicly funded measures and their impact on the economy.

Adequate governance capability is essential for the successful adoption and implementation of EU influenced innovation instruments in the new Member States. The effectiveness of this influence on innovation capabilities and the behaviour of enterprises depend on governance of these policies (EC 2003). It is especially important in terms of the integration of new Member States into the EU and their contribution to the achievement of the Lisbon strategy objectives.

4.3. Innovation performance in the new Member States

During the process of accession to the EU, the new Member States, through the use of pre-accession aid and direct participation in Community programmes, have transferred several elements and instruments of EU designed innovation policy. Thus, a number of mechanisms and instruments applied in the EU15 to foster innovation have been adopted by the new Member States and introduced into an innovation environment very different from that reigning in the EU15 in terms of history, institutional set up, priority setting and interactions between actors (Bučar and Stare 2003). Moreover, the governance mechanisms required for the implementation of innovation policies were either not in place in these countries or were only partially developed. No analyses of how new Member States governed this transfer and how it affected their indigenous innovation policy developments exist.

In order to examine innovation policy governance we conducted two types of analysis (Stare and Bučar 2006): quantitative analysis, based on EIS results, and qualitative analysis, based

4. Innovation Policy and Governance Capability: Experiences of New EU Member States and Lessons for SEE Countries

on European Innovation TrendChart Annual Country reports. The EIS was developed to provide indicators for tracking progress towards the EU's strategic goal of becoming the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth, more and better jobs and greater social cohesion (Lisbon agenda). The EIS was introduced in 2000 and provides a set of indicators that reflect the innovative capacity of individual countries, enabling comparisons with other countries.⁸ In the 2003, 2004 and 2005 reports, coverage of indicators and data availability were successively improved, enabling different dimensions of innovative capacity in Member States to be captured in more detail.

The overall innovative capacity of individual countries is usually approximated by a summary index composed of data from various innovation indicators that can be aggregated in line with certain criteria, allowing comparative empirical analysis.⁹ New Member States¹⁰ were first included in the EIS in 2002, based on rather incomplete and not fully comparable data.¹¹ The improved database for new Member States provided by EIS (2003) enables the calculation of a Summary Innovation Index (SII) that shows an overall positive pattern of catching up in candidate countries. However, this is largely due to the fact that these countries were starting from very low values for several indicators. Consequently, EIS (2003) questioned the near future sustainability of the positive trends indicated for the candidate countries.

This prediction was confirmed in recent data (EIS 2005) where the comparison of innovative capacity in the new Member States (measured by the SII for the period 2003-2005) shows that seven out of ten new Member States have shown improvements. While in 2003 only Estonia was ranked higher than the three lowest ranked EU15 countries (Greece, Spain and Portugal) in terms of innovative capacity, in 2005 both Slovenia and Hungary showed better performance. These two countries are the only new Member States that are expected to achieve the same innovative capacity as the EU25 by 2015; for the rest the catching-up process will take much longer (EIS 2005: 12).

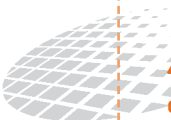
Even though the SII provides an overall picture of the innovative capacity of individual new Member States compared to the EU25 average, it is useful also to examine the results for individual indicators since it can be assumed that new Member States differ not only in terms of SII, but even more so for indicators that reflect different dimensions of innovative capacity. The identification of these elements is relevant both to achieving a deeper insight into the various factors that affect innovative capacity and also for shaping appropriate policies for improve-

⁸ A preliminary EIS was published in September 2000.

⁹ EIS 2005 identifies 5 innovation categories (innovation drivers, knowledge creation, innovation and entrepreneurship, application, and intellectual property) grouped into two major themes (innovation inputs and innovation outputs) (EIS 2005: 7). Radosevic (2004: 646) uses the term national innovative capacity to denote a system that incorporates four groups of indicators (R&D supply, absorptive capacity, diffusion, and demand). Stare and Bučar (2007) construct a composite innovation index for services and manufacturing based on a set of data for 7 indicators to differentiate between sectoral innovative capacities.

¹⁰ At that time there were 13 candidate countries.

¹¹ Individual country data for some indicators used different methodologies, which resulted not only in limited comparability between countries, but also in inconsistencies in the time series for those countries (e.g. EIS 2002 reported that the share of population with tertiary education in Lithuania was 45% (EU15 average 21%), while EIS 2004 recorded 23% of the population in Lithuania with tertiary education).



4. Innovation Policy and Governance Capability: Experiences of New EU Member States and Lessons for SEE Countries

ment. The comprehensive database built for EIS 2005¹² is a good starting point, and reveals the major lags in innovative capacity in new Member States compared to the EU average, and identifies key deficiencies that hamper their more rapid improvement in this area.

The innovation indicators that comprise the SII reveal that the majority of new Member States decreased the gap with the EU25 average in the 2003-2005 period, although results vary across countries and across individual indicators. Educational attainment stands out as a significant strength, while intellectual property is undoubtedly the least developed area. From the perspective of assessing the process of catching up in innovative capacity by new Member States, it is necessary to look not only at the most recent data, but also at developments over a longer time period. Due to deficiencies in the data our comparative analysis refers only to those innovation indicators for which data for all new Member States and the EU25 average were available for at least four years in the period 1998-2004. This produced a reduced set of nine innovation indicators.

Looking at trends in 1998-2004 we find that the majority of new Member States have decreased their lag with the EU25 average in six innovation indicators, while on one indicator (share of information and communication technology (ICT) expenditure in gross domestic product - GDP) nine new Member States were already performing better than the EU25 at the beginning of the period (six by the end of the period) (Stare and Bučar 2006).

Without more data these results can only confirm the findings of EIS 2005 on the catching-up patterns of new Member States in terms of innovative performance. From the point of view of assessing the speed of this catch-up process this is not sufficient. In the next phase, we complemented our analysis in order to check the efficiency of the catching-up process by taking account only of those improvements in innovation indicators by the new Member States relative to the EU25, that accounted for at least 10%¹³ in the observed four year period. Applying this benchmark means that the catching-up process for the majority of new Member States is recorded for one innovation indicator (share of high-technology products in total exports); for business R&D expenditure in percentage of GDP, and new European Patent Office patents per million population, half of the new Member States showed significant improvements. In the absence of longer data series for all relevant indicators of innovative capacity, our analysis shows that despite the progress achieved by the new Member States with regard to innovative capacity no major break-through has been achieved (Stare and Bučar 2006).

4.4. Appraisal of innovation governance systems

Information contained in the European Innovation TrendChart annual country reports for the new Member States provides the basis for the appraisal of innovation governance capability.

¹² This database consists of information on 26 innovation indicators for the EU25, Bulgaria, Romania, Turkey, Japan and the United States. Time series for individual indicators differ not only because of data availability, but also in terms of the type of data (e.g. data related to indicators from CIS are available only for 2 years).

¹³ The benchmark value of 10% was chosen arbitrarily and may not be the most appropriate. However, it implies that, for individual indicators, the average rate of catching-up in a four year period was approximately 2.4% annually, which is quite reasonable.

4. Innovation Policy and Governance Capability: Experiences of New EU Member States and Lessons for SEE Countries

These individual reports reflect significant similarities in the evolution of countries in the area of innovation policies. Partly as a consequence of accession, the new Member States have paid increasingly more attention to their innovation governance systems since most have new institutional and legal frameworks in place, accompanied by policies and innovation strategies. The new Member countries have introduced numerous instruments and measures to support innovation and R&D, mostly based on best practice in the more developed old EU member countries. Increased awareness seems to be building about the importance of innovation policies.

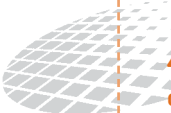
However, our analysis also revealed that awareness among politicians is still low, leading to insufficient allocation of resources for support measures, lack of policy coordination within government, and poor understanding of the importance of horizontality among policies. Evaluation is underdeveloped, sporadic and has little impact on policies. One of the most significant characteristics of the innovation and R&D systems in new Member States is poor cooperation between the public research and business sectors, which cannot be resolved by the newly formed bridging institutions, partly because of their novelty and lack of experience, and partly because of conflicting policies in other areas. In many new Member States the level of investment in business sector R&D and innovation is low and only gradually increasing, since the measures so far put in place have not yet resulted in the positive response that was expected among the business community. Again, frequent changes in these measures and frequent changes in organizational set-ups and the level of resources allocated to innovation policy, have not contributed to the formation of an innovation-friendly environment.

The poorly developed governance capability can be detected in the introduction of overlapping policy schemes, insufficient transparency of measures or of badly aligned mechanisms transferred from other countries. In several cases, country reports point to significant discrepancies between what is set out in policy papers and actual practice: while innovation is highly praised in various strategy papers, this is seldom reflected in public budget allocations. This results in a so-called 'implementation deficit', where well-designed innovation support measures never become operational.

4.5. Conclusion

We can see that the building of innovation capacity and governance capability requires long-term effort, which needs to move beyond institutional build up, which is merely the first step and must be followed up by the creation of an efficient policy mix focused on the major gaps in innovative capacity. The coherence of innovation policy with other relevant policies is a key imperative for positive results, and must be accompanied by a high level of coordination in terms of policies and different ministries and public agencies. The frequent changes in institutional set-up, in policy orientation and in the responsibilities of different public agents, experienced in new Member States, have undermined their governance capabilities in innovation policy; these problems and risks should be avoided by potential new Member States.

Closer analysis of governance capability reveals that coherence and coordination are much more demanding characteristics of this capacity than perhaps initially believed. This is also



4. Innovation Policy and Governance Capability: Experiences of New EU Member States and Lessons for SEE Countries

true of other areas. Attainment of governance capacity is a long-term process, and its complexities should not be underestimated. Benchmarking exercises and continuous monitoring and evaluation can contribute to faster development of governance capacity; thus, participation of new Member States in various European programmes and projects (such as EIS and TrendChart) contribute to greater awareness and improved evaluation practices. We found that the Europeanization of innovation policies has had several positive implications for the innovation policies in new Member States, particularly in the area of awareness raising and transfer of innovation policy concepts and practices, and various mechanisms used by the more advanced countries to support innovation activities. The risks and problems involved in Europeanization and its reliance on the 'import' of concepts from more developed countries with no heed for individual capabilities, must be avoided. Nevertheless, the capability to adjust measures, instruments and best practice from other environments, is one of the essential elements of good governance.

Overall, the development of governance capability in innovation policy would contribute to the catching up process of the new Member States. The lessons learned and the policy learning processes experienced by new Member States could also be valuable for the SEE countries in formulating their innovation processes, where governance issues need to be addressed more directly and their complexity acknowledged.

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5. Creative Reconstruction: Towards a Triple Helix Innovation Strategy in SEE Countries

Henry Etzkowitz and Marina Ranga

5.1. Introduction

This paper examines the premises for a triple helix (university-industry-government) innovation strategy in the South Eastern European (SEE) countries. Although at this stage such an innovation model seems extremely challenging, given the area's weak academic research capabilities, low company research and development (R&D) potential and weak demand for domestic R&D, and the early stages of innovation policies being promoted by its respective governments, our analysis shows that this is not a 'mission impossible': the basic elements of a triple helix regime exist and are already active in these countries, though to varying extents, and have been strengthened over recent years.

The realignment and reconfiguration of resources and institutions from a triple helix perspective can generate a creative reconstruction of organizations and stimulate the development of innovative regions. The specific objective is to encourage universities to promote regional development by bringing together relevant stakeholders thereby acting as a regional innovation organizer, especially in regions already specialized in, or intending to develop strengths in advanced services, creative industries and innovative manufacturing sectors. Academic development thus becomes a key regional, human and social capital development strategy, paving the way for the emergence of clusters of high technology firms from competitive research fields, and the infusion of advanced technology into older firms.

5.2. The triple helix thesis

During the transition period in the early 1990s, many countries were demonstrating an emerging need for a conceptual framework legitimating the role of government but not in an all controlling role, and the enhancement of the university's role to incorporate elements from the research institute sector, the source of a nascent start-up phenomenon. The triple helix thesis is that the potential for future industrial development in a knowledge-based society increasingly lies in a more prominent role for universities and a hybridization of elements from university, industry and government to generate organizational innovation.

The triple helix model comprises three basic elements: (i) a more prominent role of universities in innovation - on a par with the roles of industry and government; (ii) a move towards collaborative relationships among the three major institutional spheres, in which innovation policy is increasingly an outcome of interaction rather than government prescription; (iii) in addition to

5. Creative Reconstruction: Towards a Triple Helix Innovation Strategy in SEE Countries

fulfilling its own particular traditional functions, each institutional sphere also 'takes on the roles of the others', operating on the y axis of their new role, as well as on the axis of their traditional function. Institutions taking non-traditional roles are viewed as a major potential source of innovation. University, industry and government enter into a reciprocal relationship, in which each attempts to enhance the performance of the others.

5.2.1. Triple helix transitions

In the transition from central planning to a market economy, the role of government in innovation policy was often temporarily lost. In laissez-faire oriented societies, governments struggle to find a balance between playing a significant role and stifling initiative. It is increasingly being recognized that in market economies government has an important, if sometimes hidden part in innovation, and that government programmes have an important role to play, not only from the national (top-down) level, but also from the local (bottom-up) level, in the move from a 'hands-off' linear model of innovation to an 'assisted linear' mode (Etzkowitz, 2006).

These types of initiatives mostly take place at the regional level, where development has been hindered by gaps in industrial clusters, problems in technology transfer and lack of governmental capacity. Initiatives to address these issues may involve syntheses among organizational formats in order to develop a coherent strategy for regional innovation. Thus, in recent years, the university has not only evolved towards involvement in ever more complex research activities alongside 'traditional' education activities, but has also extended its capabilities towards technology transfer, incubation programmes and firm formation, all of which have enhanced its position as a regional innovation organizer.

Some of the most important steps in this process include: (i) consolidating the entrepreneurial potential of universities by, on the one hand, reinforcing their research capabilities and, on the other hand, strengthening their commercialization skills and infrastructure with technology transfer offices, incubator facilities, entrepreneurship education, business plan competitions and other innovation capabilities; (ii) fostering the process of innovative firm formation through science parks, clusters, etc. and the ability of local firms to perform and absorb R&D; and (iii) working towards trust building among technical and business partners as an underlying condition for the creation of new organizations and the good functioning of joint projects.

This university-driven innovation model is based upon the universities' education and technological knowledge bases (the latter have been increasing in recent years), which ensure their special generative, reproductive and renewal capabilities. Generative capabilities include the production of new knowledge and creation of new firms and industries based on that knowledge; reproduction includes education and training, and renewal encompasses re-training to circulate people and resources from older, perhaps declining areas, into newly emerging fields.

Two elements of the university are crucial in this development: the research potential (which may be under-utilized, the so-called European paradox), and the potential of students to act as an ever-renewing source of new ideas. Also, students may be trained and encouraged to be entrepreneurs and be inspired to take up new roles as firm founders. In addition, universities, hitherto seen primarily as sources of human resources and knowledge, are now looked to for



5. Creative Reconstruction: Towards a Triple Helix Innovation Strategy in SEE Countries

technology. The research university is increasingly seen as the basis for high-tech spin-offs, even as the teaching university allows access to knowledge at the research frontier for infusion into firms and other organizations through knowledge transfer activities and human capital flows of graduates.

Many universities have developed the internal organizational capabilities needed to formally transfer technologies rather than relying solely on informal ties. Universities are also extending their teaching capabilities from educating individuals to shaping organizations in entrepreneurial education and incubation programmes. Rather than being only a source of new ideas for existing firms, universities are combining their research and teaching capabilities in new ways in order to become a source of new firm formation, especially in advanced areas of science and technology (Etzkowitz, 2002).

Universities are an important element in regions, not only in terms of their technological knowledge base, but also in terms of their special generative, reproductive and renewal capabilities described above. The upgrading of teaching universities to research and entrepreneurial organizations and of intermediary transfer institutions into universities thus becomes an important regional development strategy.

The entrepreneurial university with its technology transfer offices and other innovation capabilities, combines academic features with an active role of the university as a regional innovation organizer, bringing together relevant actors to foster innovation and development. These various and conjoint academic capabilities make it imperative for regions specialized in advanced services, creative industries and/or innovative manufacturing sectors, also to develop an entrepreneurial university to ensure their future.

5.2.2. Regional innovation

The premise of the triple helix regional innovation model is that the conditions for high-tech economic growth are not spontaneous creations; rather they can be identified and put in place through explicit measures. As regions formulate knowledge-based innovation strategies, the constellations of actors and their relative importance in the local political economy are transformed. With knowledge assuming increased significance as a factor of production in both high-technology and older manufacturing industries, the importance of traditional elements of land, labour and capital is reduced, with various political consequences, including the displacement of labour unions in regional growth coalitions by knowledge producing institutions such as universities.

Regional development can be conceptualized as occurring in a series of three non-linear knowledge, consensus and innovation spaces that overlap and cross-fertilize one another (see Table 5.1).

Knowledge spaces consist of a concentration of R&D activities that provide the building blocks for technological development. The availability of such a 'critical mass' of research in a local area is a necessary condition for science-based regional development, but certainly not a sufficient one. Some universities may become very successful at technology transfer, while oth-

5. Creative Reconstruction: Towards a Triple Helix Innovation Strategy in SEE Countries

Table 5.1: Knowledge-based Regional Economic Development

Stage of development	Characteristics
Creation of a knowledge space	Focus on regional innovation environments where different actors work to improve local conditions for innovation by concentrating related R&D activities and other relevant operations.
Creation of a consensus space	Ideas and strategies are generated in a triple helix of multiple reciprocal relationships among institutional sectors (academic, public, private).
Creation of an innovation space	Attempts to realize the goals articulated in the previous phase; establish and/or attract public and private venture capital (combination of capital, technical knowledge and business knowledge) are central.

ers are only just getting involved. Consensus spaces refer to the process of persuading relevant actors to work together to generate support for new ideas to promote economic and social development. Innovation spaces are a new organizational mechanism that attempts to realize the goals articulated in the consensus space. The process of filling the gaps in a regional innovation environment may start with the knowledge space, moving to the consensus space and then to the innovation space in a linear fashion, or may start from one of the other spaces and proceed non-linearly. A problem in the creation of a viable consensus space is the need to attract representatives of the different spheres with sufficient credibility and decision making power to precipitate action, necessary to translate a consensus space into an innovation space. Without these attributes centrifugal forces may outweigh centripetal ones, especially in regions with more than one university.

Innovation is taking place bilaterally among universities and firms, and trilaterally, supported directly and indirectly by government in a bid both to meet its own needs and to foster economic and social development. Thus, innovation is being transformed from a relatively simple set of linear and reverse linear processes within industry, extending from research to the market and vice versa, to a non-linear process in the transition to a knowledge-based society. Beyond the development of new products, technologies and services, innovation is the creation of new configurations among institutional spheres. University-industry-government interactions are increasingly the basis of economic and social development strategies in both advanced industrial and developing societies.

A triple helix regime typically begins when an existing innovation regime, whether a single helix based on industry, or a double helix involving government and industry, suffers a crisis that cannot be resolved within the existing framework. Introducing new actors not traditionally directly involved in innovation, such as universities, restructuring others to perform new roles, and creating new relationships appears to be the path to the future. The realignment and reconfiguration of various entities from university, industry and government are recombined to generate entities that exemplify creative reconstruction through the triple helix: university science parks and technology transfer centres, clusters and venture capital firms.

5.2.3. Making a triple helix region

The development of innovative regions will not arise as a result of government or market actions alone, but as a result of the interaction between the triple helix institutional spheres



5. Creative Reconstruction: Towards a Triple Helix Innovation Strategy in SEE Countries

and the mobility of resources within and among institutional spheres. From a triple helix perspective, strengthening regional academic capacity is the major area of intervention. Government can play a significant role in this respect by funding university research facilities and the development of science parks. Expansion of academic research to provide an enhanced base for development is a strategy recommended for regions lacking strong research universities, which is the situation in most SEE countries. One of the necessary and sufficient conditions for creating a triple helix region, a knowledge-based conurbation that has the capability to renew itself across technological paradigms, is the presence of an entrepreneurial university.

A region with an entrepreneurial university at its core has the capability to transcend particular technological paradigms and renew itself through new technologies and firms generated from its academic base. The criteria for success are not only the ability to create a cluster of high-technology firms, but also the ability over the longer term to generate additional clusters as earlier successes are superseded. Relatively few regions have developed the institutional capacity to accomplish this goal. Nevertheless, it is the objective of knowledge-based regional economic development everywhere in the world. A high rate of national R&D spend is a necessary condition for long-term technological and economic success.

An entrepreneurial academic development strategy provides the sufficient condition to realize the potential that is created by that base. Adapting the former policy without following through with the latter strategy is the source of the so-called European Paradox. This condition can be remedied through an entrepreneurial academic development policy, whose basic elements are well known even if they have yet to be fully realized even by the most advanced entrepreneurial universities. Only the creation of a fully-fledged set of entrepreneurial universities across Europe, combining formal and informal mechanisms, will accomplish the objectives set by the Lisbon Agenda. Anything less will perpetuate the paradox of high scientific output coupled with low economic return.

The policy implication is to focus government industrial development and education resources, at various levels, on the upgrading of teaching to produce research and entrepreneurial universities, the transformation of intermediary transfer institutions and research institutes into academic institutions, and the creation of successful 'knowledge cities', especially in urban areas where the presence of an entrepreneurial university provides a competitive advantage.

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6. Technology and Industrial Development

Jaime Moll de Alba Cabot

6.1. Introduction

The United Nations Industrial Development Organization¹⁴ (UNIDO) is a UN specialized agency whose work focuses on promoting industrial development and international industrial co-operation. This paper focuses on technology and industrial development, both of which are at the core of UNIDO's work and activities. More particularly, it seeks to summarize selected results of UNIDO's research in the field of productivity growth and the role played by technology. It also presents selected figures from UNIDO's Industrial Development Scoreboard on the competitive industrial performance of countries. UNIDO's activities in the field of technology including a few selected examples in SEE are discussed.

6.2. Research on productivity growth

UNIDO's largest on-going research project (UNIDO 2005) aims at assessing and ranking the main constraints to productivity growth in developing countries including estimating the distance of 112 individual countries from the world technology frontier. It is hoped that in-depth studies of the constraints identified will suggest possible approaches to closing the gaps as quickly as possible. The results of this research point to four areas – all related to technology – of prime interest for international organizations for supporting productivity growth:

- infrastructure (hard and soft);
- human capital (or social capabilities);
- foreign direct investment (FDI);
- international trade.

The research suggests that the gap in output per capita between the advanced and the developing countries is largely due to differences in levels of technology (e.g. total factor productivity - TFP). UNIDO's research indicates that the main source of TFP growth in developing countries is increased technical efficiency rather than technical change. It will include assessment of the importance of other issues such as health, energy and environment, institutions, geography, etc. The World Productivity Database currently under development will provide access to productivity datasets for 112 countries for the period 1960-2000. Although this research has not focused so far on SEE countries, they and others will be incorporated quite soon.

¹⁴ For further information on UNIDO, visit <http://www.unido.org> [accessed 19.6.07].

6. Technology and Industrial Development

6.3. Industrial Development Scoreboard

UNIDO developed its Industrial Development Scoreboard to assist national policy makers and stakeholders to assess, monitor and compare their competitive industrial performance with that of their neighbours and competitors. Based on quantitative information, the Scoreboard provides a periodic assessment of the relative industrial performance of countries and regions. Before the analyses based on the Scoreboard can be used for strategy and policy formulation, more detailed, country-specific information needs to be collected and interpreted. At the core of the Industrial Development Scoreboard is the Competitive Industrial Performance (CIP) index. This provides an overall indication of the ability of countries to produce and export manufactured goods competitively.

Singapore and Ireland, two economies that entered into high-technology global value chains and, at the same time, developed a strong human capital base and infrastructure, were the top performers in the Industrial Development Scoreboard (UNIDO 2004). Table 6.1 includes available figures for SEE countries (mainly covered in 2000) and selected neighbouring countries.

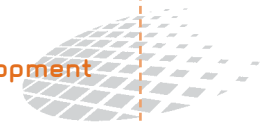
Table 6.1: Competitive Industrial Performance index.

2000		1990		1990	
Country	CIP	Country	CIP	Country	CIP
Singapore	0.833	Singapore	0.772	Switzerland	0.758
Ireland	0.738	Switzerland	0.748	Singapore	0.683
Switzerland	0.717	Germany	0.683	Germany	0.658
Austria	0.512	Austria	0.547	Austria	0.497
Slovenia	0.449	Romania	0.367	Turkey	0.306
Croatia	0.322	Turkey	0.268	Greece	0.276
Turkey	0.309	Greece	0.262	107 countries	
Romania	0.294	108 countries			
Bulgaria	0.278				
FYROM	0.271				
Albania	0.196				
155 countries					

Table 6.2: Selected determinants of industrial performance 1998

BERD pc	1998	FDI pc	1993-97	TTE	1998	Royalties pc	1998
Country	US\$	Country	US\$	Country	share pop	Country	US\$
Switzerland	859.9	Singapore	2536	Ireland	0.91	Ireland	1683.1
Austria	214.4	Switzerland	529.8	Austria	0.78	Singapore	559.2
Singapore	198.4	Ireland	484.2	Switzerland	0.51	Switzerland	151.7
Ireland	152.8	Austria	304.6	Romania	0.49	Austria	100.4
Slovenia	73.3	Slovenia	92.9	Slovenia	0.49	Slovenia	19.5
Romania	2.5	Romania	20.6	Singapore	0.47	Romania	0.9
		Albania	19.7	Albania	0.11		

Note: BERD pc: productive enterprise-financed R&D per capita, FDI pc: Foreign Direct Investment inflows per capita, Royalties pc: Royalties and licence payments abroad per capita, TTE: tertiary technical enrolments as a share of population include pure science, mathematics and computing and engineering.

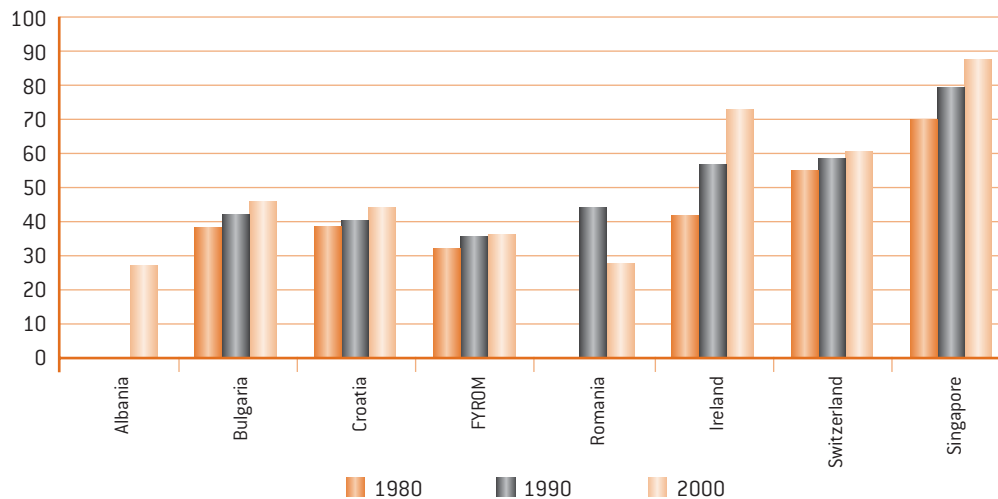


To assess the structural basis for CIP, the Scoreboard analyses such determinants as skills, technology effort, FDI, technology transfer and infrastructure. The figures presented in Table 6.2 refer to 1998 (UNIDO 2003).

It should be noted that the countries that performed the best in 2000 (see Table 6.1) showed strong dynamism in terms of the selected determinants in 1998.¹⁵

We turn now to selected technology-related indicators included in the Industrial Development Scoreboard (UNIDO 2004). Figure 6.1 shows the share of medium- and high-technology activities in manufacturing value added. It includes the SEE countries for which data were available, as well as the top performers in 2000. The figure shows that there are significant differences among countries, with the complexity of the top performers' activities higher than that of the SEE countries.

Figure 6.1: Share of medium and high technology activities in manufacturing value added



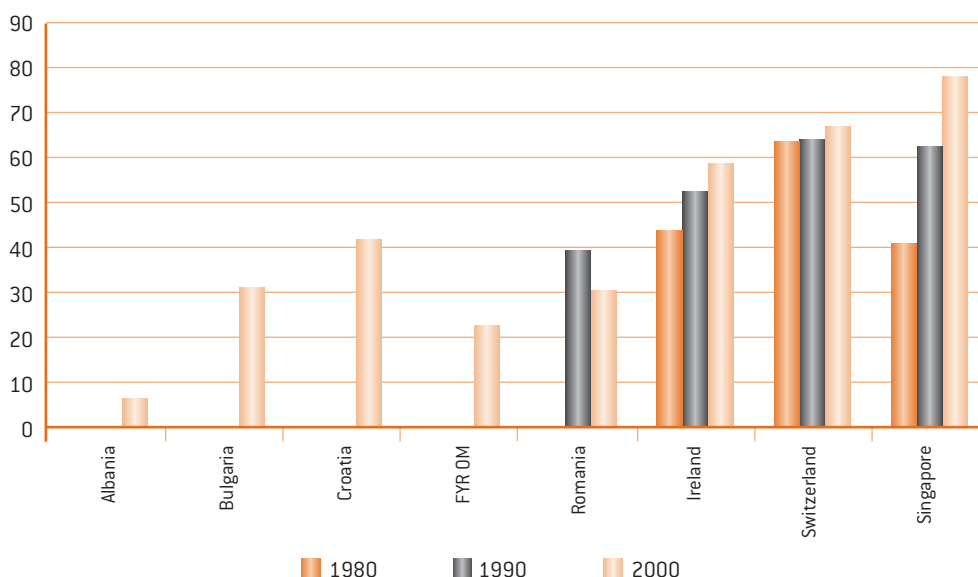
Source: Industrial Development Report 2004

Figure 6.2 shows the share of medium- and high-technology exports in manufactured exports (UNIDO 2004), again for the SEE countries as well as the top performers in 2000. The pattern is similar to that for medium- and high-technology activities in manufacturing value added with differences among countries and the complexity of the exports of the three top performers being even higher. But in order to derive any conclusions about country performances, more detailed analyses will be required.

¹⁵ It is expected that it will take some time for a given determinant to have an impact on industrial performance. Therefore, the presentation combines 2000 performance and 1998 determinants.

6. Technology and Industrial Development

Figure 6.2: Share of medium and high technology goods in manufactured exports



Source: Industrial Development Report 2004

6.4. UNIDO and technology

A tentative list¹⁶ of the key elements required for participation in technological development and management might include:

- government/institutional leadership;
- strong research base;
- ability to attract and retain key people;
- access to capital;
- access to infrastructure;
- entrepreneurial culture;
- protection of intellectual property rights;
- synergies and mutual reinforcement;
- regional cooperation (of particular relevance to SEE countries).

UNIDO's activities include a service module that focuses exclusively on investment and technology promotion,¹⁷ which supports technological upgrading, diffusion and progress in the following areas:

¹⁶ The list builds upon the work undertaken in the framework of an internal UNIDO report 'Success factors for biotechnology – An assessment of the status of China's innovation' (2002).

¹⁷ For a detailed description of UNIDO's Investment and Technology Promotion service module, go to <http://www.unido.org/doc/18264> [accessed 19.6.07].



- support services for strengthening national technology management systems where UNIDO provides assistance in creating and strengthening the various technology-related institutions, as well as in fostering their linkages;
- technology foresight for development where assistance is provided to undertake technology foresight activities in industrial sectors, regions and countries;
- capacity-building in emerging technologies.

Technology is also a key component of other UNIDO service modules, such as those focusing on agro-industries, environmental management, etc. UNIDO has undertaken a range of technology-related activities in SEE countries including:

- regional initiatives on technology foresight¹⁸ that focus exclusively on Central and Eastern Europe (CEE) and the Newly Independent States;
- in the framework of the UN Development Programme Global Environmental Facility Pollution Reduction Programme in the Danube Basin, work with selected manufacturing enterprises contributing to trans-boundary environmental problems, to support transfer of environmentally sound technology¹⁹ and enhancement of cleaner production capacities among environmental management institutions;
- implementation of such international environmental conventions as the Montreal Protocol,²⁰ resulting, e.g., in the introduction of an alternative to Macedonian farmers using methyl bromide, an important ozone-depleting substance, as a fumigant in tobacco cultivation.

6.5. Conclusions

UNIDO's research on productivity growth suggests that the gap in output per capita between the advanced and the developing countries is largely due to differences in technology levels (TFP). The research further indicates that the main source of growth in TFP in developing countries is increased technical efficiency, rather than technical change. Therefore, adoption and adaptation of existing technologies available in the advanced countries would seem more likely to promote per capita growth in developing countries than carrying out radically new innovation.

Technology and industrial development play a leading role in boosting economic growth and development within a knowledge-based economy. Supporting the learning process for technological upgrading, diffusion and progress is, therefore, at the core of UNIDO's efforts and activities.

¹⁸ For further information on UNIDO's Technology Foresight initiative, visit <http://www.unido.org/doc/5216> [accessed 19.6.07].

¹⁹ For detailed information on the project, go to <http://www.unido.org/doc/26190> [accessed 19.6.07].

²⁰ For further information on UNIDO's services in the framework of the Montreal Protocol, visit <http://www.unido.org/doc/18265> [accessed 19.6.07].



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7. Creating New Tools to Advance Research and Innovation in Canada

Howard Alper

How can we advance research and development (R&D) to benefit the economy of a nation? While Canada was a rather minor player in research and innovation in 1996, it has become a global pacesetter in terms of support for research in academia, for progress in the commercialization of research, and for enhancing the quality of life of its citizens. This paper describes the tools that have been created in Canada to boost research and innovation capacities and their impact on the overall economy.

In 1995, Canada had significant economic challenges; there was a large budget deficit, and the research Granting Councils faced budget cuts of 18% over a short time frame. In addition, there was a significant brain drain. A concerted effort was made to convey to decision makers the importance of R&D to build capacity. The elements of the R&D system that were emphasized as key were infrastructure (laboratories, e-libraries, high performance computing, etc.) and human resources (faculty, researchers and students).

In 1997, the Canada Foundation for Innovation (CFI) was created; it has provided a major boost to innovation, including the research infrastructure, equipment, facilities. A total of more than \$3.5 billion was allocated by the Government of Canada to R&D infrastructure for the period 1997-2010. This amount is boosted to \$11 billion when provincial and other contributions are taken into account.

The following policy initiatives were implemented since 1997:

- 1.** The Canada Research Chairs Programme was designed, in part, to bring Canadians back from the diaspora. This programme has a total budget of \$2,000 million (\$400 million a year over 5 years). There are two types of Chairs; a Tier 1 or “Senior” Chair (total of \$200,000/annum) and a Tier 2 or Junior Chair (\$100,000/annum). This programme has stemmed the ‘brain drain’ and is helping to create a ‘brain gain’ phenomenon. This programme has become a model that has been successfully emulated elsewhere—e.g. in South Africa where it will make a major impact, providing benefits to the nation.
- 2.** Targeted programmes were supported: Genome Canada (\$800 million to Genomics and Proteomics), Canadian Foundation for Climate and Atmospheric Sciences (\$110 million), and the Sustainable Development Technology Fund (\$550 million).
- 3.** Budgets for the research Granting Councils were increased substantially: Social Sciences and Humanities (2006-2007 budget: \$280 million), Natural Sciences and Engineering (2006-2007 budget: \$885 million), Canadian Institutes of Health Research (2006-2007 budget: \$762 million).



7. Creating New Tools to Advance Research and Innovation in Canada

4. The Canada Graduate Scholarship Programme provides funds for 2,000 doctoral students and 2,000 masters students annually, following a phase-in period of four years, with \$35,000/year for a doctoral student for a total of 3 years and \$17,000/year for a masters student for a period of one year. This money is disbursed via the various granting councils.

5. Support for the Networks of Centres of Excellence (NCE) was increased. The NCE programme brings together researchers from different locations across Canada to pursue innovation on issues of importance to the country, e.g., stroke research, research on aquaculture, automobile technology in the 21st century, and stem cell research. The funding provided to each NCE is \$2.7 million per year for seven years, with the possibility of a renewal for an additional seven years. The total budget is \$95 million/year.

6. Several programmes were established that are dedicated to the commercialization of university research, including Industry Canada's programme (2004 budget was \$10 million/year for five years) to empower universities to create start-up companies, etc., the Granting Councils: Intellectual Property Management (Mobility) Programme (IPMP) and thus contribute to capacity building enabling universities to successfully engage in technology transfer activities (budget of \$7 million/year). Examples of innovations based on university technology transfer include: the BlackBerry (wireless phone/e-mail/internet/etc. which in the 4th quarter of 2005 generated \$561.2 million in revenue, and revenue for the fiscal year 2006 was up 39% compared with the same period in 2005); Visudyne (treatment for age-related macular degeneration) developed by QLT Inc based on research conducted at the University of British Columbia—revenue for year ending 31 December, 2005 was \$484 million, an increase of 8% over year end 2004 results.

7. 'Ideas to Innovation' (I2I) and Proof of Principle (POP) programmes were established to accelerate the pre-competitive development of promising technology and promote its transfer to Canadian companies. It provides crucial assistance to university researchers in the early stages of technology validation and market connection (budget for 2006-2007: \$11.1 million).

There were several science policy developments in Canada recently. First, the creation of the Office of the National Science Advisor to provide scientific advice to the Minister for Industry on several issues including international R & D. Second, assessments by the new Council of Canadian Academies. The Council is entrusted with providing independent and objective assessments of on issues of importance to Canadians. The founding academies are: the Academies of the Arts, Humanities, and Sciences of Canada, the Canadian Academy of Engineering, and the Canadian Academy of Health Sciences.

Science, technology and innovation strategies make important contributions to the development of economies of scale, including the knowledge-based economy. As a result of the imaginative and innovative programmes described above, Canada's effectiveness in the knowledge-based and natural resources sectors has increased appreciably.

With regard to international cooperation in the field of S&T, there is no funding specifically related to participation of Canada in the EU framework programmes. Canada has chosen

7. Creating New Tools to Advance Research and Innovation in Canada



instead to allocate financial resources to encourage co-operation with several countries classified as emerging economies. In February 2005, \$18 million was allocated to collaborations/partnerships with India, China and Brazil. Canada views the emerging economies as strong competitors. Some countries with rapidly rising economies have more advanced science, technology, and innovation policies than a number of countries in the EU and South Eastern Europe. The basis for economic development is different in these countries. In China, economic development was largely due to cheap labour and manufacturing, but the country is now rapidly evolving into a knowledge-based economy. This is being supported by robust government assistance for S&T and the creation of a formidable corporate R&D presence in Shanghai (>1,000 doctoral students will be hired in 2006-2008).

India's economic development is largely based on intellectual capital and a developing knowledge-based society. India is at the forefront in information and communication technology (e.g. connectivity to rural communities), fuel cell automobile technology, etc., with powerhouses in academia (Indian Institutes of Science, Indian Institutes of Technology) and industry (e.g. GE).

Canada's International Development Research Centre (IDRC) supports research and innovation by researchers from developing countries on issues they identify as pivotal to their communities, and also provides technical support. Through its various programmes, IDRC is creating new partnerships, and thus contributing to capacity building in developing countries. Its budget for 2006-2007 is \$130.5 million.

8. Fostering Scientific Cooperation for Dialogue and Peace Building: UNESCO's SESAME and IPSO Initiatives

Walter Erdelen

SESAME (Synchrotron-light for Experimental Science and Applications in the Middle East), an independent, intergovernmental centre set up under the auspices of UNESCO on the CERN model,²¹ is a perfect example of UNESCO's action to build up capacity in science and promote peace through science.

Membership in SESAME, which is located in Jordan, includes Bahrain, Cyprus, Egypt, Israel, Jordan, Pakistan, the Palestinian Authority and Turkey. Countries with observer status include France, Germany, Greece, Italy, Kuwait, Portugal, the Russian Federation, Sweden, the UK and the USA.

Why do we need a synchrotron light source in the Middle East? The scientific motivation is, of course, the extraordinary power of synchrotron light, which makes it an essential scientific tool. In fact, since the first light source was developed in the late 1940s, more than fifty have come into operation worldwide, a further ten are currently under construction and thirteen are in the planning stage. And the worldwide user community for synchrotron radiation is estimated to be in excess of 20,000. The need for such a light source in the Middle East region was recognized by eminent scientists, such as the Nobel laureate Professor Abdus Salam, more than 20 years ago.

SESAME will fill this void and once fully operational will become a world-class laboratory providing facilities for basic research and many applications, thereby promoting science and technology in the region. It will be exploited in a wide range of applications, including spectroscopy, microscopy, crystallography and other structural techniques, radiology, industrial fabrication, and many other experimental approaches. It will also provide opportunities for extensive training, which has already begun. During the first five years of the project more than 300 scientists and engineers from the region have participated in SESAME workshops and schools, in the Middle East, and elsewhere, on applications in biology, materials science and other fields, as well as on accelerator technology. Through science, a culture of peace will be promoted in the Middle East.

SESAME will have as its centrepiece a synchrotron radiation source based on a gift from Germany of a 0.8 GeV BESSY I storage ring and injector system, which was taken out of operation in

²¹ CERN = European Organization for Nuclear Research.

8. Fostering Scientific Cooperation for Dialogue and Peace Building: UNESCO's SESAME and IPSO Initiatives

Berlin at the end of November 1999 and was transported to Jordan. This machine is being upgraded to 2.5 GeV, and its design has been based on the scientific needs expressed by users.

Politicians and scientists worldwide have recognized the value and utility of SESAME for fostering peace through science, which makes it a particularly successful tool for North-South cooperation. This is testified to by the fact that the world's scientifically most advanced countries have observer status in SESAME; that Germany donated the 0.8 GeV BESSY I storage ring and injector system to SESAME; that France is donating a complete beamline and other equipment dismantled from LURE,²² that the SLAC²³ in the USA intends to transfer to SESAME beamline equipment; that synchrotron radiation facilities in Europe, the USA and Asia have provided training for 35 scientists and technicians from the Middle East region, for periods of up to two years; that Japan provided US\$130,000 for the first SESAME users' meeting; that in 2006 the IAEA²⁴ provided ten long-term fellowships for scientists from SESAME and is in the process of setting up an inter-regional project for 2007-2010 devoted to SESAME through which US\$150,000 to 200,000 will be provided annually, principally for training; that ICTP²⁵ has provided funding for a number of SESAME activities; and that CERN has signed a tripartite cooperative agreement with SESAME and Jordan. To this long litany of examples can be added the very real interest in SESAME being displayed by the international scientific community as evidenced in the numerous articles (at least fifty between 1999 and 2005) that have been written about the Centre in leading scientific journals and newsletters such as *Science*, *Nature*, *Synchrotron Radiation News*, *Physics Today*, *Fermilab* and *CERN Courier*.

It was to UNESCO that the scientists who formulated the idea of setting up an international synchrotron light source in the Middle East turned for help, based on the Organization's unique mandate for the basic sciences in the United Nations system and its experience in setting up centres of excellence in regions where peace needs to be constructed, for example CERN, which was established in the 1950s in the aftermath of the Second World War in Europe.

UNESCO responded energetically to this plea and became the backbone of SESAME. It initiated the project, provided secretariat and financial services, and helped identify a host country and draft the basic legal texts of the Centre. SESAME was created under the auspices of UNESCO, which is the depository of its Statutes. However, UNESCO's help has extended beyond the very early stages of the project. Because of the sensitive and very specific political situation in the region, until the laboratory is fully functional, UNESCO will continue to be very closely associated with SESAME and to offer assistance as required. Thus, it will continue to actively encourage countries to become members or observers of SESAME and to attract funding for the Centre; it will assist in developing networking with synchrotron radiation laboratories in other countries and facilitate the acquisition of equipment by SESAME; it will associate SESAME with its pro-

²² LURE = Laboratoire pour l'Utilisation du Rayonnement Electromagnétique

²³ SLAC = Stanford Linear Accelerator Center

²⁴ IAEA = International Atomic Energy Agency

²⁵ ICTP = 'Abdus Salam' International Centre for Theoretical Physics



8. Fostering Scientific Cooperation for Dialogue and Peace Building: UNESCO's SESAME and IPSO Initiatives

grammes and promote the use of the Centre for the implementations of UNESCO's physics and allied areas of the basic sciences programme; and it will provide opportunities to spread excellence in the region by organizing training activities using the facilities available at SESAME.

Another example of UNESCO's action in favour of peace building through science and research is the support offered to the creation of the Israeli-Palestinian Science Organization (IPSO). The idea of creating such an organization was born during the Round Table on 'Science for Peace' organized by UNESCO in November 2002 for the celebration of World Science Day for Peace and Development. The participants of that Roundtable—Nobel Laureate Prof. Torsten N. Wiesel; Prof. Sari Nusseibeh, President of Al Quds University; and Prof. Menahem Yaari, Hebrew University of Jerusalem and Former President of the Israel Open University—deliberated the challenge of finding new ways to foster Israeli-Palestinian academic and scientific cooperation. Some of the panellists on the UNESCO Roundtable participated in these discussions, as did Dr Janet Aviad, Senior Vice-President of the Andrea and Charles Bronfman Philanthropies (ACBP), Dan Bitan, Director of Israeli-Palestinian Co-Existence and Cooperation Unit at the ACBP, and Carol Corillon from the US National Academies of Science. Further consultations were held with French Nobel Laureates Prof. François Jacob and Prof. Claude Cohen-Tannoudji, and informally with UNESCO's Mustafa El-Tayeb, who was very supportive of any form of promotion of Israeli-Palestinian cooperation in science.

The main aim of IPSO, which was launched on 15 November 2004 at UNESCO Headquarters, is to promote scientific cooperation for peace in the Middle East by bringing together the skills and expertise of Israeli and Palestinian scientists. The Organization identifies areas of science where cooperation between Israelis and Palestinians is feasible and productive thus creating an environment in which Israeli and Palestinian scholars and scientists can meet and establish scientific cooperation. Led by an International Scientific Council chaired by Nobel Prize laureate Torsten N. Wiesel, the Organization supports joint scholarly and scientific projects through funding and administrative assistance. For example, in 2006, 71 proposals for joint scientific research between Palestinian and Israeli scientists, engineers, health professionals, and scholars were submitted to IPSO's Scientific Council.²⁶

IPSO and SESAME are clear illustrations of UNESCO's mission to contribute to peace through concrete actions, and the positive developments in both organizations reinforce UNESCO's belief that scientist-to-scientist and institution-to-institution interactions between Palestinians and Israelis are possible, and indeed vital to the future success of the region. The case of SESAME, which is designed to provide research services for the Middle East, Mediterranean and neighbouring countries, is already demonstrating how efficient and important this cooperation can be to the region and beyond.

In supporting these and similar initiatives, UNESCO hopes to contribute to increased professional exchanges and partnerships, which can bring shared visions and solutions to bear upon common scientific issues vital for development and peace in the region.

²⁶ Additional information on IPSO can be found at www.ipso-jerusalem.org [accessed 30.07.07].

9. Situation of Scientific Research System in Albania

Eduard Sulstarova

9.1. Introduction

The network of scientific research in Albania originated with the Institute of Sciences created in 1946, which was integrated into the University of Tirana (UT) when it was founded in 1957. In 1972 the Academy of Sciences was created, and absorbed all of the UT centres of scientific research and some government centres. Within the Academy of Sciences (ASA) these centres were split into social and the natural and technical science organizations.

The social sciences group includes almost all the institutes involved in social, historical, archaeology, linguistics, literature, arts, popular culture, etc. and the natural and technical sciences include seismology, hydrometeorology, nuclear physics, informatics, geography, etc. The establishment of the ASA crystallized a system of scientific research in Albania. In addition to the institutes of the ASA there are several research-study institutes that are overseen by government ministries.

At the end of 2005, government launched an initiative to reform scientific research in Albania and created a single system of scientific research, concentrated in universities. The institutes of the Academy of Sciences underwent reform in 2007. Some research institutes were separated from the Ministries and have been integrated into the higher education system, others have been reorganized into centres or agencies having as their mission only counselling services and technology transfer.

9.2. Structure and Legal Framework up to 2006

Main institutional elements of the scientific research system in Albania include:

- ASA with its research institutes/centres (up to September 2007);
- research institutes and centres of ministries (most transformed into service centres);
- Universities.

Legal framework: the scientific research system is administered on the basis of a legal and sub-legal framework that includes:

- the 1994 Law on Science and Technological Development;
- the 1999 Law on Higher Education, reformed in 2007;
- the 2004 Law on the Academy of Sciences of the year 2004, reformed in 2006;
- regulations and instructions of ministries (DCMs);
- ASA and university statutes.



9. Situation of Scientific Research System in Albania

Administration: vertical administration of the scientific research system involves:

- the Council of Ministries;
- the Council of Scientific Policy and Technological Development (CSPTD) replaced in 2007 the High Council of Education and Sciences;
- the ASA, the Ministry of Education and Science, and line Ministries.

9.3. Financing of the R&D

Research and development (R&D) activities are financed by:

1. *Institutional financing*, awarded by government to research institutions, the ASA and research institutions of ministries independent of the Ministry of Education and Sciences;
2. *Programme financing* within the framework of National Research and Development Programme (NRDP) through the Ministry of Education and Sciences (MES) according to European standards;
3. *Programme financing* within the framework of the Bilateral Programmes established with the MES based on European standards;
4. *Other financing* besides the State budget include:
 - international collaboration;
 - collaboration with foreign or domestic organizations within Albania;
 - international programmes (UN, EU, etc.);
5. Financing from other public or private sector activities.

The fund for scientific R&D in Albania is less than 0.18 of GDP, which is the lowest level in Europe.

9.4. Research Institutes

There are seven institutes under the Section of Social and Albanological Sciences: the Institute of History, the Institute of Linguistics and Literatures, the Institute of Popular Culture, the Institute of Archeology, the Institute of Economy, the Centre of Arts Studies and the Centre of Albania Encyclopedia of Inter-disciplinary studies.

There are seven institutes under the Section of Natural and Technical Sciences: the Institute of Nuclear Physics, the Institute of Informatics and Applied Mathematics, the Institute of Hydrometeorology, the Institute of Seismology, the Institute of Biological Research, the Centre for Geographical Studies and the Centre for Hydraulic Research.

These 14 institutions were part of the ASA until April 2007, and most will now be subsumed into universities. There are 24 research-study institutes that will be under the responsibility of various Ministries, as follows:

- the Ministry of Agriculture, Food and Consumer Protection: nine institutes (Institute of Field Crops Research, Fushe-Kruje, the Institute of Food Research, Tirana, the Institute of Veteri-



- nary Research, Tirana, the Institute of Zootechnical Research, Tirana, the Institute of Plant Protection, Durres, the Institute of Corn and Rice, Shkoder, the Institute of Fruit-Growing, Vlore, the Institute of Vegetables and Potatoes, Tirana, the Institute of Soil Study, Tirana);
- the Ministry for the Environment, Forests and Water Administration: three institutes (Institute of Forest and Pastures Research, Tirana, the Institute of Research of Fishing, Durres, the Institute of Environment, Tirana);
 - the Ministry of Economy, Commerce and Energy: six institutes (Albanian Geological Service, Tirana, the Institute of Technology of Extraction and Processing of Minerals, Tirana, the National Scientific Centre of Hydrocarbons, Fier, the Institute of Studies and Designs of Light Industry, Tirana, the Institute of Mechanics and Wood, Tirana, and the Institute of Metallurgy, Elbasan);
 - the Ministry of Public Works, Transport and Telecommunication: three institutes (Institute of Transport, Tirana, the Institute of Studies of Construction, Tirana, the Institute of Studies of Town-Planning, Tirana);
 - the Ministry of Tourism, Culture, Youth and Sports: two institutes (Institute of Culture Monuments, Tirana, and the Centre for Sports Studies, Tirana);
 - the Ministry of Health (MH): one institute (the Institute of Public Health, Tirana).

9.5. Universities

Currently there are 13 public higher education schools in Albania: University of Tirana (UT), Polytechnic University of Tirana (PUT), Agricultural University of Tirana (AUT), Military University, Tirana (MU), Academy of Physical Education and Sports, Tirana (APHES), Academy of Arts, Tirana (AA), Academy of Police, Tirana (AP), University of Shkoder (USH), University of Elbasan (UE), Agricultural University of Korce (AUK), University of Gjirokaster (UGJ), Technological University of Vlore (UV), University of Durres. There are also ten private higher schools as well as some public and private R&D agencies.

Higher education schools function on the basis of the 1999 Law on Higher Education which has been revised in 2007.

9.6. Human Resources

From 1990 human resources in science and technology (S&T) dramatically decreased. Surveys show that during 1990-1999, approximately 40% of the professors and research scientists from the universities and science institutions in the country emigrated. This exodus has continued and according to a 1998 survey even more of Albania's highly educated population want to emigrate. They are mainly young people who intend to remain away for a long time or for ever. It is clear that if the economic and social situation in the country does not improve, the Albanian brain drain will continue.

This continuous brain drain poses a severe threat to the system. It is motivated by the deteriorating economic living conditions, poor infrastructures and lack of funding which constitute serious obstacles to research. In addition, restrictive visa regulations hinder scientific exchange

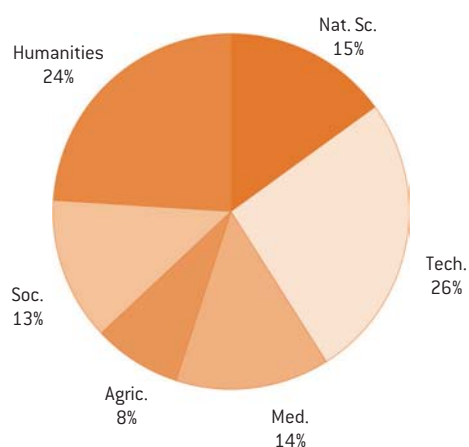
9. Situation of Scientific Research System in Albania

and temporary employment abroad. Some people return to Albania after a period of study. During 2007 the new government is planning to provide facilities in order to introduce 'brain gain'.

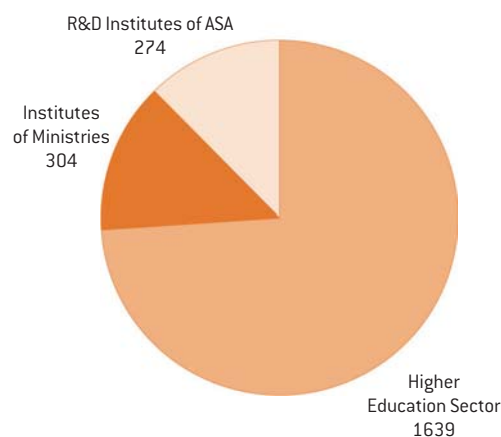
There was a total 578 scientific workers in Albania: 274 in ASA and 304 in governmental R&D institutions. Some 0.2 per 1,000 population were engaged in R&D (see fig 9.1) but as a result of the reform this number decreased by more than 50%.

Figure 9.1: R&D Personnel by Scientific Disciplines & Sectors of Employment (2005)

R&D Personnel by Scientific Disciplines



R&D Personnel by Sectors



Source: ASA, MES, Agency of Accreditation of Higher Education.

9.7. The Reform of scientific research system including ASA

At the end of 2005, the government launched an initiative to reform scientific research in the country. A group of experts was charged by the government to prepare a platform for this reform. According to the group of experts, Albania should have one system of scientific research, concentrated in the universities. The ASA should become an Academy without institutes.

The following actions were proposed in order to attach the research institutes to respective faculty departments within universities:

1. creation of Research Centres within faculties; this model to be applied if an institute or a group of institutes is engaged in scientific studies that cross departments, but fit within different departments within a faculty;
2. creation of Study Centres at a university or Inter-Disciplinary University Research Centre: an institute or a group of institutes with fields of scientific study that are wider than those of a single faculty, but match the interests of different faculties within a university;



3. creation of Inter-university or National Research Centres: an institute or a group of institutes with fields of scientific study wider than those of a single university, but which match the interests of the national system.

Every scientific worker in the system should teach, conduct research and, whenever possible, become involved in knowledge and technology transfer and other services to benefit society.

The ASA has for long believed that reform and strengthening of scientific research and institutions of higher education schools is urgently needed. The ASA began its programme of reform at the end of the 1990s, and the Law on the ASA was approved in 2004 by consensus. The Group of Experts platform has been discussed by the Assembly of the Academy, all Albanian research and scientific institutes, and government ministries.

No country has a single system of concentrated scientific research, even within universities. In some Western European countries and ex communist countries there are scientific research systems that have been developed in parallel, within the academies of sciences or in national multi-discipline centres. The Western European countries and almost all the ex-communist countries have completed reform of scientific research, have joined the EU or are preparing to do so, and have preserved their academies with institutes.

The ASA, based on its positive experience of reorganization is of the opinion that it should function as a set of research institutions and academicians (members of the Academy). This system will work in cooperation with the higher education system in terms of teaching and scientific research, based on the framework of the research scientific infrastructures (archives, laboratories, experimental plots, expeditions, etc.).

The ASA's views have been made known to IAP (Inter Academy Panel), ALLEA (All European Academies), UNESCO, etc. The Presidents of IAP and ALLEA, the honorable Mr. Yves Quéré and Pieter Drenth, have visited Albania in order to inspect the situation at first hand, and have met with the highest authorities in Albania. On the basis of the information obtained, ASA has established a platform for its further reformation. The help of outside experts has been promised which should make a qualitative contribution to the reform. The ASA proposes reformation of its leading structures and further restructuring of its research institutions. This reform will enable development of the role of the ASA in R&D based on the priorities of the country. It will also allow the ASA to contribute to the work of institutions of higher education. In October 2006 Prof. Yves Quéré wrote to the Speaker of the Parliament of the Republic of Albania proposing a meeting to exchange views on the reform and accompanying problems and a visit from a small team of experts with the intention of assisting reform of the scientific research system in Albania before any decision by the Parliament. However the Speaker did not respond.

In December 2006 the Parliament of Albania approved the new law for the ASA and in April 2007 the government approved a decree for the reorganization of the scientific institutions of the ASA and their integration into the universities.

10. Need for a Science Policy in Bosnia and Herzegovina

Bozidar Matic

10.1. Introduction

Innovative capacity is the most important factor of competitiveness. However, despite this the reconstruction of innovative capacity in Bosnia and Herzegovina has received little attention. In 1990, investment in science at universities and research in firms was only 1.5% of gross domestic product (GDP) with the State responsible for 1% and firms 0.5%. In 2003 investment in science was only 0.05% of GDP. Universities engage in research activity only sporadically, and represent less than 3% of the finance required. Federal and State statistics do not include research. The assessment presented in this paper results from a study made by the Academy of Science and Arts of Bosnia and Herzegovina in 2005. The total budget items under science in the entities and the canton's were collected. The State budget did not include this category. Only one company was involved in research and development (R&D).

An indicator of the poor performance and isolation of Bosnia and Herzegovina can be seen in the number of articles published in refereed journals, per 100,000 population (see Table 10.1).

10.2. Funding of R&D

A simple numerical example can be used to illustrate the funding situation in Bosnia and Herzegovina. GDP in Bosnia and Herzegovina is about KM14.5 billion,²⁷ and we will assume that optimal funding of R&D should be 2% of GDP, i.e. KM290 million. If we also assume that the ratio of R&D funding for the State and the economy should be 2 to 1 (cf the USA situation in 1974) then State:economy R&D investment should be KM190 to 100 million.

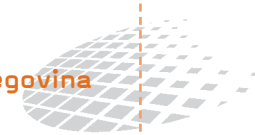
The participation of different State levels of government in R&D funding should be based on actual fiscal capacities:

- Bosnia and Herzegovina: KM 190 million
- Bosnia and Herzegovina government: KM 14.193 million
- Federation of Bosnia and Herzegovina: KM 108.148
- Republic of Srpska: KM 57.209 million
- District of Brčko: KM 10.469 million.

The ratio between the Federation of Bosnia and Herzegovina government and the Cantons should be similar, i.e. 2 to 1:

²⁷ KM is 'Converted Mark'.

10. Need for a Science Policy in Bosnia and Herzegovina



- Federation of Bosnia and Herzegovina: 100% or KM 108.148 million
- Government of Federation of Bosnia and Herzegovina: 43% or KM 46.5 million
- Cantons: 57% or KM 61.64 million.

Thus the R&D financing for the Cantons would total KM 61.64 million split as follows:

- Una-Sana – KM 6.02 million
- Posavina – KM 1.08 million
- Tuzla – KM 9.52 million
- Zenica-Doboj – KM 7.79 million
- Bosnian Podrinje – KM 0.86 million
- Central Bosnia – KM 4.48 million
- Herzegovina-Neretva – KM 5.28 million
- Zupanija Hercegbosanska – KM 2.07 million
- Sarajevo – KM 23.23 million
- Liv – KM 1.43 million

10.3. How can these amounts be achieved?

It is not possible to achieve the amounts estimated above through budget increases because the budget is controlled at all levels by the International Monetary Fund (IMF). They can be achieved only via a reallocation of finances *within* the budget. Other countries that were faced with similar problems reduced spending on military and administration in order to free up finance for research.

10.4. Academy of Sciences and Arts of Bosnia and Herzegovina – proposals for S&T policy

The Academy of Sciences and Arts of Bosnia and Herzegovina prepared a 'Strategy of Technological and Scientific Development of Bosnia and Herzegovina' which contained the following recommendations.

It identified the urgent need to establish legal regulation of science and a system for financing R&D in accordance with the constitutional responsibilities of the entities and cantons, and in line with the 2006 UNESCO recommendations:

- to put an end to the isolation of Bosnia and Herzegovina in relation to the EU by joining the COST programme;
- to increase State funding for R&D;
- to establish funds for R&D within the entities;
- to establish funds for R&D within cantons that have universities by inclusion of budget items in cantons without universities;
- to develop a decentralized approach to R&D funding.



10. Need for a Science Policy in Bosnia and Herzegovina

To reduce isolation it will be necessary for Bosnia and Herzegovina to:

- join the COST programme;
- achieve OECD targets of every university teacher being 0.5 FTE (full time equivalent) teaching and 0.5 FTE research. This could be achieved by drawing on the new sources of funding and would enable participation in the EC's 7th Framework Programme.

The State should provide funding in accordance with its constitutional responsibilities to enable:

- local share in international science and technology (S&T) and R&D projects;
- membership fees for international research and scientific associations (UNESCO, ISO, IEC, COST, IMA, CIGRE)²⁸, etc.
- funding for joint university R&D projects involving faculties and/or institutes from both entities, including District Brčko;
- incentives for R&D collaborative projects involving companies from both entities, including District Brčko;
- State awards for R&D results;
- BIHARNET academic network (domain.edu);
- COBISS (Cooperative Online Bibliographic System and Services);
- access to R&D databases (Current Contents, Science Citation Index, Web of Science, etc.);
- access to electronic science journals (EBSCO, etc.);
- edit journals acceptable for international reference databases;
- S&T relevant State statistics harmonized with OECD/UNESCO standards.

Entity fund – the Federation of Bosnia and Herzegovina should provide financial resources for:

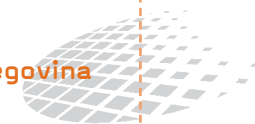
- R&D projects at universities – stimulate collaboration between subjects from two or more cantons or entities, and international collaboration;
- R&D projects in companies – stimulate collaboration between subjects from two or more cantons or entities, and international collaboration;
- science infrastructure – register of R&D personal institutions and projects, infrastructural investments and capital research equipment, publishing scientific literature;
- science and R&D projects of interest for the Federation of Bosnia and Herzegovina;
- establish institutes for basic and applied research in areas of particular interest for the Federation Bosnia and Herzegovina.

Cantonal funds should provide financial resources for:

- R&D project at universities – financing with special support for inclusion in the 7th Framework Programme and for doctoral students;
- R&D projects in companies.

²⁸ ISO = International Organization for Standardization; IEC = International Electrotechnical Commission; CIGRE = International Council on Large Electrical Systems.

10. Need for a Science Policy in Bosnia and Herzegovina



In both cases part of the resources should be invested in developing institutions and their capacities. There should be funding for soft loans for housing for researchers.

Budget item in cantons without universities should be used to:

- finance R&D projects for teaching staff at universities where citizens from cantons without universities study;
- provide incentives for R&D projects in firms.

The Entity fund of Republic of Srpska should also be used for these last two purposes.

For Bosnia and Herzegovina, sector participation based on equal numbers of working R&D hours should be: Natural sciences 26%; Technical sciences 24%; Biomedical sciences 30%; Biotechnical sciences 11%; Social sciences 9%; Humanities 10%.

The media should draw attention to the problems in Bosnia and Herzegovina. In the past when the lack of attention to the R&D sector has been criticized the official response has been that the Bosnia and Herzegovina economy is in the process of privatization and that science funding is not the responsibility of the State.

11. S&T Policy Guidelines for Bosnia and Herzegovina

Pierre Papon and Stane Pejovnik

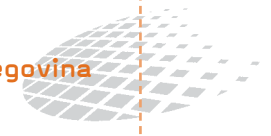
This paper discusses the main conclusions of a report on science and technology (S&T) in Bosnia and Herzegovina, prepared for UNESCO BRESCE in 2005. The mandate was to assess the scientific potential of Bosnia and Herzegovina and make recommendations for the definition and implementation of a S&T policy and for the integration of research activities into the international and European research areas (ERA). The report was based on information gathered during three visits to Bosnia and Herzegovina in 2005. Universities, national institutes and companies in several towns were visited and several interviews were conducted with politicians, government representatives and representatives of the scientific community and industry.

11.1. A difficult context

A decade after the signature of the Dayton Peace Agreement (1995), which put an end to the war, Bosnia and Herzegovina still faces a very difficult economic situation. Large sectors of the economy have collapsed and the unemployment rate is officially about 40%; much of the country's infrastructures have yet to be reconstructed. Furthermore, the division of political and administrative responsibilities between the three levels of government inherited from the Dayton Agreement (the State of Bosnia and Herzegovina, the Srpska Republic and the Federation of Bosnia and Herzegovina and its ten cantons) makes it very difficult to define and implement country-level policies, and especially S&T policies.

Although Bosnia and Herzegovina inherited from former Yugoslavia a scientific and technological tradition and strong potential (before the war, in 1991, SFR Yugoslavia invested 1.5% of its gross domestic product – GDP in research and development R&D) and a solid industrial base (with companies investing in R&D and exporting their technology), its present research system is unable to function in accordance with international standards. The present funding of R&D in Bosnia and Herzegovina is very low: around 0.05% of GDP according to official figures. This is probably underestimated by a factor of 2 or 3, as salaries and industry expenses need to be taken into account and are difficult to evaluate. However, any underestimation of R&D funding would not change the picture very much. Most of the research infrastructures are obsolete; many laboratories have no operating funds, libraries cannot afford subscriptions to international journals; and the internet connection is low bandwidth. The present generation of university students has no scientific research facilities; most industrial research has been dismantled; and it is estimated that in the last ten years 60% of Bosnia and Herzegovina's scientists, researchers and university personnel have left the country.

According to the Academy of Sciences and Arts of Bosnia and Herzegovina the number of scientific publications per 100,000 inhabitants has decreased from 1.95 in 1990 to 0.61 in 2000.



France's OST (Observatoire des sciences et des techniques) statistics shows Bosnia and Herzegovina's share in scientific literature has slightly recovered since 1997 (0.04 of world share). For number of personal computers (PCs) per capita, Bosnia and Herzegovina ranked 40th in the world in 2000.

Modern societies rely largely on the capacities of their countries to mobilize scientific and technological expertise. In Bosnia and Herzegovina there are neither the mechanisms nor the resources at State level to define and implement a policy for the reconstruction of the country's research infrastructure; political and administrative barriers resulting from the war are a major obstacle to this process. The ministries in charge of research and technology in the Federation of Bosnia and Herzegovina and in several cantons, as well as in the Srpska Republic, have launched programmes to support research activities, but they are not sufficient to provide critical mass for those activities at country level, and within the academic system (there are eight universities in the country). However, despite all these difficulties, some research institutes have managed to maintain some competitive activity and retain some expertise through cooperation with what remains of the industrial sector, although frequently these collaborations have very short term objectives.

Nevertheless, although the situation is serious it is not hopeless as, in many sectors, there is awareness of the urgency of providing solutions to the problems that exist.

11.2. Recommendations for S&T policy

Bosnia and Herzegovina's future will be very precarious if it cannot rebuild its scientific and technical expertise through research activities at various levels. The rebuilding of this scientific and technological potential requires a focus on three mid-term (2006-2015) objectives:

- training of a new generation of scientists in Bosnia and Herzegovina's universities or abroad;
- development of research infrastructures to international standards aligned with projects (technical equipment, computers, libraries);
- reinvestment in industrial research in a limited number of sectors. Basic research should be primarily developed in several disciplines to train young people and lay the ground for the future; a limited number of priorities will have to be defined, including health and metallurgy, related to the country's technical development; national technical institutes should be supported through industry collaboration in these areas.

The definition of a State level S&T policy for Bosnia and Herzegovina is a prerequisite for the reconstruction of a recognized and effective competence in S&T, in particular to address the country's needs. This State policy should be complemented by actions supported at the level of the other political and administrative entities (federation, canton, etc.). Switzerland is a good example of a successful policy of this type. A State S&T policy also requires a legal framework to be put in place and as a first step government in 2004, drafted two laws on Higher Education and on Science. Adoption of these laws by parliament is urgently required. The Science law, within its articles, must explicitly set out the responsibilities of the Bosnia and Herzegov-



11. S&T Policy Guidelines for Bosnia and Herzegovina

ina State in terms of the definition of a S&T policy and its implementation. For the mid-term (2012) a financial plan should be adopted aimed at increasing public and private funding of S&T to 0.5% of GDP. In the long term, Bosnia and Herzegovina should invest around 2% of GDP in research. Industry should be encouraged also to invest in R&D (probably up to the level of one-third of national R&D expenditure). The creation of State institutions is necessary. We recommend that there should be establishment of:

- a State Ministry responsible for science and research in Bosnia and Herzegovina;
- a State Agency for S&T with several tools to define, implement and evaluate activities (in particular data and statistics on research activities must be collected);
- a State Fund for R&D to be controlled by the Agency for S&T, to support projects evaluated as being in the national interest.

Science must be seen not only as necessary to rebuild the economy of Bosnia and Herzegovina and to support public policies, but also as an essential dimension of the country's culture. This will require specific actions to enhance public understanding of science. We recommend that the Bosnia and Herzegovina scientific community should have strong involvement in regional and European cooperation in research projects. The European Commission's 7th Framework Programme should provide funding to support the rebuilding of Bosnia and Herzegovina's scientific potential and further international and regional cooperation. Because of the difficult conditions in Bosnia and Herzegovina, special tenders should be issued as part of the EU's activities that would enable Bosnia and Herzegovina's researchers to compete. UNESCO, which commissioned our report, should continue to act as a catalyst in the region to encourage regional cooperation in science.

11.3. Looking forward

Scientific and technological research in Bosnia and Herzegovina is in a state of emergency, and actions are urgently needed at both national and international levels. Reconstructing the S&T potential of the country is a necessity both to secure the country's future and as another step in the consolidation of peace. The situation is difficult, but not unsolvable; the seeds for future development exist in several parts of the country.

12. Bulgarian Science and Innovation System: Policy Challenges in the First Year of EU Membership

Ruslan Stefanov

12.1. Introduction²⁹

Bulgaria enjoyed stable economic performance in the nine years prior to accession to the EU in January 2007. Its economy has expanded at an annual real gross domestic product (GDP) rate of 4-5%. Inflation has remained in single figures. Unemployment has declined steadily from almost 20% in 1998 to just below 9% at the time of accession. However, production and employment remain concentrated in low to medium technology economic sectors, relying mainly on low costs to sustain their competitiveness (Figure 12.1). This low value added specialization of the economy in part explains the expanding current account gap, which was over 11% of Bulgarian GDP in 2005 and 2006. Although this gap in Bulgaria's external financial position is more than covered by foreign direct investment (FDI) and a prudent surplus fiscal policy it could potentially become a downward risk should the economy fail to transform current economic growth into higher technological development and higher value added production sufficiently quickly in the future. An open and flexible national innovation system would help to transform Bulgaria into a high-growth knowledge economy based on available EU funds and the technical expertise provided by partner Member-States.

The analysis in this paper summarizes the annual performance assessment report of the Bulgarian national innovation system - *Innovation.bg*. It examines the dynamics of the Bulgarian national innovation system in recent years in five related areas:

- innovation, technology and scientific output of the economy;
- entrepreneurship and innovation networks;
- investment and financing of innovation;
- human capital for innovation;
- information and communication technologies (ICT) for innovation.

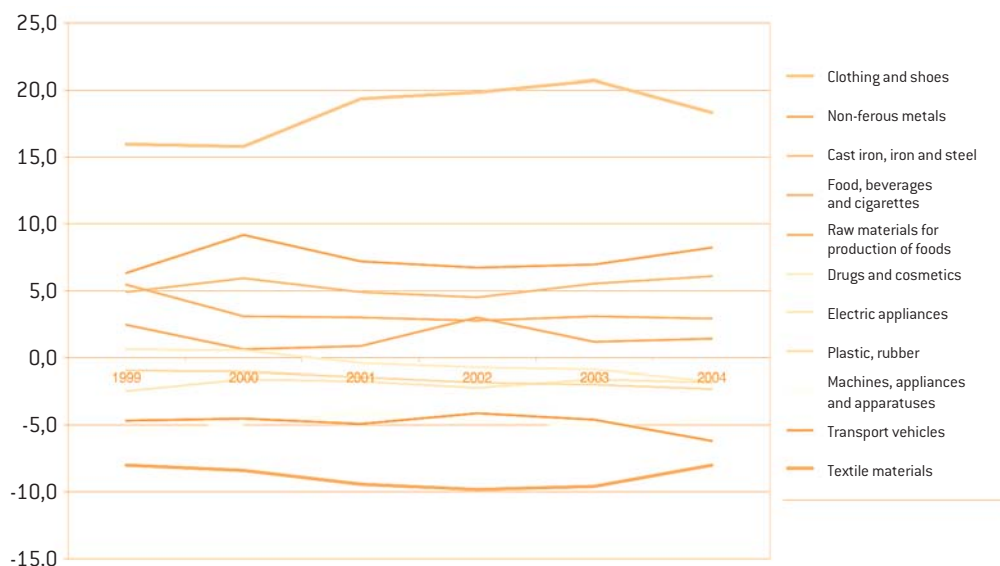
The analysis takes account of the specific starting position and the heritage of the Bulgarian innovation system. Bulgaria is at the beginning of its market economy development with still low capital depth, poor domestic market demand and a not well developed entrepreneurial culture. Poor management capacity and practice are hampering Bulgaria's competitiveness.³⁰

²⁹ This contribution is heavily based on the ARC Fund's annual innovation performance assessment report on the Bulgarian national innovation system. For an in-depth description of the methodology and analysis of *Innovation.bg*, visit www.arcfund.net (accessed 20.6.07) or <http://www.innovation.bg/eng/> (accessed 20.6.07).

³⁰ As identified by the World Competitiveness Yearbook 2006, IMD.

12. Bulgarian Science and Innovation System: Policy Challenges in the First Year of EU Membership

Figure 12.1: Revealed competitive advantages in Bulgarian import and export (1999–2004)



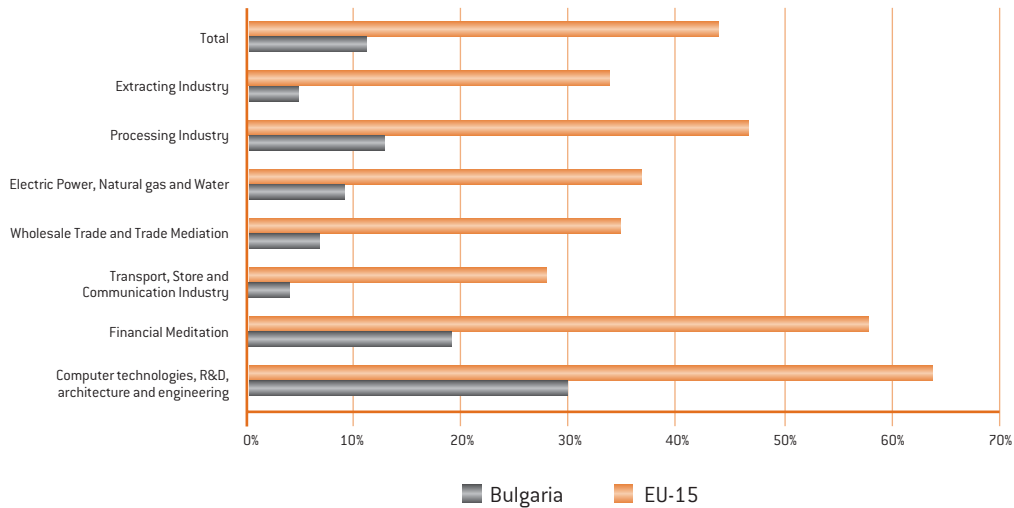
Note: Revealed competitive advantages are the difference between the share of a good in a country's export and its share in a country's import, i.e. $(X_i/X) - (M_i/M)$

Like other countries from the former Soviet bloc Bulgaria has inherited a substantial state science and research sector locked into a few state subsidized organizations. In most international innovation performance assessments the Bulgarian innovation system ranks among the poorest performers in the EU. Typically the ranking of the new EU Member States in such assessments is artificially boosted by their inherited high education attainment and R&D labour force; these assessments do not take quality into account. This calls for an in-depth examination of the innovation systems of these countries.

Compared to the EU25 the share of innovative enterprises in Bulgaria is four times lower (Figure 12.2). Only one in every ten Bulgarian enterprises with more than nine employees is involved in innovation and this activity is mainly directed towards product innovations. Innovation activity is based primarily on the acquisition of new machinery and equipment, with investment in R&D, marketing and staff training being secondary. Bulgaria is lagging around 50% behind the new EU Member States for number of patent requests and patents issued by the European Patent Office and the United States Patent and Trade Mark Office. The lag is roughly the same for number of scientific publications in internationally peer-reviewed journals. Disruption to the links that existed in the centrally planned innovation system as a result of the transition process, long-term under funding, lack of market and innovation oriented reform and mismanagement has resulted in underperformance by the Bulgarian R&D and technology system. Bulgaria has much higher potential in science and technology (S&T) than it currently delivers (Figure 12.3). Under current conditions there is no link between Bulgarian innovative enterprises and the bulk of the Bulgarian S&T sector. Demand is not matched by supply.

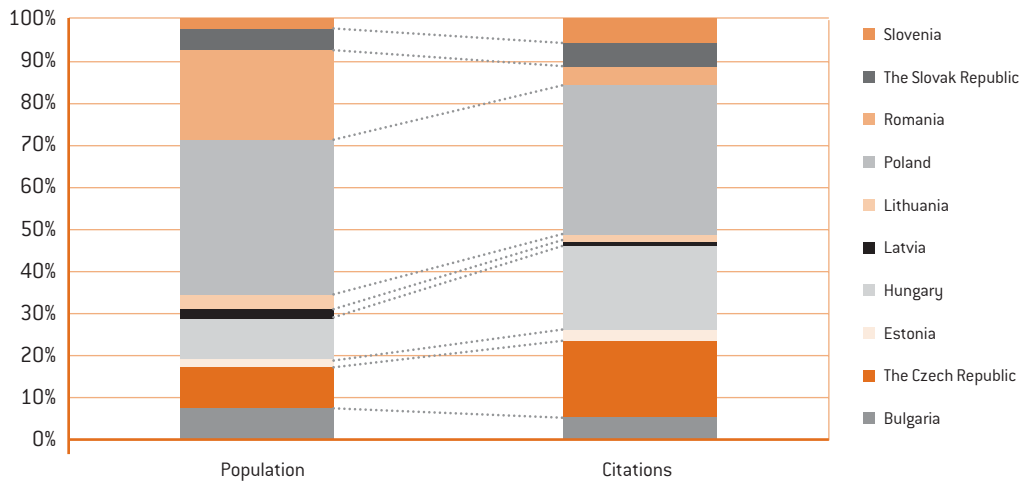
12. Bulgarian Science and Innovation System: Policy Challenges in the First Year of EU Membership

Figure 12.2: Relative share of the innovative enterprises in Bulgaria and EU-15



Source: Bulgarian National Statistical Institute, Eurostat.

Figure 12.3: Relative performance of science systems in EU8+2 [countries' share in the region's citations compared to their share in the regions total population]



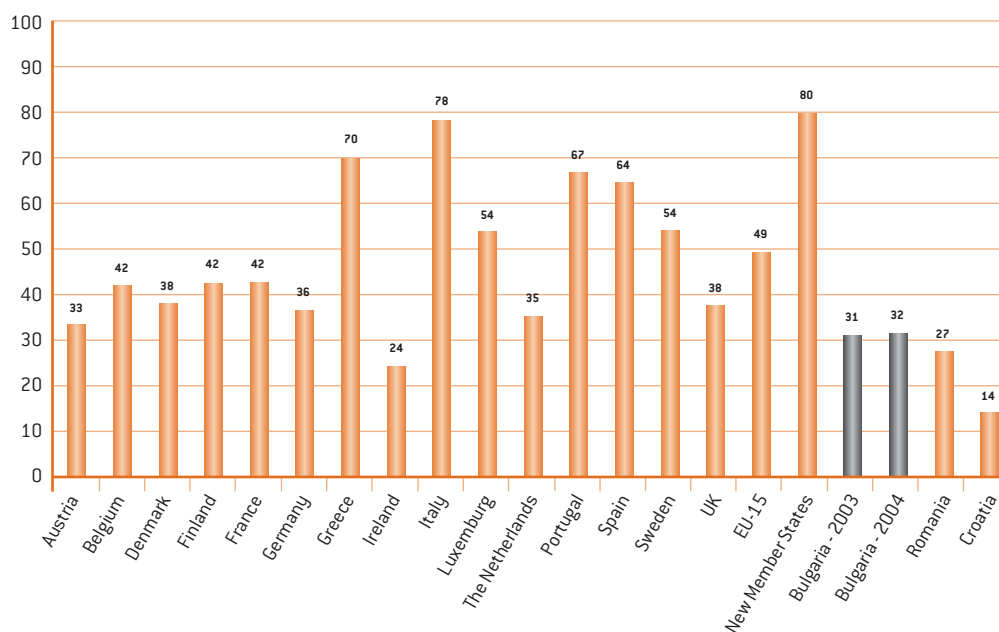
Source: US National Science Foundation.

The entrepreneurship and business environment in Bulgaria continues to improve in line with overall growth in the Bulgarian economy. Lasting macroeconomic stability has provided conditions for company growth and the establishment of productive partnerships for innovation. Yet, microeconomic factors, such as high entry barriers, low competitiveness and unfair competition, high market concentration, poor protection of property rights, etc. continue to hinder

12. Bulgarian Science and Innovation System: Policy Challenges in the First Year of EU Membership

the development of the Bulgarian innovation system and, thus, the competitiveness of Bulgarian enterprises in the EU. This leads to lower levels of entrepreneurialism among Bulgarian citizens compared to the countries of EU15 (Figure 12.4). Bulgarian enterprises are also less engaged in innovation and production networks than their EU counterparts.

Figure 12.4: Level of entrepreneurship (number of enterprises per 1000 inhabitants)



Source: ARC Fund based on EBRD and data from Eurostat and the Bulgarian National Statistical Institute

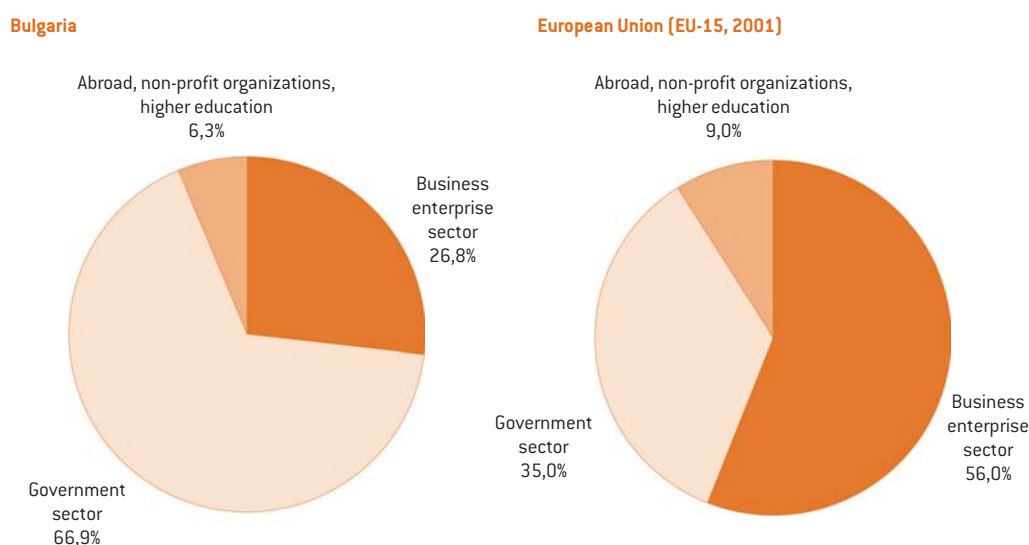
12.2. Investment in innovation

Investment in innovation in Bulgaria depends primarily on knowledge transfer from the EU through FDI and import of investment goods. The business sectors with the highest accumulation of FDI in Bulgaria have the largest share of innovative enterprises. In the last five years inward FDI in Bulgaria has tripled, but the Bulgarian economy's FDI intensity remains lower than the EU8 average level. R&D expenditure in Bulgaria has remained stable at a relatively low level (approximately 0.5% of GDP) for the past five years. R&D expenditure and performance remains highly concentrated in the Bulgarian public sector and is subsidized primarily by government. The contribution of enterprises to total R&D expenditure is less than half that of the state (Figure 12.5). The reversed structure of financing and implementation of R&D in the Bulgarian economy compared to innovation leaders and peers is a direct reflection of the low R&D demand of Bulgarian enterprises and the low commercialization capacity of the Bulgarian R&D sector. Employment in and financing of R&D follow similar patterns: dominated by the public sector, and lower than the average for the ten new EU Member States in 2004. Bulgaria does not have any substantial venture capital instruments in place to support high risk innovative

12. Bulgarian Science and Innovation System: Policy Challenges in the First Year of EU Membership

investment. The development of more diverse and sophisticated financial instruments for innovation is primarily associated with the deployment of European funds after Bulgaria's entry to the EU. This should lead to higher financing of innovation, but will probably not resolve the existing mismatch between the public and private sectors.

Figure 12.5: Structure of R&D expenditure by sources of funds



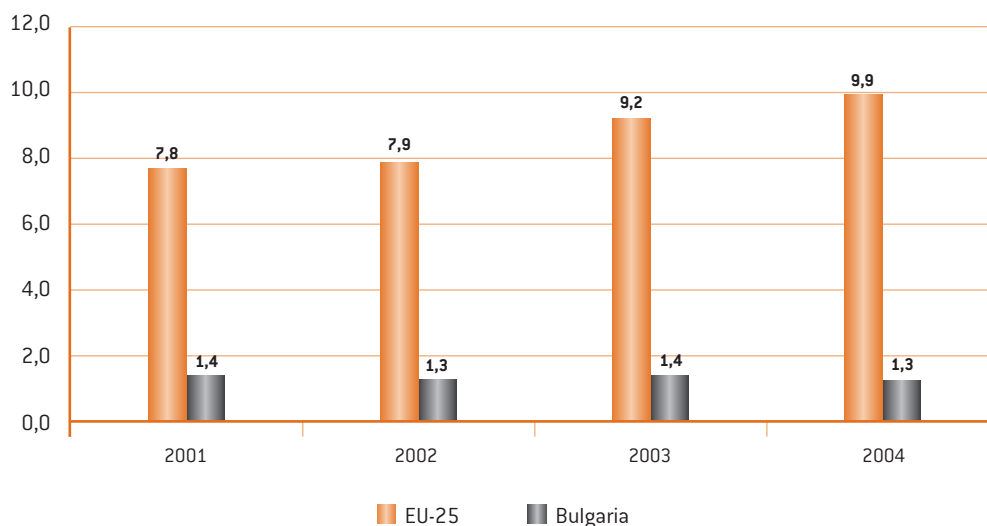
Source: Eurostat.

12.3. Human capital

In the years of transition, due to emigration and under funding, Bulgaria lost a substantial part of its human capital although on education indicators it performs reasonably well in international comparisons. Bulgarian secondary education was worst affected. Comparative international tests reveal a 50% drop in the quality of Bulgarian 8th graders' performance in science and mathematics. This could become a major and long-term barrier to the development of successful innovation in the Bulgarian economy. Bulgaria's higher education sector faces similar problems although stronger local and international competition might bring positive and more rapid results at this education level. Bulgaria lags significantly behind the average for the EU25 for level of participation of the population in vocational education and training outside the formal education system, which is a threat to the workforce's preparedness to face the challenges of the knowledge economy (Figure 12.6). Overall, Bulgarian human capital performance remains below the level of EU10 and EU25.

12. Bulgarian Science and Innovation System: Policy Challenges in the First Year of EU Membership

Figure 12.6: Life-long learning (share of population aged 25-64, engaged in education and training)



Source: Eurostat.

12.4. Penetration of ICTs

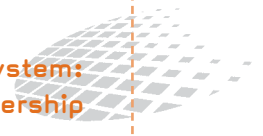
Exploitation of ICTs by Bulgarian enterprises is increasing at a steady and fast rate, but available information technology (IT) capacity is not yet being fully utilized, especially in micro enterprises operating in the traditional sectors of the economy. The information and communication infrastructure in Bulgaria still lags behind the average level for the EU new Member States and access is more expensive than in EU countries with much higher standards of living. The most innovative Bulgarian companies use computers and the Internet more often and for more sophisticated purposes, than their non-innovative partners. Bulgarian enterprises are still predominantly equipping themselves with e-business tools, but actual participation in e-business is relatively low.

12.5. Conclusion

This short overview of the main elements of the Bulgarian innovation system reveals that the country is still at the beginning of market-based innovation development and needs to overcome a number of past rigidities. The first years of Bulgaria's EU membership will be formative for the shape, character and functioning of the Bulgarian innovation system. The main challenges for innovation policy in Bulgaria include:

- creating effective linkages between the public and private sectors of the R&D system;
- integrating the Bulgarian innovation system into the European innovation infrastructure and making the best use of the available technical assistance and financial instruments to support innovation and R&D and technology development;

12. Bulgarian Science and Innovation System: Policy Challenges in the First Year of EU Membership



- reforming publicly financed R&D and innovation support organizations to ensure higher efficiency, better accountability and stronger links to and focus on the market needs of Bulgarian enterprises;
- eliminating existing imbalances in the national innovation system regarding public and private sector participation in R&D financing and R&D employment;
- improving the quality of education – both within the education system and in the labour market.

13. Croatian Innovation Policy Meets Reality

Jadranka Švarc and Emira Bečić

13.1. Introduction

Since 2000 Croatia has made significant efforts to establish a national innovation system and introduce innovation policy as a specific policy framework for accelerating the transition of Croatia towards a knowledge-based economy. These efforts have been supported by the negotiations for accession to the EU, which began on 4th October 2005 and have brought the Lisbon and Barcelona targets onto the policy agenda of the Croatian government. For example, the most recent strategic document, *Science and Technology Policy of the Republic of Croatia 2006-2010* (MSES 2006), points out that the goals of the Lisbon declaration are incorporated within and are the basis of the Croatian national research and development (R&D) programme, denoting a country that belongs to the European cultural and economic framework.

13.2. The Croatia innovation system

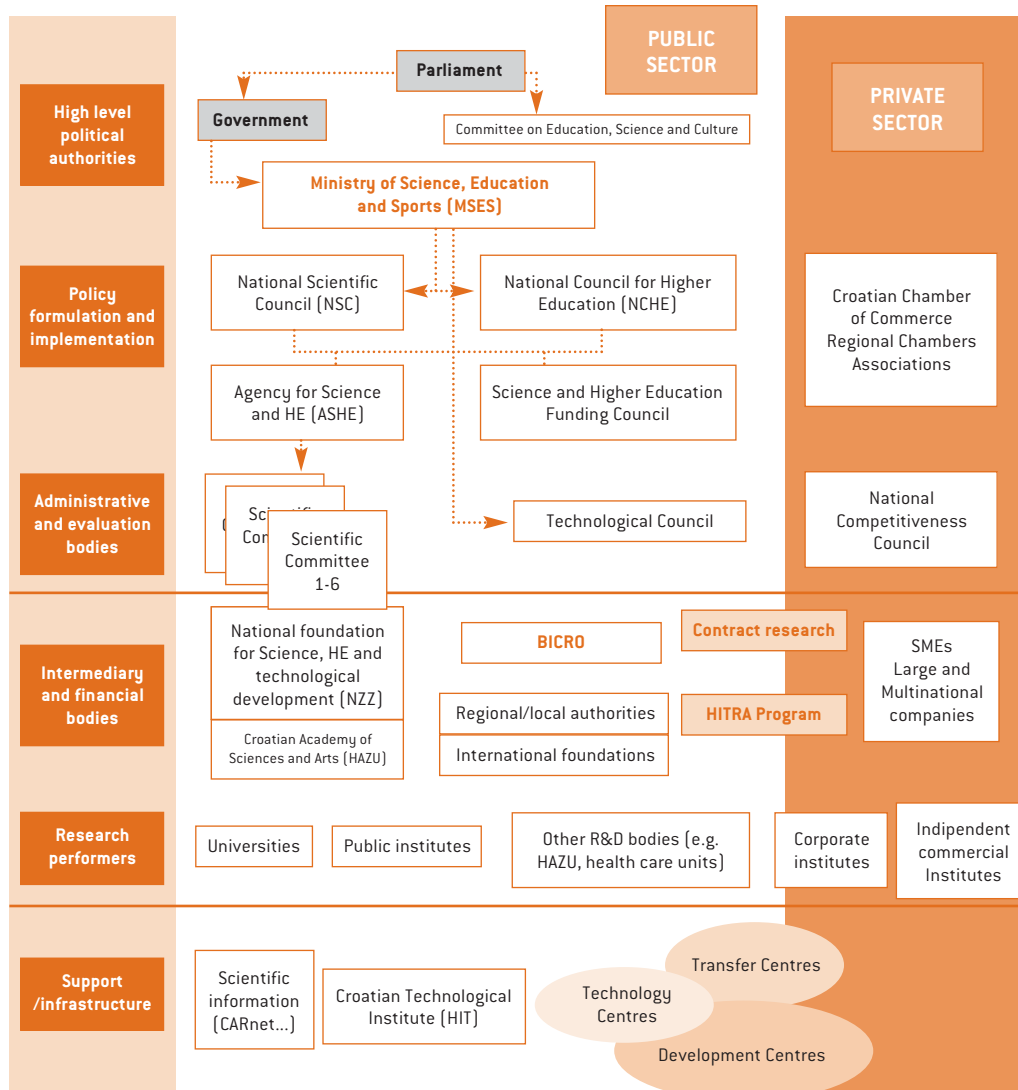
The innovation system in Croatia consists of a rather complex, but not completely coherent set of institutions (Figure 13.1) mutually interrelated to pursue the mission of using knowledge for development. It is dominated by a public R&D sector for the organization of research supported by a technologically weak private sector. Innovation policy is similarly not yet fully integrated; it is at present a narrowly-shaped programme for fostering science–industry cooperation with limited impact on technological and economic development. Croatian innovation policy, therefore, must face the realities and address the specific development needs of Croatia determined by the stages of technological advancement of industry, business conditions and the social maturity of the nation, using innovation and knowledge as the main driving forces for economic growth.

13.3. Institutions and policy instruments

Core management of the innovation system in Croatia is currently the responsibility of the Ministry of Science, Education and Sports (MSES), which initiated innovation policy in Croatia. The system currently comprises five technology centres as well as the Business-Innovation Centre of Croatia (BICRO) and the Croatian Institute of Technology. BICRO was established in 1998 with the main aim to develop the national financial system for fostering technologically advanced businesses while the aim of the Institute of Technology, established in 2006, was to become a leading national institution to promote and strengthen a knowledge based society in Croatia.

13. Croatian Innovation Policy Meets Reality

Figure 13.1: Institutional set up for R&D and innovation in Croatia



Source: Švarc, J., Račić, D. (2006).



The Ministry of Economy, Labour and Entrepreneurship (MELE) is responsible for activities complementing those of MSES. MELE is mainly focused on strengthening the technological capabilities of companies, including quality of production, business management, automation, computerization, etc. MELE supports a network of about 9 business incubators, 20 entrepreneurial centres, 10 development agencies, 14 free zones and a technology park.

The institutions and policy instruments aimed at fostering innovation and science–industry cooperation were initiated by the MSES within the first innovation policy programme – The Croatian Programme for Innovative Technological Development (HITRA) (see Figure 13.2), which was launched in May 2001 (MOST 2002).

13. Croatian Innovation Policy Meets Reality

Figure 13.2: Structure of the Croatian Programme for Innovative Technological Development (HITRA) programme



Sub-Programs	Type of projects	Targets of the policy measures
Technology projects 	"Simple" technology projects (TP)	Commercially promising products, processes and services prior to their commercial use (prototype/pilot stage)
	"Collaborative" technology projects (STIRP)	Multidisciplinary, cooperative research for launching new or developing the existing technological areas
	Nucleus (Jezgre)	Research and technological NUCLEUS concentration of R&D resources (experts, equipment, instruments) to gain critical mass for research based services
	Knowledge-based companies	Commercialization of research through companies (start-up, spin-offs, expansion...)

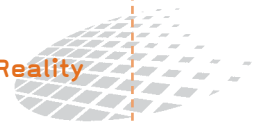
Source: Ministry of Science and Technology (MOST) (2002).

HITRA aims to provide an institutional, administrative and financial framework for researchers, entrepreneurs and SMEs to develop their commercial ideas using national research resources, and to provide a framework for direct cooperation between entrepreneurs and scientific institutes/universities. HITRA has introduced a range of completely new instruments into standard science policy, including grants for prototypes and feasibility studies, arrangement of intellectual property rights (IPR) among partners, subsidies to companies for R&D, favourable commercial loans and, in the case of high-risk projects such as academic spin-offs, conditional loans. HITRA has also initiated socio-cultural changes in the academic environment leading to the idea of linking domestic R&D, industrial development and commercial exploitation of research results.

Since 2005 reform of the whole HITRA programme has been in progress with the emphasis on expanding the activities of BICRO through the four new programmes supported by the World Bank (MSES 2006). These new programmes are the development of the technology infrastructure (TehCro), risk capital industry (VenCro), R&D services for companies (IRCro) and the business competitiveness upgrading programme (KonCro). Although all these actions show that progress is being made in terms of innovation policy, it is estimated that the Croatian national innovation systems faces some difficulties in serving as a tool for structural adjustment to the knowledge economy.

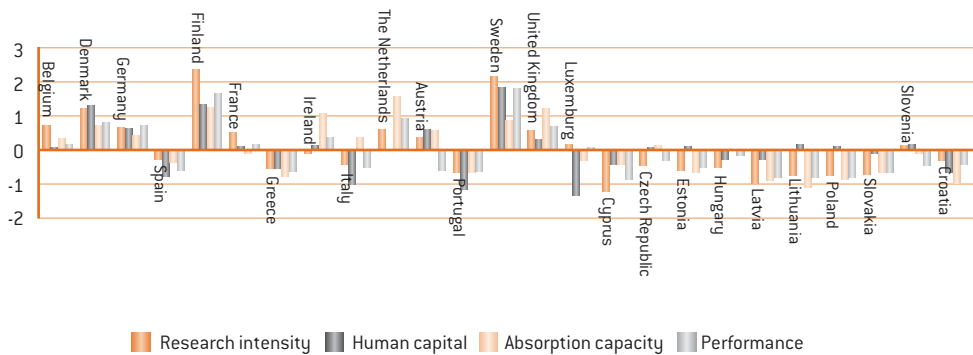
The results of the pilot benchmarking analysis of the national innovation systems of Croatia and the EU countries (Švarc and Bečić 2005) reveal that the supply side of the Croatian system is reasonably satisfactory, especially compared to the new Member States, but that the demand side and absorption capacities are rather weak. The analysis was based on the simple national innovation system model with four composite indicators: research intensity, human capital, absorption capacity, and technological performance (EC 2002).

13. Croatian Innovation Policy Meets Reality



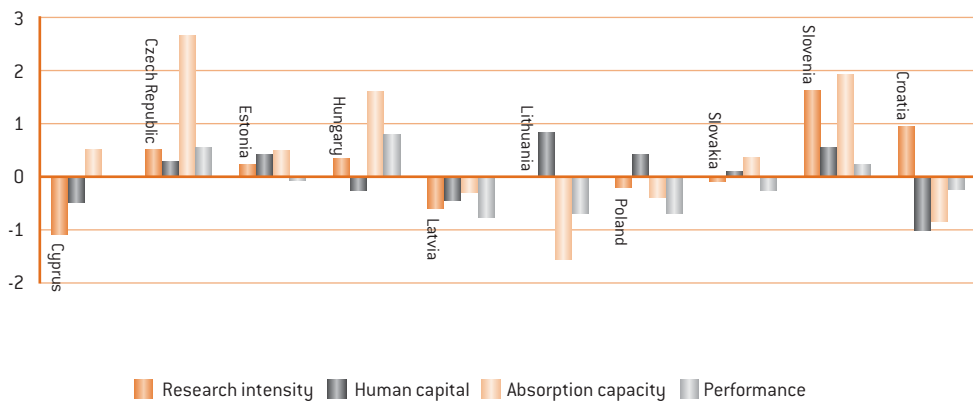
The analysis enabled identification of three groups of countries within the European Member States (the EU25) (Figure 13.3). The first group includes countries that are significantly above the EU average in all four components of the national innovation system, i.e. Sweden, Finland, Denmark, Germany, the UK and the Netherlands. These countries are the most efficient in the transition towards the knowledge economy. The second group comprises countries that are roughly equal to the EU average, i.e. Belgium, France, Austria, Ireland and Luxembourg. These countries are catching up with the first group in knowledge-based growth. Croatia belongs to the third group of countries, which are below the EU average for almost all the composite indicators. This group includes all the new Member States and the Southern European countries such as Greece, Spain, Italy, Portugal and Cyprus.

Figure 13.3: Croatia and EU 25 composite indicators: divergence from average, 2001



Source: Švarc, J. and Bečić, E. (2005)

Figure 13.4: Croatia and EU10 - new Member States composite indicators: Divergence from average, 2001.



Source: Švarc, J. and Bečić, E. (2005)

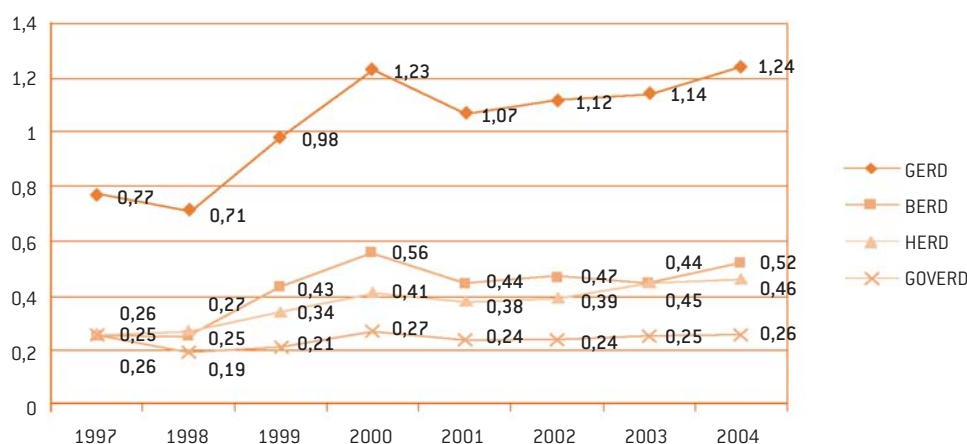
13. Croatian Innovation Policy Meets Reality

Three groupings of countries can also be identified from among the new Member States (the EU10) (Figure 13.4). The first group consists of countries that are above average in all four, or at least three, of the components of the national innovation system, i.e. Czech Republic, Estonia, Hungary and Slovenia. Hungary and Slovenia are definitely the leaders in innovation capabilities among the EU10. The second group consists of countries that are above (or about) average in two components of the national innovation system, such as Cyprus, Lithuania and Slovakia. Croatia is again in the third group, which includes countries that are below the average for the EU10 for all four, or at least three components. This group consists of Croatia, Poland and Latvia.

It can be concluded that the Croatian national system of innovation is underdeveloped in comparison with both the EU25 and the new Member States – the EU10. Croatia lags the most in absorption capacity, followed by human capital and technological performance. The most critical components of the Croatian national innovation system are: absorption capacity (quality management, number of researchers in industry, and computerization), and human capital (investment in tertiary education, number of new scientists in engineering, and an educated labour force).

Croatia is competitive with the EU countries only in research intensity, which reflects the present primary orientation of innovation and research policy towards the supply side in terms of number of researchers and investments in R&D in the public sector. Gross domestic expenditure on R&D in Croatia is constantly growing and reached 1.24% of gross domestic product (GDP) in 2004 (Figure 13.5). Croatia tops the list of new Member States for research intensity (Figure 13.6) and number of researchers (Figure 13.7).

Figure 13.5: Gross domestic expenditures on R&D in Croatia³¹



Source: Central Bureau of Statistics of Croatia.

³¹ GERD = Gross Expenditure on R&D; BERD = Business Expenditure on R&D; HERD: Higher Education Expenditure on R&D; GOVERD = Government Expenditure on R&D.

13. Croatian Innovation Policy Meets Reality

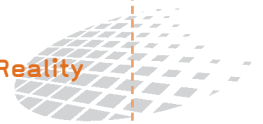
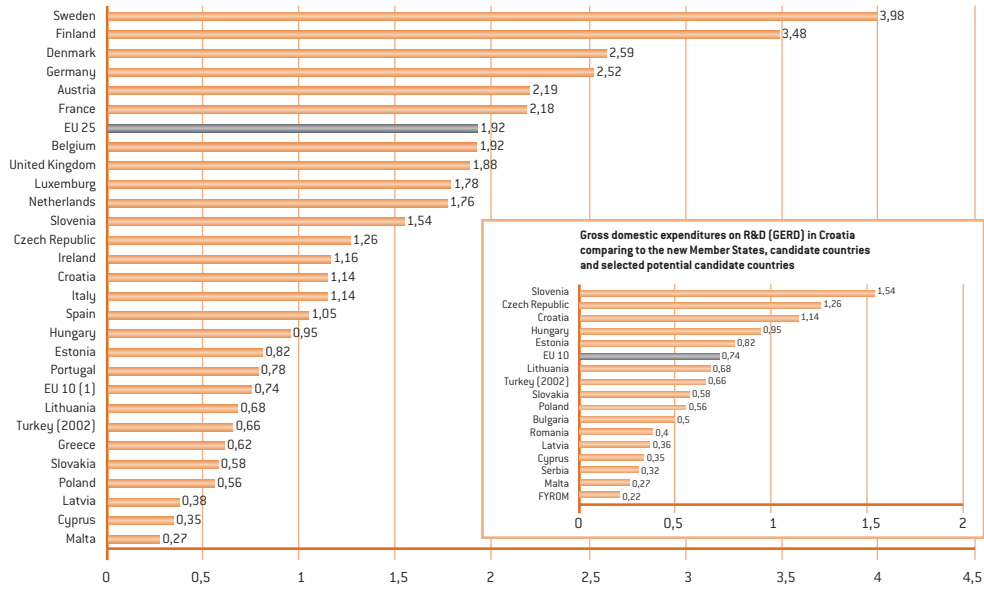
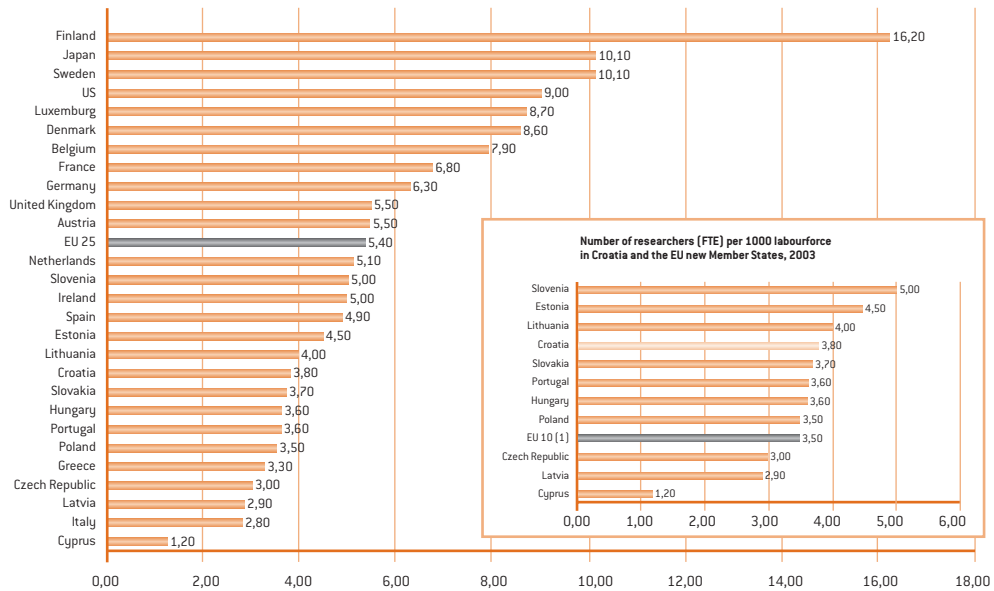


Figure 13.6: Gross domestic expenditure of R&D (GERD), 2003



Source: EUROSTAT

Figure 13.7: Number of researchers (FTE) per 1000 labour force in Croatia and EU 25, 2003



Source: EUROSTAT



13. Croatian Innovation Policy Meets Reality

This supports the thesis that the core of innovation policy in Croatia relies upon a standard science policy based on a linear model of innovation in which science is the main driver of technology development. Therefore, the focus of development policy in Croatia will continue to be scientific research based on the assumption that capitalization of science begins and ends with science.

In this context, MSES is the main financier and consumer of R&D, with a few new institutional and organizational structures oriented to science-industry cooperation and the commercialization of research results such as the HITRA programme.

13.4. Conclusion

The strong orientation towards research in the public science sector is simultaneously the main advantage and the main shortcoming of the Croatian innovation system. It helps to preserve and maintain the national science base, but neglects the innovative and technological capabilities of the private business sector. The weak technological capacities of the business sector hold back the innovation system and concurrently undermine the role of research in economic growth. The public sector (higher education and public institutes) employs 85% of researchers, the remaining 17% being employed by the business sector. Industry in Croatia invests 0.45% of GDP in R&D. Although this is higher than in many other countries, it is definitely not sufficient for increased economic progress.

The main reasons for this situation are socio-cultural inertia and lack of policy learning, which are prerequisites for a shift in conventional science policy to a proactive innovation policy. Research intensity and recovery of the R&D sector since 2000 illustrate that policy makers do care about development and the technological aspects of economic progress. However, they are not able to manage the transformation of basic R&D into innovation as they lack the knowledge and experience required to boost development based on innovation and research. The complexity of the innovation process and the need for the technology capabilities of companies to be upgraded are poorly perceived in Croatia, by all the key strategic development actors: policymakers, entrepreneurs and researchers. Science and entrepreneurship in Croatia, as well as engineers and researchers, are involved in a mutual confrontation rather than the cooperation that is required. The recent developments initiated by the innovation programmes, primarily those of BICRO, are promising. However, they are also challenging the ability of policy makers and business managers to fully support all the components of the national innovation system, which includes not only R&D, but also revitalization of industry research, the innovative capabilities of companies, human capital, computerization, etc. Without this support, these good policy concepts will fail in the face of obstacles stemming from the tough reality of the business world, technology gaps and the poor ability of stakeholders to undertake socio-cultural change.



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14. Science and Research in the Former Yugoslav Republic of Macedonia

Viktor Stefov

This paper discusses the organization of the Macedonian science and research national system. The Ministry of Education and Science is responsible for the country's science policy, which is organized and executed by the Department of Science and Technology with advice from the Council for Science and Research. The Ministry of Education and Science is responsible for organization, financing, developing and promotion of scientific research, technological development, technical culture, informatics and information systems as well as international cooperation related to these issues.

The legal frame for scientific research and technology development (RTD) in the country includes four laws (Law on Scientific and Research Activities, Law on the Macedonian Academy of Sciences and Arts, Law on Encouraging and Supporting Technology Development, Law on Industrial and Intellectual Property Protection) and several internal regulations and instructions for the various research and development (R&D) sector activities. The scientific institutional infrastructure consists mainly of faculties and institutes within universities. Scientific activities at national level are performed and organized by a network of scientific institutions comprising three state and two accredited private universities, 13 public research institutes and several industrial R&D units. The Macedonian Academy of Sciences and Arts is a well established and well recognized scientific institution.

Because of the overall political, social and economic conditions in the past, the funding of scientific research has been very limited and has been accompanied by a continuous decrease in the number of active researchers in the country. However, the Ministry has promoted activities towards an integrated approach in research and greater regional and international cooperation.

Scientific and technological development funding in the country includes:

- salary provision for public scientific and higher education institutions;
- programmes for public scientific institutions;
- fellowships for postgraduate (masters and doctoral) students;
- participation in scientific meetings;
- research projects, technological development projects;
- bilateral projects;
- infrastructure.

Government measures for improvement of the R&D sector are defined within several programmes, including programmes for improvement of R&D and programmes for enhanced technological development. The Ministry of Education and Science takes the problem of the tech-

14. Science and Research in the Former Yugoslav Republic of Macedonia

nological development of the country very seriously, and measures have been taken to stimulate and support cooperation between the universities and industry, improve and intensify the use of scientific research results by industry, and promote technological development of enterprises aimed at stimulating their competitiveness.

In 2004-2005, for the first time, a complete database with publications in scientific journals with impact factors (journals contained in the Thomson Science Citation Index (SCI) and citations to institutions and researchers) was constructed. A database of all patenting activity in the country was also built. In 2006, the National and University Library and the publisher Elsevier, in collaboration with the Ministry of Education and Science, signed an agreement for national access to the electronic scientific database, Scopus, which is available for all faculties and institutes in state universities.

In 2005, the new Council for Scientific Research was established. A completely new system of project evaluation was established with national coordinators assigned for every scientific discipline to manage the evaluation of scientific projects in their respective fields. In 2006, the government approved the national Programme for the Development of Scientific Research Activities for the period 2006-2010. This is the first official document relating to development of R&D to be adopted by the government. The Programme was prepared over the course of a year with input from experts and officials from all fields of science. Future activities are set out in the action plan within this programme. The new strategy for improvement of R&D defined in this document suggests an integrated approach to research activities characterized by need and quality. Increasing the funding for RTD projects and fellowships for young researchers is among its priorities, together with increased regional and international cooperation. The definition of national priorities in the R&D sector and improved intragovernmental coordination among ministries are emphasized as among the main requirements for the future development of the country. This strategy for future science policy also includes the definition of criteria to support R&D, and establishes a completely new peer evaluation procedure, which will be the responsibility of the national coordinators for scientific disciplines

The Department of Science has assigned contact persons to enable continuous coordination with other ministries and with scientific RTD centres in the business sector. Furthermore, efforts have been made to obtain credit from the World Bank, to be used to improve the scientific infrastructure and establish centres of excellence in the country.

Five potential centres of excellence have been identified based on their results in scientific research: the Institute of Chemistry in the Faculty of Natural Sciences and Mathematics; the Research Centre for Genetic Engineering and Biotechnology of the Macedonian Academy of Sciences and Arts; the Nephrology Clinic in the Faculty of Medicine; the Research Centre for Energy, Informatics and Material Science of the Macedonian Academy of Sciences and Arts; and the Institute for Earthquake Engineering and Engineering Seismology. They are recognized not only at national level, but also internationally due to their publications, citations and international cooperation records.

During 2003-2006, the Ministry promoted and stimulated international cooperation in all fields



14. Science and Research in the Former Yugoslav Republic of Macedonia

of scientific RTD. This strategy produced a substantial increase in international scientific cooperation with many countries, and especially EU countries. This scientific cooperation has been achieved within the EC's 6th Framework Programme, with COST, NATO - North Atlantic Treaty Organization, UNESCO, International Atomic Energy Agency and Japan International Cooperation Agency. The increased participation of Macedonian scientists in the EC 6th Framework Programme is especially significant. According to our data, more than 50 projects involving Macedonian scientists have been approved, nearly five times more than in the 5th Framework Programme. The Department of Science at the Ministry of Education and Science is an active participant in two large and important multilateral projects in the 6th Framework Programme (SEE-ERA.NET and ERA-WEST-BALKAN), which are enabling the wider incorporation of the country in European activities in scientific R&D. Participation of Macedonian scientists in the COST programme during the last three years has also significantly increased, from five actions in 2003 to 25 in 2006.

The Department of Science creates European oriented science policy and, in every way possible, promotes, stimulates and assists in establishing international cooperation. Three years ago, there was bilateral project cooperation only with Slovenia and Germany. Similar cooperation has been established with Bulgaria, Serbia, Croatia, France, Albania, Russian Federation, Japan and China through more than a hundred bilateral projects. Further bilateral cooperation with USA, Israel, Austria and Spain is planned in the near future. There is an open call for joint project proposals with institutions from countries with which Macedonian institutions have not yet signed agreements for scientific cooperation.

All these activities are intended to facilitate the incorporation of Macedonian projects into European activities in the area of scientific research, recognized by the European Commission, which acknowledged Macedonian competence in this sector stating that in the fields of science and research the country should not have major difficulties in applying the *acquis* in the medium term.

Finally, the necessity to achieve full understanding, coordination and support among science policy makers and decision makers cannot be overstated: it is the only way that efficient and productive improvement in scientific RTD will be achieved.

15. Europeanization of the Romanian S&T System: How Far Has It Advanced?

Andreea Vass

15.1. Introduction

Despite the positive economic trend since 2000, Romania's innovation performance remains very weak compared to the other EU countries. However, the Romanian research and development (R&D) and innovation system is showing some signs of recovery. Recent policy initiatives have proved that Romania is strongly committed to reaching the Barcelona targets by 2010. Nevertheless, increasing public funding of R&D and innovation is not sufficient. We must focus on the efficient spending of this money, otherwise national resources will be wasted. In the struggle for Europeanization of the Romanian science and technology (S&T) system, public policies have mainly focused on strengthening human resource bases and research capacities in research institutes and universities, with few measures geared towards the development of innovative performance in industry. In this paper we focus on those obstacles related to economic performance and the gap with the EU, and the key challenges and objectives of the national innovation system with respect to public R&D intensity and business R&D and innovation intensity.

15.2. Romania's economic development and business environment

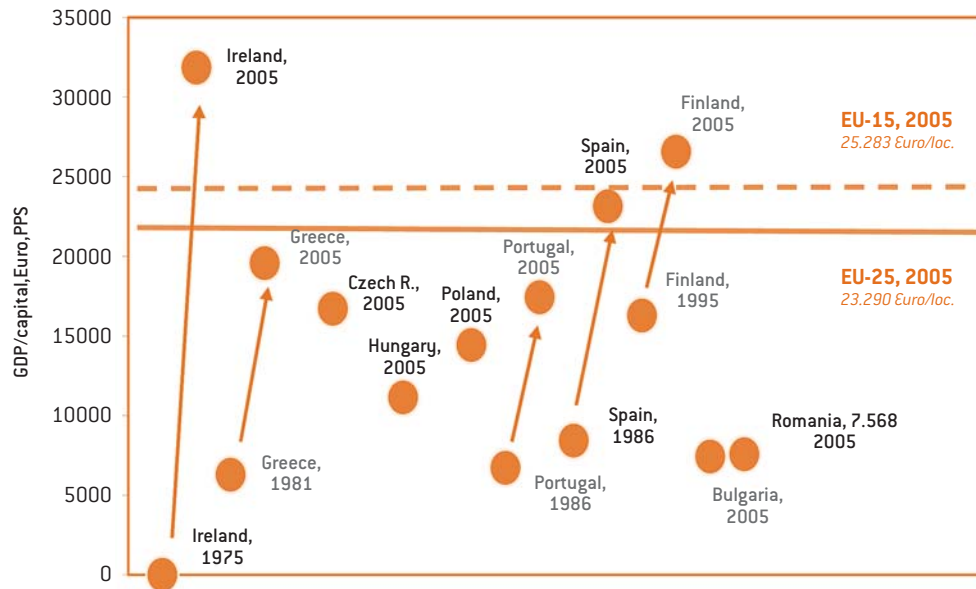
Romanian gross domestic product (GDP) per capita was estimated to be 36% of the European average (EU25) in 2006 at purchasing power standard (PPS), and 17% based on euros per inhabitant at market prices.³² This level of development is similar to that of Greece, Spain and Portugal in the 1980s, before they joined the EU (see Figure 15.1).

In 2006, Romania had one of the most stable economic environments in the Central and East European (CEE) region, highly favourable to economic growth, social development and foreign investment. This is likely to continue up to 2013, the years during which inflows of European funds are expected - €32 billion, to be matched by national funding resulting from co-financing and investments. At the same time, during this period we will see further structural reforms, but there may be problems in efficiently exploiting the funding and in building a knowledge-based economy in compliance with the new Lisbon criteria.

³² Calculations based on EUROSTAT statistics for 2006.

15. Europeanization of the Romanian S&T System: How Far Has It Advanced?

Figure 15.1: Economic gaps between Romania, the other new Member States and EU average, 2005



Source: Calculations based on EUROSTAT, 2006 data (purchasing power standards)

The Romanian government recently approved a draft budget for 2007 raising the consolidated budget deficit to 2.8% of GDP in a bid to increase spending to modernize the economy.³³ The increase in the budget deficit is based on 38% of GDP budget expenses (compared with 34.8% of GDP estimated for 2006) and 35.2% of GDP budget revenues (compared with 32.3% of GDP estimated for 2006), the highest levels in ten years. In terms of expenditure, record amounts have been allocated to education (5.2% of GDP), healthcare (4.1% of GDP) and R&D and innovation public funding (0.56% of GDP). Other areas that are receiving high levels of funding in 2007 are agriculture (2.3% of GDP compared to 1.8% of GDP in 2006). Some of this funding will come from the EU budget contributions (around 1% of GDP) and EU co-financing funds, high increases in public sector wages and a 21% increment for average pensions. Overall, the draft budget includes 6.6% of GDP for investment, the largest amount since 1990.

Conditions are generally favourable for medium and long term further economic development. Strategic investors are adjusting their perceptions of risk and are increasingly interested in Romania. Romania has also received votes of confidence from prestigious international institutions. The World Bank ranked Romania in 2nd place worldwide and 1st in Europe in terms of speed and quality of reform of the business environment. In 2006 the country was ranked 49th for ease of doing business, up 22 positions against the previous year, and 7th for ease of opening a business and entering the market. Moody's upgraded Romania's foreign currency long-term debt rating to Baa3 (which is the first investment level, on Moody's rating scale) -

³³ Proposal for the 2007 state budget, Romanian Government – Ministry of Public Finances, October 2006.

15. Europeanization of the Romanian S&T System: How Far Has It Advanced?

from Ba1 (the last non-investment grade on the same rating scale). In terms of foreign direct investment (FDI) performance, Romania ranks 24th among 141 countries, benchmarked by the UNCTAD 2006 World Investment Report, up 7 positions from the previous year; the main drivers have been the favourable legislative framework and the flat tax rate of 16%.

15.3. Key challenges and objectives of the national innovation system

The four main challenges to public and private R&D intensity in Romania identified through SWOT – Strengths, Weaknesses, Opportunities and Threats - analysis by the National Innovation Governance System (EC 2005) in Romania are related to:

- deficiencies at decision-making level;
- deficiencies in R&D and innovation programme management;
- low R&D and innovation intensity, i.e. low public funding of R&D vs increasing costs of R&D equipment; drastic reduction in in-house business R&D; limited financial freedom; deficiencies in R&D and innovation programme management;
- early stage of development of technology transfer and innovation infrastructure and diffusion mechanisms – which results in low visibility for Romanian research, weak correlation between R&D and innovation and industrial policy and lack of a system of policy evaluation.

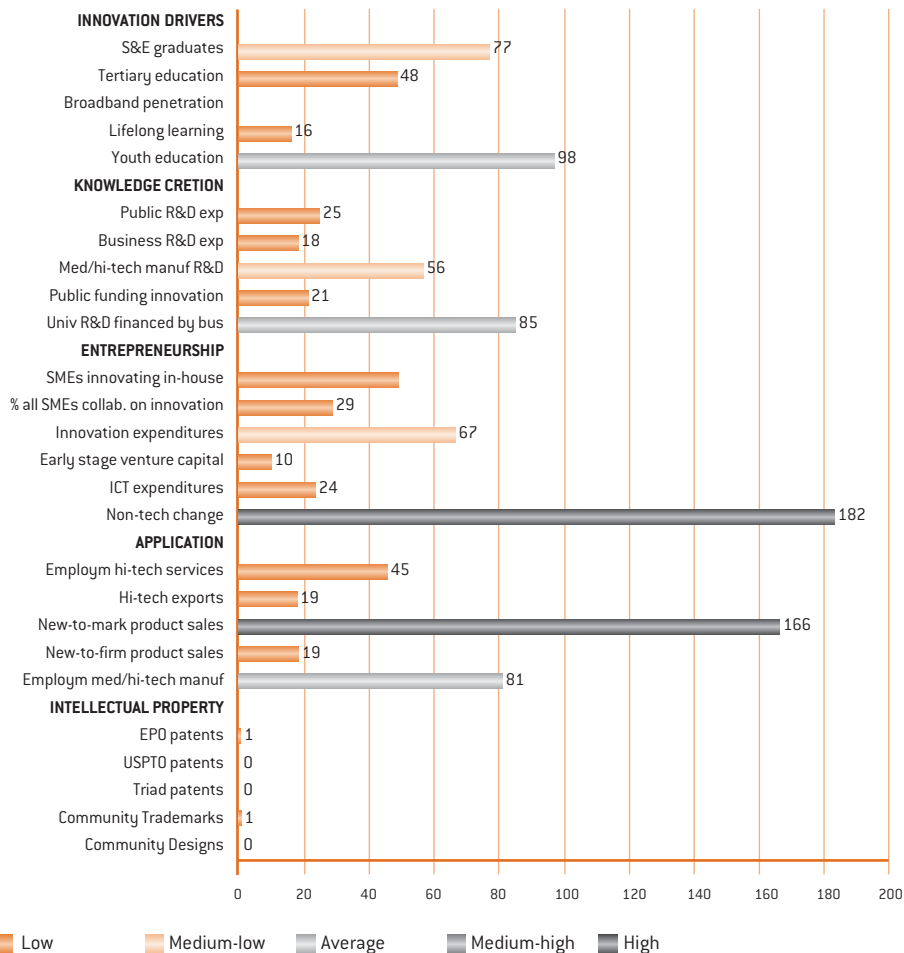
In 2005-2006, the innovation governance system in Romania was faced with a mix of positive developments, such as the decentralization of the decision-making system and externalization of the R&D and innovation management system, improvements in the innovation legal framework, consolidation of the R&D system and slow down of the brain drain, and problems arising from effective implementation either at the decision-making level or at the programme management level. Much still remains to be done in order to promote innovation, to make Romanian R&D more responsive to the needs of the economy and to enhance the integration of Romanian researchers into international networks and programmes, particularly at EU level.

Despite the favourable evolution of some national innovation system components and the policy making efforts to design an innovation system compatible with European requirements, its performance is still poor (Figure 15.2).

According to the European Innovation Scoreboard (EIS 2005), Romania ranks 32nd out of 33 countries on the Summary Innovation Index (SII). Only two indicators are above the EU average: percentage of small and medium sized enterprises (SMEs) that have introduced non-technical change and sales of new-to-market products. Romania performs very poorly for innovation drivers and knowledge creation, and poorly for innovation and entrepreneurship, and applications (Figure 15.2).

15. Europeanization of the Romanian S&T System: How Far Has It Advanced?

Figure 15.2: Romania's innovation performances relative to the EU average, 2005



Source: European Trend Chart on Innovation (EC 2005)

Romania is ranked low for all five categories of indicators relating to different dimensions of innovation performance: innovation drivers as a measure of the structural conditions required for innovation potential (30th), knowledge creation measuring investments in R&D activities (32nd), innovation and entrepreneurship, which measures the efforts towards innovation at firm level (30th), application as a measure of performance expressed in terms of labour and business activities and value added in innovative sectors (27th), and intellectual property, which measures the results achieved in terms of successful know-how (33rd). Its worst performance is for intellectual property rights (IPR), with almost no US Patent and Trademark Office patents and no Triad patents.

Romania's best performance is for innovation drivers; the supply of new Science and Engineering (S&E) graduates doubled between 1998 and 2003 due to expansion in private universities.

15. Europeanization of the Romanian S&T System: How Far Has It Advanced?

There was a slight fall in the proportion of the population in 2002 and 2003 with tertiary education, which could be due to emigration. One discouraging sign is a gradual decline in the youth education attainment level, although it was 98% of the EU average in 2004. Public R&D expenditures have increased from 0.07% of GDP in 2000 to 0.38 % of GDP in 2006, but conversely business R&D declined from 0.26% of GDP in 2000 to 0.21% in 2004 (National Institute of Statistics 2005: 474). Consequently, the main challenge for the Romanian national innovation system is the development of knowledge and innovation capacity and performance, and making Romanian R&D and innovation more responsive to economic and social needs.

Romania also needs to substantially improve levels of lifelong learning in order to create the skills required within the workforce to adopt new technologies. Romania needs to increase the level of its information and communication technologies (ICT) expenditures, which accounted for only 1.5% of GDP in 2004. In addition, the share of SMEs that cooperate on innovation projects and the percentage of firms that receive support for innovation projects must be increased (EC 2006).

The innovative profile of Romanian firms is still very poor. New technologies to a large extent are based on imports and FDI, and many productive enterprises are engaged in assembly in the sub-contracting sector. In 2005 only 19% of Romania's active enterprises were innovative (13% of small enterprises and 21% of medium-sized companies), and fewer than 2% of SMEs are involved in cooperation with foreign companies. R&D activity is not the main source of innovation:

- approximately 3% of the total turnover of innovative enterprises is oriented towards innovation expenditure;
- 53% of technological innovations are in the form of new machinery and equipment (of which SMEs represent 59%).

Thus, innovative firms account for less than a fifth of the country's total number of active firms and workforce, but for about 42% of the total turnover of active firms (National Institute of Statistics, CIS 2004).

Levels of European Patent Office patenting and business R&D are very low, which is related to the low innovative potential of Romanian firms, the strong tendency to import foreign technology and equipment, poor demand for domestic R&D and a predominant orientation towards trade and services. In 2005 Romania submitted only 50 international trademarks, compared to the Czech Republic with 500 and Hungary with 400.

We can conclude that the four main challenges related to business R&D and innovation intensity are:

- the very low level of public funding of innovation, with only 10% of innovative firms receiving funding;
- the very low level of innovation expenditure, which is less than 3% of the turnover of innovative firms;

15. Europeanization of the Romanian S&T System: How Far Has It Advanced?

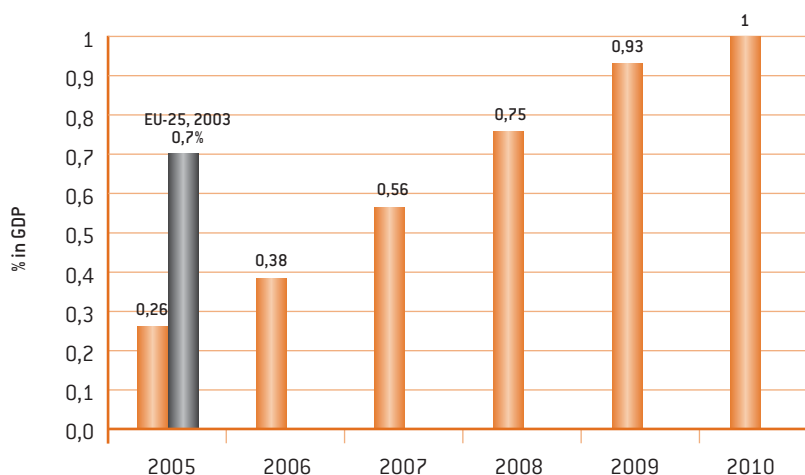
- the weak innovation culture in the country - although significant progress has been made to foster it;
- weak application of R&D results by business and the urgent need to turn innovation into a driver of national competitiveness.

The 2005-2008 government programme defined four major innovation objectives and several implementation measures:

- new technology transfer mechanisms for forging long-term partnerships between the R&D sector and industry;
- increased public R&D expenditure to 1% of GDP by 2010, and stimulation of private sector R&D to 2% of GDP;
- strengthened institutional capacity;
- restructuring of the R&D sector.

Increasing the public budgetary resources assigned to R&D is an important challenge for Romania and seems achievable according to the medium-term fiscal and financial programming (see Figure 15.3). But how the Romanian private sector will achieve the 2% of GDP for R&D and innovation is uncertain (see Figure 15.4) and has no coherent policy-mix foundation.

Figure 15.3: How will public R&D intensity reach the Barcelona target?

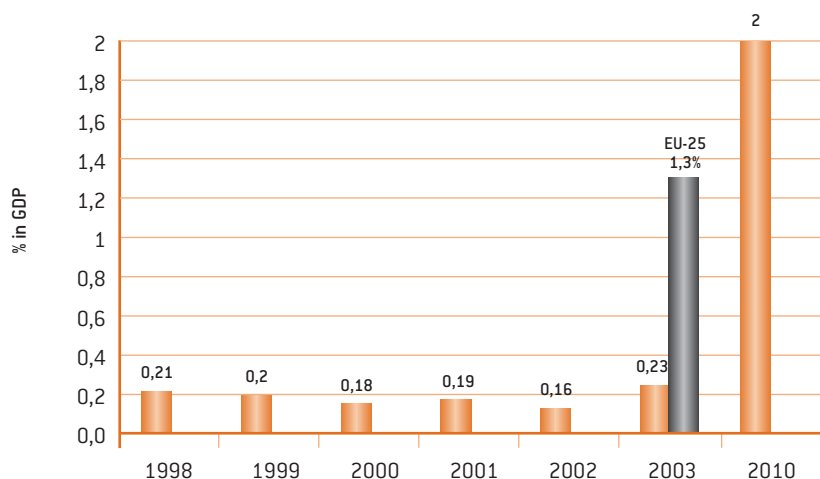


Source: Author based on the data projections of the Ministry of Education and Research – National Authority for Scientific Research, in accordance with the Law 379/2005 of the state budget and the Medium-term Fiscal Management Strategy, 2006

After a long period of declining R&D intensity (from 1% in 1990 to 0.39% in 2004), the National Authority for Scientific Research (NASR) has firmly undertaken to increase the total expenditure for research in order to catch up to the objective established by the revised Lisbon Strategy. The system of public funding of R&D has gradually become competitive, open to all institutional actors irrespective of in which sub-system they are active, with multi-annual financing.

15. Europeanization of the Romanian S&T System: How Far Has It Advanced?

Figure 15.4: How will business R&D intensity reach the Barcelona target? (BERD as share of GDP)

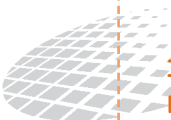


Source: Author based on data provided by the Ministry of Education and Research – National Authority for Scientific Research, 2005

In 2004, public funding facilitated 20,630 research projects. The distribution of projects by type of R&D programmes shows an increased weight of projects related to industrial production and technology, and to fundamental research (NASR Annual Report 2005). A major weakness results from the concentration of research potential in the area of Bucharest-Ifov, which has a share of 57.33%.

Romanian GERD consisted of 45.7% public expenses, 44.0% private and 5.5% foreign expenses – the private contribution to R&D and innovation is less than two-thirds of GERD (NIS 2005: 474). Major weaknesses in the Romanian innovation system are also related to the quality of the science base and the poor technology transfer infrastructure. Most companies do not conduct R&D in house and do not exploit the results of research from R&D institutes and universities. The National Plan for R&D and Innovation encourages partnerships between researchers in the public sector including universities, and private companies. The Plan also focuses on SMEs. The great challenge for Romania is how to direct R&D outputs towards SMEs and also the R&D departments of bigger companies, and possibly through them, to the best research institutes.

Finally, Romania found it difficult to get more out of the 5th and 6th EU Framework Programmes than it contributed. For the coming years, another challenge will be the need for efficient utilization of European structural funds.



15. Europeanization of the Romanian S&T System: How Far Has It Advanced?

15.4. Current interactions between direct and indirect R&D and innovation policy instruments

The present national R&D and innovation objectives and policy instruments in Romania take account of the following policy-making processes for the period 2007/13:

- the preparatory process for the future National Plan for R&D and Innovation for 2007-2013;
- the development of integrated national level technological platforms with a view to their integration in similar platforms at EU level;
- elaboration of the National Development Plan for 2007/2013, whose main priority is growth of economic competitiveness and development of a knowledge-based economy, in which the role of R&D and innovation is considered of major importance;
- the government-driven process supporting overall improvement to the business environment.

Although we expect consistent and positive outcomes from this integrated policy-making approach in the near future, it should be emphasized that after 1990 direct and indirect R&D policy instruments to a large extent will be disconnected. The R&D and innovation policy-making learning process reached maturity in 2005, when a coherent national R&D and innovation policy, accompanied by an indirect measure, became a reality and produced several concrete results.

The increase in public funding of R&D and innovation from 0.26% of GDP in 2005, 0.38% in 2006 to 0.56% in 2007, and of education from 0.39% in GDP in 2005 to 0.5% in 2006 and 0.55% in 2007, are the most positive outcomes of the change in the government's medium-term financial expenditure strategy, after 15 years of chronic under financing of R&D and innovation in Romania.

In 2006, public R&D and innovation funds were managed by three main categories of institutions (see annex 1):

- Ministry of Education and Research, through its National Authority for Research, development and Innovation – 81%; out of the total Ministry funds 95% were allocated on a competitive basis, 2.5% as grants and 2.5% as capital expenses and management;
- all the other ministries dealing with the specific sectoral research programmes – 10.2%;
- Romanian Academy – 8.2%.

Increased funding does not automatically result in greater R&D and innovation efficiency, growth in productivity and/or average national competitiveness. These funds must be allocated carefully. For example, public policies have been focused on strengthening the human resources and research capacities of research institutes and the university sector rather than on the development of innovative performance in industry. Unless reform of both the public research and the education systems is speeded up and directed towards market needs and European standards, and towards a wages policy that justifies performance, there will be no positive outcomes in terms of Romanian R&D and innovation productivity.

15. Europeanization of the Romanian S&T System: How Far Has It Advanced?

One of the new policies of the Romanian Ministry for Education and Research is related to improvement of the R&D infrastructure. Between 2000 and 2004 the National Plan for R&D and innovation, the main competitive instrument for financing R&D, included a specific component dedicated to development of centres of S&T excellence in priority areas. This included identifying existing pillars of excellence, and based on the development strategies elaborated by these centres, provided financial support of 30% of the cost of equipment and instruments. This initiative financed research teams in 30 (out of 700) R&D institutions. Five of these R&D institutions are also involved in the development of centres of excellence in the EU candidate countries under the EU 5th and 6th Framework Programmes. Starting in 2001, the Romanian National University Research Council became responsible for the evaluation and certification of research centres in higher education institutions, within the centres of excellence programme, based on criteria such as: research capacity, scientific competence and research performance (no funding involved). This process has identified 29 centres of excellence in universities.

Collaborative R&D involving enterprises and universities/R&D institutions is at a low level. The main cooperation framework between the research and productive sectors consists of the national R&D and innovation programmes and direct orders - R&D and innovation procurement. The main national programmes for promotion, support and enhancement of cooperation between research units and the productive sector are the National Plan for R&D and innovation (1999-2006), and the Programme Research of Excellence (2005-2008). The co-financing funds from enterprises represent about 30% of the total budget of the National Plan for R&D and innovation.

One factor undermining the progress of R&D and innovation expenditure in Romania is the absence of a legal framework and financial instruments to stimulate research activity, the application of research results to the economy (i.e. risk capital funds for high-technology start-ups and spin-offs), and tax incentives to foster innovation activities in enterprises. Unfavourable financing conditions have been compounded by the rather high level of spread between the interest on loans and new deposits of 13.2% (World Economic Forum 2006).

Most R&D is performed in the research institute sector. Most of these organizations are sector based and perform applied R&D. Many of them are state-owned and recipients of major R&D grants (CREST 2006). Industry performs very little R&D, and what there is involves mainly low-to medium-technology and is not geared to innovation. Only 10% of innovative firms receive funding (400, of which 306 are SMEs). Signs of recovery are present, e.g. business R&D and innovation intensity increased from 0.21% in 2004 to an estimated 0.42% in 2006.

It must be remembered that a highly relevant indirect R&D and innovation instrument with positive impacts on private R&D and innovation intensity, which should boost this recovery in the future, is the new fiscal code. This established a flat rate tax of 16% on profits and revenues (from 25%-45% in 2004), and to a small degree reduces the social insurances burden on the labour market in annual increments (from 49.5% in 2004, to 45% in 2007, and 42% in 2013). The relevance of this measure for R&D and innovation intensity can be translated as more funds being available for business players to be in charge of decision-making for future invest-



15. Europeanization of the Romanian S&T System: How Far Has It Advanced?

ments, within which R&D and innovation are important. The positive effects will become more obvious in the medium and long run.

The EU accession process has made it a major objective for Romania to focus on the development of a more dynamic and competitive economic environment, able to assimilate and develop high technology and to respond to strategic demands for long term development. Romania has oriented its efforts towards SME development and towards the National Export Strategy, which gathers direct and indirect R&D and innovation instruments and enhances them in order to boost SME competitiveness and export capacity. The positive outcomes have been rather small, but are becoming more evident in terms of bridging the technological and competitiveness gaps and in terms of higher export value added.

In a recent survey related to SMEs' competitiveness, the propensity to innovate was shown to be very low (National Agency for Small and Medium-Size Enterprises and Cooperation 2006). Only 1% of Romanian SMEs are developing their own information technology (IT) systems and their own R&D and innovation activities and capitalizing on R&D and innovation results that have not been previously developed in the market. This demonstrates that the measures described above are having only a small impact in terms of the business environment, which is reluctant to make large investments where only small increases in turnover are achieved. This is strategic management based on quantitative expansion, and only later on performance. Even though the average levels of turnover and the assets of Romanian SMEs are similar to those of European firms, SME intensity per 1,000 inhabitants in Romania is half that of the EU25 (26 SMEs in Romania against 50 SMEs in EU per 1,000 inhabitants, in 2005).

Young people are poorly represented in entrepreneurial initiatives, despite the existence of national programmes, such as START, which targets this group. Only 2% of current SMEs are based on the professional backgrounds of entrepreneurs or on development of innovative ideas. Regional development policies have not been successful in overcoming the very high disparities at national level. Investment attractiveness is almost five times higher in Bucharest and environs (with an agglomeration of 53 SMEs in Bucharest-Ilfov per 1,000 inhabitants) than in Muntenia, Oltenia or North of Moldova (with counties such as Vaslui or Botosani with less than 11 SMEs per 1,000 inhabitants).

The technology transfer and innovation infrastructure, i.e. the organizations specialized in the dissemination, transfer and valorization of R&D through the economy, is still poorly developed. The development and consolidation of the technology transfer and innovation infrastructure is an important objective of government R&D policies and could provide a very favourable framework for strengthening the partnership between enterprises, universities and research institutions, for stimulating research demand and the development of in-house R&D departments in enterprises (especially high technology firms), and supporting the setting up and development of innovative enterprises in advanced technologies to increase their numbers. Establishment of technology transfer and innovation entities showed a slight increase after the 2003 decision on set-up, evaluation and certification. In 2006, there are 26 functional and certified organizations. To stimulate innovation based on absorption of R&D results, and to strengthen partnerships between research institutes, higher education institutions and industry partners, the setting up S&T parks has been encouraged. There are seven S&T parks planned, to be locat-

15. Europeanization of the Romanian S&T System: How Far Has It Advanced?

ed in Galati, Braila, Slobozia, Brasov, Bucharest, Timisoara and Iasi, of which three (those in Galati, Iasi, and Brasov) were operational in 2004. The National Programme Development of Technology Transfer and Innovation Infrastructure – INFRATECH, approved in 2004, is the main instrument providing financial and logistical support for the establishment of specialized technology transfer and innovation institutions, including S&T parks.

In Romania 12% of exports are based on high technologies, compared to the world average of 30% and the European average of 20% (European Central Bank 2005). Romania has significantly improved its trade competitiveness with the EU, but its export structure was still dominated in 2005 by low (54%) and medium technologies (34%), reflecting the limited capacity of Romanian companies to innovate in the development of products and services. Eighty-three per cent of companies are non-innovative, 3% are strategic innovators and 2% of companies implement new technologies. There is little innovation and, as a result, there are few industries using new technology intensively. Rather than focusing on exporting cars, computers, equipment, ecological/agricultural products, tourism and services to achieve economic growth, Romania has relied on exports of footwear and clothing (still the largest weight in Romania's export volume), i.e. the emphasis has been on low labour costs and primary resources.

A well trained, specialized and skilled labour force is a current market requirement for high-technology sector development. It can only be achieved by reconfiguring the content and priorities of the academic curricula and by implementing serious reform of the higher education system, starting with a major upgrade in the competencies of academic staff.

Privatization is continuing at a slow pace and achievements have fallen short of government targets. Some progress has been made in the restructuring of the energy, mining and transport sectors. The Authority for State Assets Recovery is under direct control of the Romanian Government. Its privatization plan involves 120 companies. Privatization of the institutes of R&D from the AVAS portfolio began in September 2005. Of the 120 organizations in the AVAS portfolio targeted for privatization, 17 are research institutes (AVAS 2006). The main priority must be to maintain and develop their research activities and retain current cohorts of researchers. In privatizing these trade companies, given the importance of the research institutes within the framework of the national economy, AVAS must take account of strategic criteria and economic criteria, which are related to the opportunities arising from the transformation to private ownership.

The rate of privatizations and liquidations must be increased in order to meet the revised target for privatization from end-2006 to end-2007. Substantial progress will be required to eliminate persistent losses and reliance on direct and indirect subsidies in large parts of the sectors. The largest share of state aid is still oriented towards the restructuring of state-owned companies - 74% in 2004, with a small proportion to R&D and innovation.

In 2005, the volume of authorized state aid was RON³⁴4.2 billion, a considerable decrease on the previous year (Competition Council 2006). State aid authorized in 2005 represented only

³⁴ Romanian New Lei.



15. Europeanization of the Romanian S&T System: How Far Has It Advanced?

38% of the total value of aid payments authorized in 2004. In summary, the evolution of state aid reflects:

- a significant reduction in the weight of state aid for rescue and restructuring of firms in difficulty, from 74% in 2004 to 25% in 2005;
- a significant increase in the value of state aid provided to compensate certain enterprises for the provision of services of general economic interest, from 17% in 2004 to 44.3% in 2005;
- a significant increase in the share of R&D state aid in total state aid, from 0.1% in 2004 to almost 15% in 2005.

15.5. Conclusions

The current R&D policy mix in Romania is a mosaic of somewhat arbitrary policies, some of which are complementary, some totally inefficient, but all too often they are overlapping. For the next few years, policies other than those directed towards the research sector, should increasingly take into account the possible impact on R&D and innovation.

It appears that policies outside the R&D domain have had a generally negative impact until 2004. After this time, the significant shifts undertaken in public policies, under pressures from European standards, had a mixed impact on R&D policies. Overall, the net effects on public and private spending on R&D have been positive although at a still low level in comparison with other European countries.

There have been positive impacts in terms of the macroeconomic conditions and a strategic government vision that favours increased public spending on R&D and education in the current budget; greater fiscal relaxation and tax reform; competition policies and zero tolerance of corruption; increased FDI; business environment reform; reduction in bureaucracy and speeding-up of public administration reform; public-private cooperation in drafting and implementing a national export strategy and the other public policies introduced in 2006; and European integration.

The effects of industrial policy have been fairly neutral for SMEs and regional policy instruments that indirectly affect R&D intensity. There are some components that may however have stimulated the R&D intensity of a few actors in the business sector.

The unfinished and late privatization process has had negative effects on education reform, lifelong learning and human resource policies; restructuring of the public R&D and innovation sector and increased cooperation between industry, research and universities; and the very small role of the private sector in public R&D and the innovation decision-making process in Romania.

This situation must change in the future if a healthy business environment is to be achieved. Romanian producers can no longer rely on a cheap and/or low-skilled labour force. The government seems to have recognized the need for the development of a knowledge society and R&D activities.

15. Europeanization of the Romanian S&T System: How Far Has It Advanced?

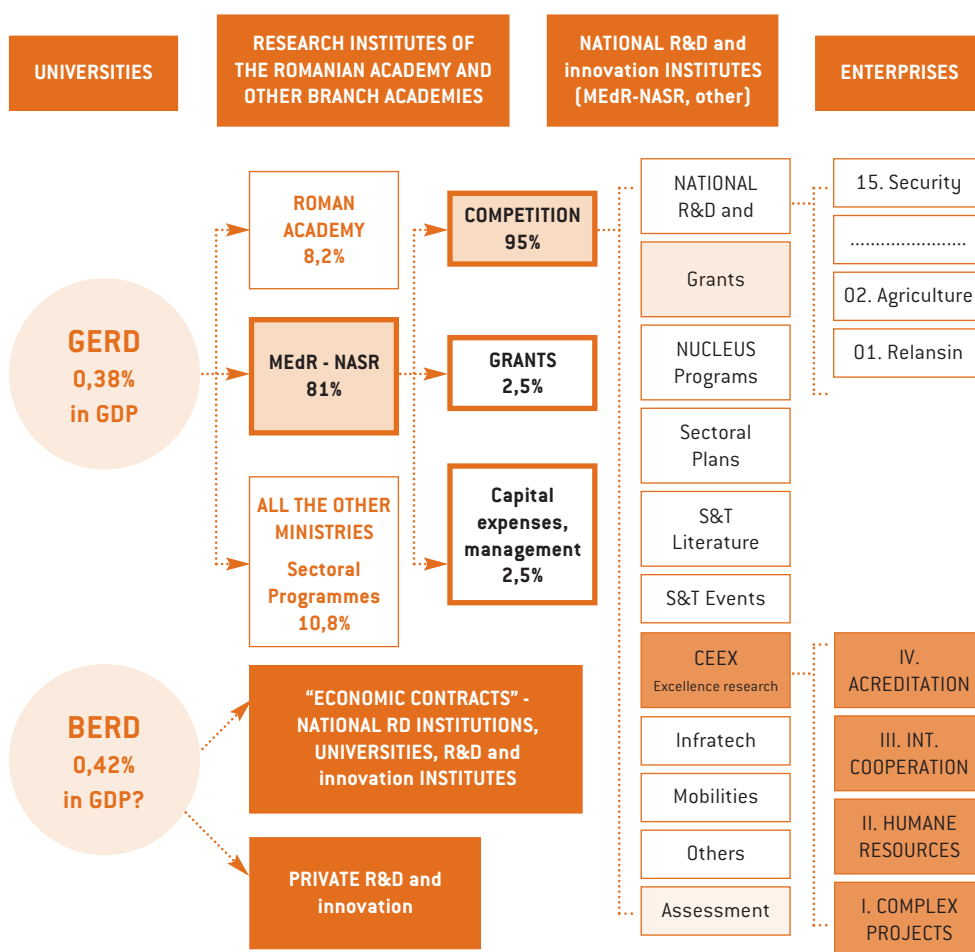
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15. Europeanization of the Romanian S&T System: How Far Has It Advanced?

Annex I - Institutional framework, direct R&D and innovation policy instruments and financial allocations in the Romanian R&D and innovation system, 2006

R&D and innovation system in Romania, 2006



Note: RELANSIN is "Relansare Economica prin Cercetare si Inovare"(the Economic Relaunching through Research and Innovation) project

Source: Ministry of Education and Research – National Authority for Scientific Research, 2006

16. Science and Technology System in Serbia: Between Survival and Restructuring

Đuro Kutlača

16.1. Introduction

Previous research (Radosevic 1999; GFF 2006) has shown that research and development (R&D) systems in South Eastern Europe (SEE) during the transition period failed to contribute to a faster and more efficient transformation from central planning to a market economy. This paper analyses the influence of the organization of the R&D system in Serbia on this country's economic development. Changes within the R&D system since 1991 are of particular interest, because of the fact that there were no government actions directed toward changes in the R&D system during that period. The paper is organized in three parts. The first - Science and innovation in Serbia: country perspectives - addresses the historical development of the R&D system in Serbia, from 1980 to 2004. The second - Main changes: silent transition of the Serbian R&D system - looks at the key challenges for science and innovation policies in the Serbian' economy and the third examines science and technology (S&T) and innovation policy in Serbia and variance from best practice models. The last section provides some concluding remarks and proposes actions that the authorities should introduce and manage in order to restructure the country's R&D system.

16.2. Science and innovation in Serbia: country perspectives

The changes in the S&T system in Serbia from 1980 to 2004 can be characterized by several trends/characteristics (see also Figures 16.1, 16.2 and 16.3) (Kutlača and Lazić 1998; Kutlača 2004; Kutlača 2005a, b):

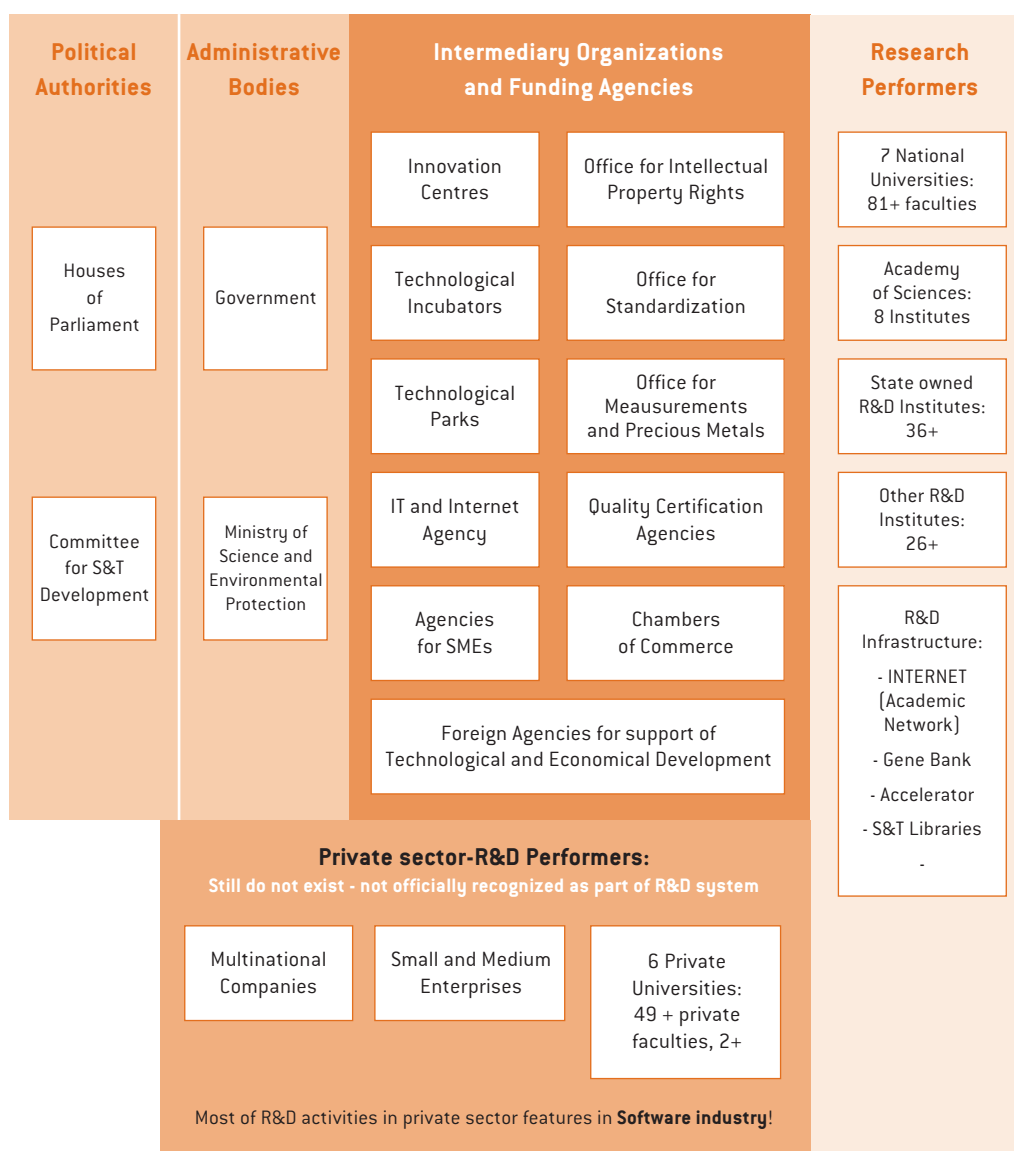
- the number of R&D organizations decreased between 1980 and 2004 (from 375 to 163);
- the number of R&D organizations in the business enterprise sector (29 in 2004 and 57 in 2004) is consistently less than the number of independent (government) institutes;
- income from R&D activities has decreased – in 2004 this share was only 21.6% of R&D organization' total income. Although there is no official government policy towards restructuring of the R&D system, it is obvious that R&D organizations are in a process of spontaneous transformation, searching for all possible sources of income, performing activities usually without R&D content, i.e. we can conclude that a process of 'silent' transition is a main ongoing characteristic of R&D in Serbia (see Figure 16.1);
- the total number of employees in the R&D sector decreased up to 2001 (from 34,758 in 1987 to 19,415 in 2001). Since then, this number has been increasing (22,485 in 2004);
- the distribution of researchers between sectors in Serbia does not mirror the OECD countries (see Table 16.1); in the OECD member countries researchers are concentrated in the busi-

16. Science and Technology System in Serbia: Between Survival and Restructuring

ness enterprise sector, but in Serbia this is the weakest sector within the R&D system. In other words, R&D in Serbia is performed **for** industry; R&D in OECD member countries is performed **in** industry;

- the private sector is still weak and barely integrated with the public R&D system. Also, private universities and faculties are mostly only educational;
- organizations, with very few R&D activities (see Figures 16.1, 16.2 and 16.3 and Table 16.1).

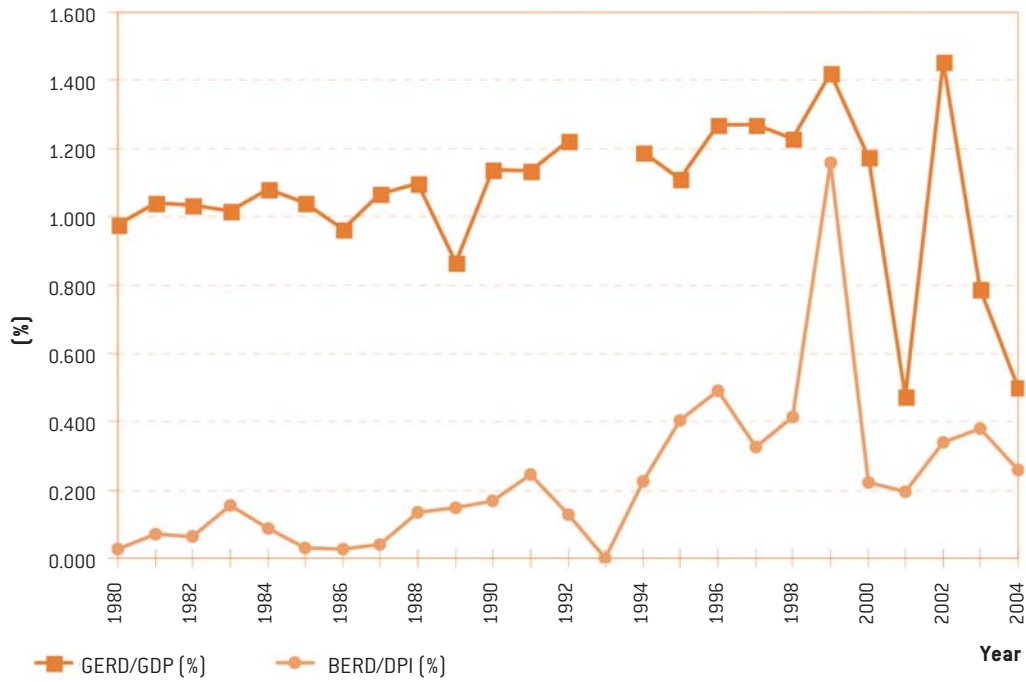
Figure 16.1: Structure of Science, Technology and Innovation system in Serbia



Source: Based on ENIP-PRIME NETWORK model of STI system [Kuhlman, 2003; PRIME, 2003].

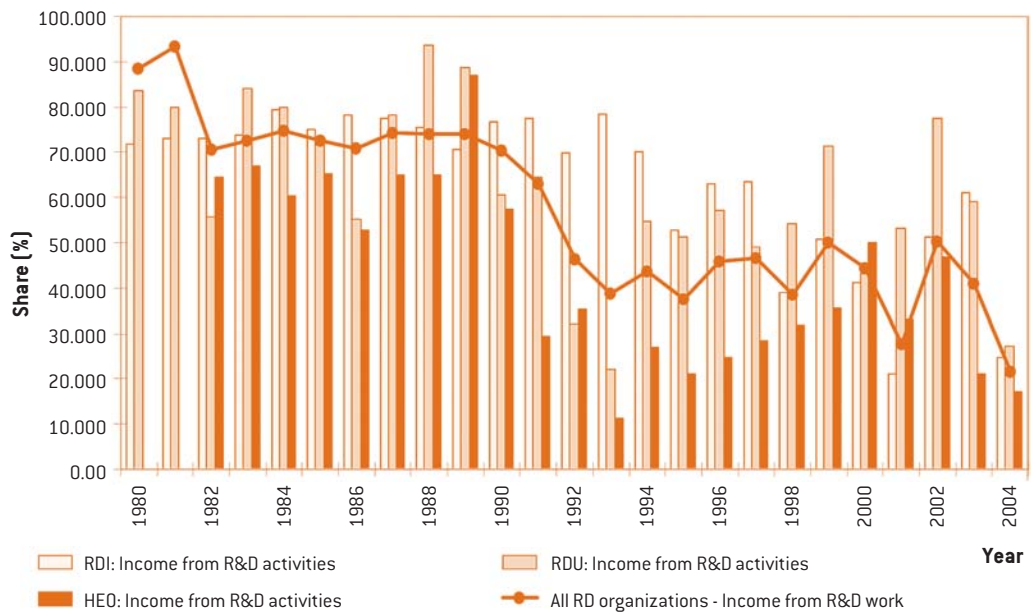
16. Science and Technology System in Serbia: Between Survival and Restructuring

Figure 16.2: GERD and BERD in Serbia, as % of GDP in period 1980–2004



Note: GERD = Gross expenditure on R&D; BERD = Business expenditure on R&D

Figure 16.3: Income from R&D activities in R&D organizations in Serbia 1980–2004



Note: RDI: R&D institutes, RDU: R&D units, HEO: Higher education organizations



16. Science and Technology System in Serbia: Between Survival and Restructuring

Table 16.1: Researchers by sectors of performance, year 2001

	Business Enterprise Sector	Government Sector	Higher Education Sector
OECD average	64.60%	8.8%	26.30%
Serbia	6.37%	18.8%	74.83%

16.3. Key challenges for science and innovation policies in the Serbian economy

Following years of war and destruction of the economy, the transition period and structural changes in the economy, science and innovation policies in Serbia face a number of challenges. The first is the problem of very low level of national innovation capacity (Kutlača 2005b). Although it is very difficult to identify S&T and innovation performance indicators for Serbia that are comparable with EU standardized measurement approaches, such as innovation scoreboard indicators (EC 2005), for the comparison in this paper two dimensions of national innovation capacity are calculated: absorptive capacity and R&D supply (see methodology and definitions of dimensions of national innovation capacity and individual indicators for each particular dimension in Radosevic 2004). The other two dimensions - diffusion and demand for R&D and innovation are not calculated because of missing values for the majority of individual indicators. Comparisons are made with the following provisos. Data for EU member countries are for the year 2000; data for Serbia are for the year 2004 because of rather unstable conditions in that country during the 2000-2003 period (war and post-war turbulence, i.e. the economy stabilized in 2004).

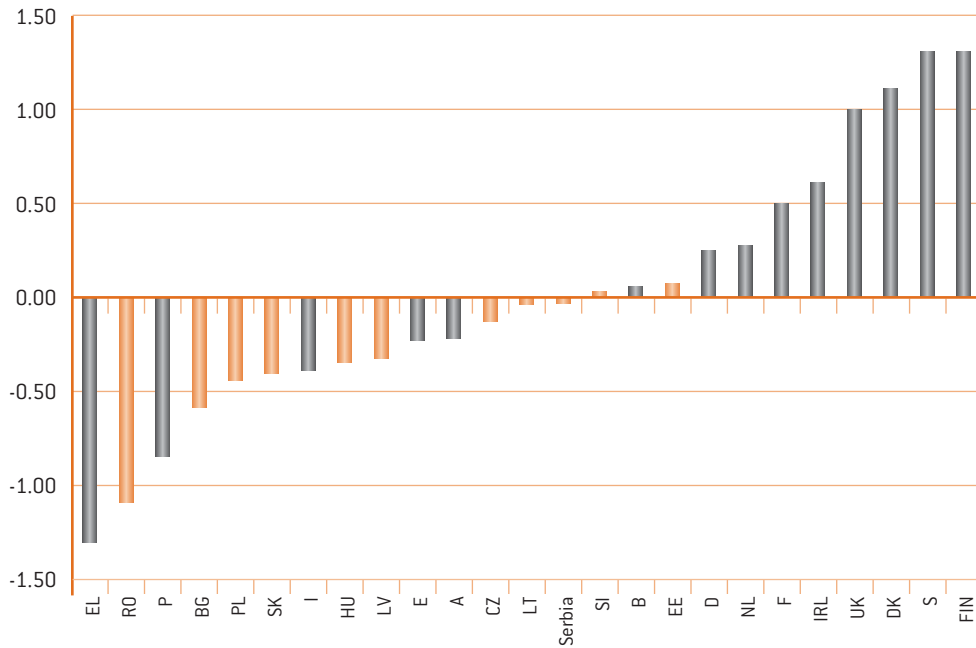
Absorptive capacity in Serbia can be said to be satisfactory based on the very small differences with the EU average (see Figure 16.4), and is better than the situation in half the EU member countries, and better than that in most of the new Member States. R&D supply in Serbia is very low compared with the EU average (see Figure 16.5), and, together with Romania, is the worst in the EU member countries as a whole.

Another challenge is the brain-drain. Serbia is suffering a major brain-drain which began during the 1990s because of war and the political instability in country and has continued. Although the number of officially registered (a requirement of the Science Law) researchers in the country has remained stable, the absence of middle-aged researchers is notable. This is the generation of researchers that would be expected to become mentors for new and young researchers, and managers of complex R&D projects and activities.

There is an imbalance between R&D outputs: increase in basic research outputs, but weak applied research and technology development (R&TD) outputs. Tables 16.2 and 16.3 provide evidence of the structural inefficiency of the S&T and innovation systems in Serbia. There has been an increase in the number of scientific articles and technical papers in refereed international S&T journals and the still very low number of domestic patent applications. This is further confirmation of the concentration of R&D potentials in basic, rather than in applied sciences, and technology development (see also Table 16.1).

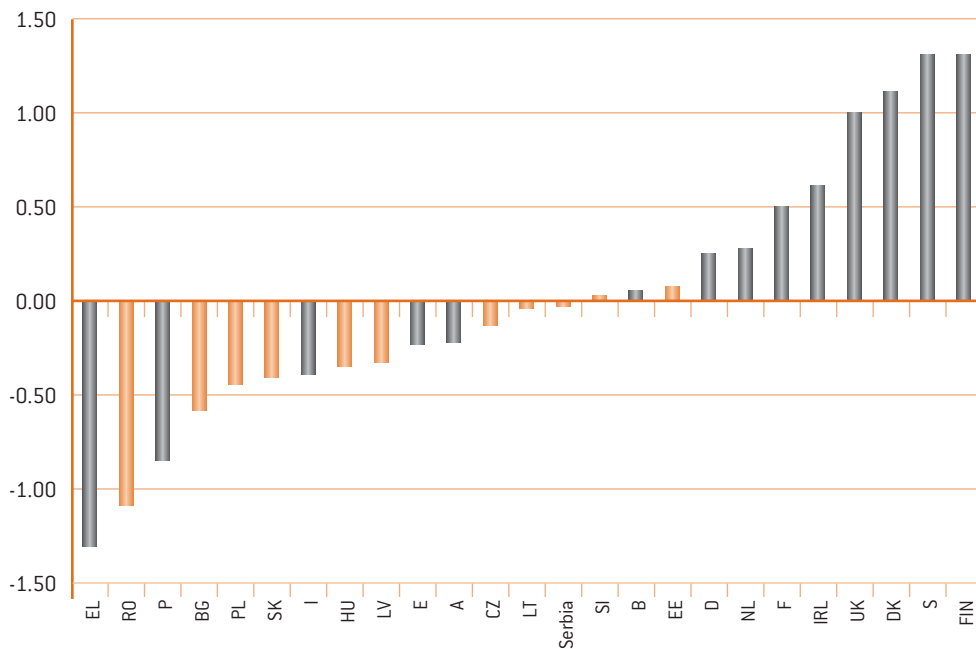
16. Science and Technology System in Serbia: Between Survival and Restructuring

Figure 16.4: Absorptive Capacity – Aggregate Indicator for EU member countries (for year 2000) and Serbia (for year 2004)



Source: based on Radosevic (2004).

Figure 16.5: R&D supply – Aggregate Indicator for EU member countries (for year 2000) and Serbia (for year 2004)



Source: based on Radosevic (2004).

16. Science and Technology System in Serbia: Between Survival and Restructuring

Table 16.2: Authors from Serbia – Production of R&D papers in international refereed S&T journals

Year	2000	2001	2002	2003	2004	2005
Number of scientific articles	1023	990	1011	1163	1410	1594
Number of technical papers	1177	1124	1298	1372	1782	2036
Total number of articles	2200	2114	2309	2535	3192	3630

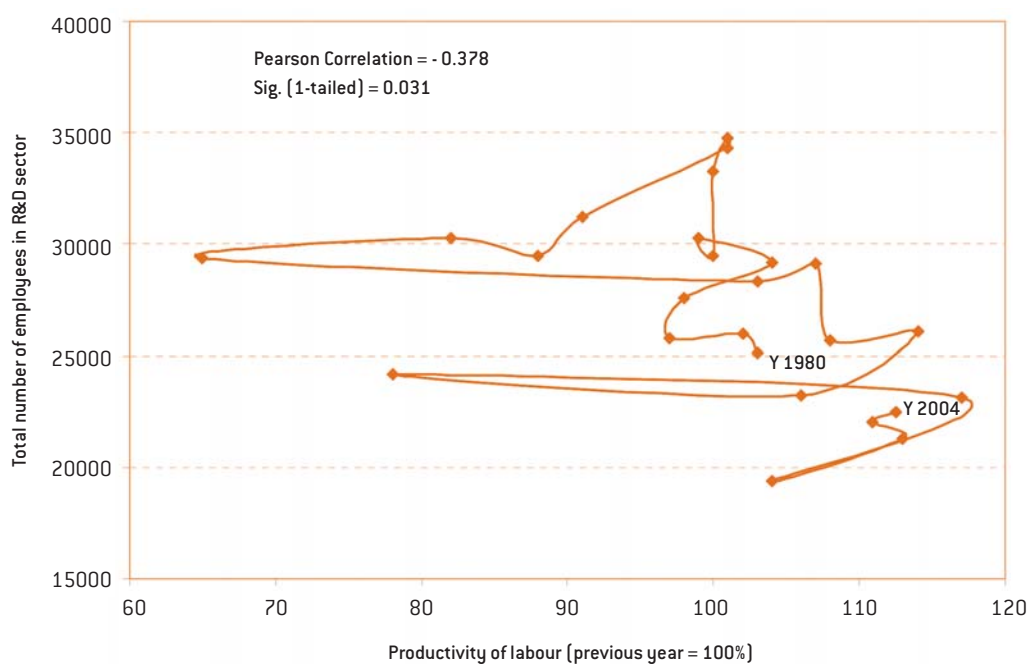
Source: Based on National Library of Serbia and WOS – Web of Science.

Table 16.3: Resident patent applications in Serbia: distribution by applicant type and total patent applications in country

Year	Number of patent applications:			Total
	Individuals	Companies	R&D organizations	
1999	219	10	6	235
2000	280	18	4	302
2001	331	15	3	349
2002	325	21	4	350
2003	330	15	8	353
2004	448	15	6	469
2005	351	14	4	369

Source: IPG, 2006.

Figure 16.6: Correlation between labour productivity of economy and total number of employees in R&D sector in Serbia



Source: SOS (1980-2005).

16. Science and Technology System in Serbia: Between Survival and Restructuring

The decreasing share of income from R&D activities in the total income of R&D organizations and the increasing number of scientific articles could be rather misleading. The criterion for evaluation of (successful) R&D performance, both for individual researchers and for research projects/organizations is number of published scientific articles, i.e. evaluation is higher when this number is bigger. A poor evaluation could result in the cancellation of financing from the Ministry of Science and Environmental Protection. Therefore, researchers are motivated to concentrate on the publication of scientific articles as the main objective of R&D to the detriment of other results.

Additional analysis of the correlation between labour productivity and gross expenditure on R&D (GERD) in Serbia during 1980-2004 period (see Figure 16.6; Pearson Correlation: -0.227 ; significance [1-tailed]: 0.142756354) supports various theories. First, that in Serbia the R&D system makes practically no contribution to the economic development of the country and second, that the R&D system exists independently of the needs of the Serbian economy.

16.4. S&T and innovation policy in Serbia: How far is it from best practice?

The main differences between the S&T and innovation systems in Serbia and the EU/OECD best practice can be explained by the minor role of R&D outputs for industry, i.e. the business enterprise sector. As pointed out earlier, R&D in Serbia is performed for rather than by industry as in the EU/OECD member countries (see Table 16.1). This problem was identified and some actions were taken including the setting up of the Strategic Group for Innovation, which was established by the Government of Serbia on 11 November 2005, with the aim of enhancing triple helix relations in Serbia, i.e. relations between government, the R&D system, and industry.

The main outcome of this action was creation of a National Innovation Strategy for Serbia, which should be completed in 2007 with the collaboration of several foreign and international agencies active in Serbia, i.e. the European Agency for Reconstruction, ECORYS, etc. in collaboration with the Ministry of the Economy and the Ministry for Science and Environmental Protection.

In order to change Serbia's S&T and innovation landscape a number of initiatives have been launched since 2003, including:

- creation of business and technology incubators (already established in Beograd, Novi Sad, Niš, Zrenjanin, Subotica, Vršac);
- establishment of several innovation centres mostly located in the main universities (University of Belgrade: Faculty of Mechanical Engineering, Faculty of Electronic Engineering; University of Niš: Faculty of Mechanical Engineering; etc.);
- development of S&T parks in several locations in Serbia (Mihajlo Pupin Institute Belgrade; Faculty of Technical Sciences, Novi Sad; Radmilovac – Agriculture; etc.);
- development of other innovation infrastructure, including a regulatory framework in the shape of the Science Law, the Innovation Law, laws defining the role and functioning of development funds, etc.

16. Science and Technology System in Serbia: Between Survival and Restructuring

16.5. Conclusion

Table 16.4 presents the results of a SWOT – Strengths, weaknesses, opportunities and threats – analysis which shows that the only strengths in the country are human resources. However, this result should be interpreted with some caution because of the obsolete and still not reformed education system (primary to university level), and the consequences of the brain-drain of the last 15 years which is still ongoing. The main weaknesses are caused by no basic understanding of the role of a national innovation system for the organization and performance of innovation in the economy and society. Opportunities could arise from activities organized towards EU membership, which would include integration of EU standards in all sectors. The adoption of standards and best practice in S&T and innovation will eventually change Serbia's R&D landscape and create the necessary innovation infrastructure for the country's economic development and accession to the EU. The main threats to S&T and the innovation system in Serbia are the mentalities inherited from its past which create obstacles to actions and frameworks to support changes, restructuring and creation of an innovation culture in Serbia.

Table 16.4: SWOT analysis of S&T and Innovation system in Serbia

Strengths:	Weaknesses:
<ul style="list-style-type: none"> • Human Resources. 	<ul style="list-style-type: none"> • R&D system: old, inefficient structure; • Lack of knowledge and general acceptance of role of national innovation system; • Insufficient national innovation capacity.
Opportunities:	Threats:
<ul style="list-style-type: none"> • EU membership; • National Investment Plan and other investments in economy; • Cheap outsourcing. 	<ul style="list-style-type: none"> • Wait and See' strategy; • 'No change please'; • Mentality; • Absence of Innovation culture.

Source: IPG, 2006.

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17. Turkish Policy Focus on Science and Technology

Sirin Elci

17.1. Introduction

This paper provides an overview of the Turkish research policy and the research systems, and recent developments in the area. It discusses Turkish innovation policy issues, mainly the challenges involved in improving innovation performance through R&D, commercialization and creation of innovative firms. The paper concludes with some recommendations for how these challenges might be addressed.

17.2. Turkish research policy

Research policy, which dates back to the early 1960s, forms an integral part of Turkey's national development plans. There is a well-developed institutional framework and policy measures are in place mainly directed to funding research and development (R&D) activities. However, R&D expenditure as a percentage of gross domestic product (GDP) remains at a low level (0.67% in 2004), and has shown little increase since the late 1990s. Unlike most of the OECD countries, the higher education sector in Turkey performs a significant proportion of total R&D; the business sector accounts for only 24% of total R&D spending.

In order to change this situation, the Turkish Government recently committed to increasing R&D investments, and set a goal of 2% R&D intensity by 2010, with the private sector accounting for half of the total amount. To achieve this, government also committed to gradually increasing the amount of public funds allocated to R&D in the public and private sectors, starting from 2005. In line with these developments, the total amount of funds put aside for new and ongoing R&D programmes in 2005 and 2006 was €1.5 billion compared to €1 billion in the period 2000-2004.

Another positive step in support of the 2010 goal was the creation of the Turkish Research Area (TARAL) in 2004 as a platform for the private and public sectors and non-governmental organizations (NGOs) to strategically focus and collaborate on R&D. TARAL was inspired by the European Research Area (ERA), and the integration of TARAL with the ERA is one of the priorities of Turkish research policy.

Science and technology (S&T) policies are governed by the Supreme Council of Science and Technology (BTYK), which is chaired by the Prime Minister and whose membership includes relevant ministers and high level representatives from the private and public sectors and NGOs. The Scientific and Technological Research Council of Turkey (TUBITAK) acts as secretary to the BTYK, and is the main organization involved in designing and implementing support programmes. S&T strategies and the plans for their implementation for the period of 2005 to 2010, based on the results of a study involving all stakeholders and coordinated by TUBITAK,



were issued by BTYK at the beginning of 2005. Since then, new and improved R&D support programmes targeting researchers, universities, public institutions and the private sector have been developed and implemented by TUBITAK.

17.3. Innovation policy and challenges

While the developments described above are very important and promising for Turkey, investment in research alone is not sufficient for solving the major and urgent issues facing the country. The most important challenge is unemployment, which is currently around 11%. Although average growth rates since 1992 were the second highest since 1950 (~8%), this economic growth has not reduced unemployment levels. The high unemployment rates among young people with higher education degrees are particularly worrying. More than 38% of university graduates under the age of 24 are unemployed. Another challenge is that investments in innovation, skills and technology, which are the drivers of productivity and growth producing jobs, are low. Finally, there are large regional disparities, and industrial activity and thus R&D activity, are unevenly distributed: More than half of Turkey's total industrial value added is generated by one region, which also accounts for approximately 55% of projects that have applied for public support for R&D. The three most developed regions account for over 95% of total R&D project applications.

Carefully designed and successfully implemented innovation policies are needed to address these challenges. However, until very recently, innovation was not a policy priority and the political emphasis on innovation was weak. An important development is that in September 2006 government took the decision to design appropriately focused innovation strategies and policy measures. There is increased awareness of the importance of innovation among stakeholders, largely driven by civil society organizations, such as the Technology Management Association and the National Innovation Initiative.

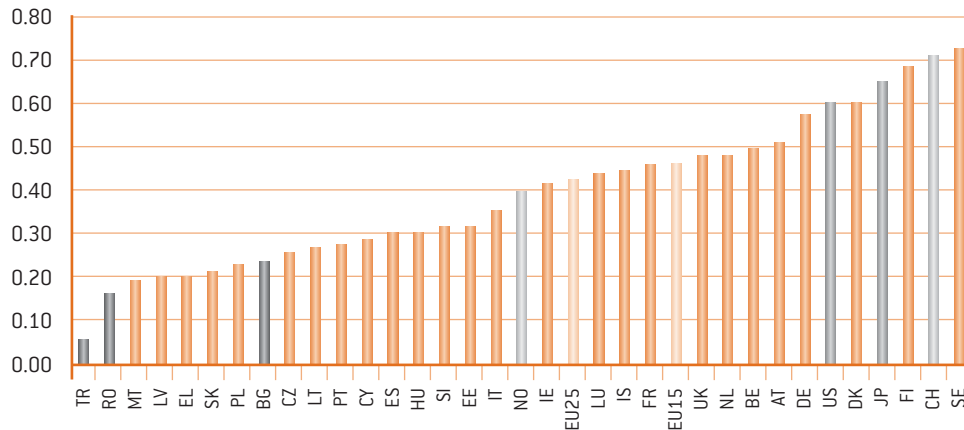
As the results of the European Innovation Scoreboard (EIS) show, innovation performance in Turkey has a long way to go (Figure 12.1). Although there are many missing EIS data for Turkey, which results in only a partial picture of the innovation performance of the country, it ranks as one of those with the weakest innovation performance.

There are a number of challenges that must be addressed if this situation is to improve. From a policy perspective, they include:

- the limited number and diversity of innovation support measures aimed at increasing investments in innovation;
- the poor availability of appropriate financing options (in particular the underdeveloped venture capital (VC) and business angels market; and the lack of private means to support innovative start-ups);
- weak regulatory and incentive regimes that do not provide encouragement to scientists and universities to transform applied knowledge into innovation and strong business developments;
- absence of regional and sectoral policies and systems of innovation.

17. Turkish Policy Focus on Science and Technology

Figure 17.1: European Innovation Scoreboard - 2005 Summary Innovation Index (EC 2005).



From the mid 1990s, funding for R&D and innovation projects in the private sector has been provided in the form of grants and loans from the state budget and international funders, such as the World Bank. With the increase in state support for R&D, private sector funding has almost doubled since 2005 (€80 million were allocated for private sector projects that year). In addition, starting in the mid 1980s, fiscal incentives for R&D have been implemented. There are two main tax incentive schemes, one provides for tax exemptions accounting to 40% of R&D expenditures, and the other provides for exemptions from corporate and personnel income taxes for R&D activities for firms located in technoparks.

However, seed and early stage funding options are scarce, which is an important impediment to the commercialization of research results and difficulties over access to finance by innovative start-ups are a problem for the creation of new innovative companies. One important reason is the low level of VC investments in the country. There are only three registered VC companies and around a dozen off-shore private equity (PE) funds. The total fund size for VC and PE is around €330 million and annual investments are less than €80 million. VC companies and PE funds prefer to invest in the expansion stages and do not specifically target innovative or high-tech industries. Government measures to support innovative start-ups are also almost non-existent and there is little business angels activity, and lack of business angels networks blocks entrepreneurs' access to these types of finance.

There are various factors hindering VC development on the supply side. These include:

- instability of the macroeconomic environment and insufficient foreign direct investment (FDI) levels until recently;
- immature pension funds and insurance markets that make fund raising difficult;
- small size and limited liquidity of the capital market;
- insufficient exit mechanisms;
- legislative barriers;
- lack of policies to support development of the VC industry.



On the demand side, firms' and entrepreneurs' cultural and managerial practices negatively affect the quality and quantity of deals. Companies generally are family owned and owner-managed and have weak corporate structures. They are generally reluctant to share ideas, ownership or control. The Informal economy is another major barrier. Young well educated entrepreneurs would offer great potential for investors. But, there is a low level of awareness about VC investments and limited capabilities among entrepreneurs to transform their ideas into business plans.

The low levels of seed and early stage funding options also hinder R&D commercialization by universities which is particularly significant for Turkey since:

- universities account for 68% of the country's R&D spending;
- universities employ 62% of researchers;
- the level of university scientific output is high (e.g. world ranking for number of scientific publications improved from 41st to 19th in 15 years), but is not transformed into innovation.

Key factors hindering technology transfer and R&D commercialization include the disincentives caused by regulations; the insufficient incentives (e.g. academic promotion rules are based on number of publications; only a few private universities use R&D related indicators such as number of research projects, co-operation with the private sector, number of patents in addition to the number of articles); and the very low number of specialized institutions and intermediaries such as technology transfer offices.

17.4. Recommendations and conclusions

As first steps to addressing the challenges and eliminating the main weaknesses outlined above it will be necessary to:

- develop financing options from the early to the later stages of innovative businesses;
- benchmark and revise VC regulations according to international best practice;
- design public VC initiatives to help the development of industry (e.g. by creating a fund-of-funds similar to Israel's YOZMA³⁵ programme);
- provide tax and other incentives to stimulate private investment in innovative businesses;
- encourage establishment of business angels networks;
- improve the regulatory environment to stimulate R&D commercialization and the creation of university spin-offs;
- encourage companies to move to the formal sector;
- develop mechanisms to stimulate the establishment of technology transfer offices at universities;
- provide seed and start-up funding for academic entrepreneurial activities;

³⁵ See www.yozma.com (accessed 21.06.07).



17. Turkish Policy Focus on Science and Technology

- consider regional disparities and stimulate regional policy-making and implementation in the design of policies;
- train, educate and raise awareness about innovation and innovation-related issues.

The Turkish Government took an important step by increasing the investment in research and building an effective S&T governance system. It is expected that recent decisions about the design of innovation strategies and support mechanisms will be pursued with equal enthusiasm and dedication, allowing challenges to be met through an integrated approach to research and innovation and the integration of innovation in other policy areas.

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PART III

**RT&D in South Eastern Europe:
International Policy Actions
and Assistance**



18. Towards the Introduction of the System of Innovation Concept in Official Development Assistance

Klaus Schuch

18.1. Introduction

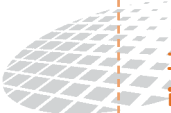
The role and value of science and technology (S&T) as an element *within* the system of official development assistance (ODA) and their position as distinct systems are not easy to define. This is in part due to the different perceptions associated with S&T, the changing paradigms in international S&T cooperation and the different goal and value systems underlying it. This paper discusses some recent activities conducted as part of Austrian ODA with respect to higher education and S&T. It explicitly refers to relevant interventions in the Western Balkan countries (WBC) with a special focus on Kosovo. It starts with two short reflections: one on new trends in international S&T cooperation strategies and one on potentially different understandings of research in ODA. It aims to connect these two threads in order to systematize some of the commonalities and intersections as well as the major differences between internationally oriented S&T policy and S&T within a development cooperation policy. That this combination of policies is not just a matter for theoretical thought, but is also one of practical trial (and maybe error) is exemplified by the Austrian ODA cases in relation to higher education and S&T in the Western Balkan countries. Special emphasis is given to the introduction of the system of innovation concept in one of Austria's exemplary ODA projects in Kosovo.

18.2. Towards a new paradigm in international S&T cooperation?

One starting point for our reflections is the observable changes in the social construct of international S&T policy formulation. The establishment of a dedicated working group on Internationalization Strategies in S&T towards Third Countries³⁶ under CREST³⁷ indicates the importance assigned to this topic. Some of its legitimation and dynamism stem from the attempts of some EU Member States, e.g. Austria, Spain, the UK, to (re)formulate their S&T relations with non-EU countries. Also the European Commission's efforts to reshape international research and technology development (RTD) co-operation towards third countries within the 7th European Framework Programme for RTD are relevant.

³⁶ Third countries are those that are neither members of the EU27 nor countries associated with the European Framework Programme for research and technology development (RTD).

³⁷ CREST is the Comité de la Recherche Scientifique et Technique. It is the highest S&T body facilitating dialogue between the EU Member States within the Council of S&T ministers.



18. Towards the Introduction of the System of Innovation Concept in Official Development Assistance

The most prominent sign of a potential paradigmatic shift is the ostensible disappearance of the INCO³⁸-programme as a separate programme under the new Framework Programme for RTD. The international (i.e. third country directed) activities under the European Framework Programmes for RTD were initially in a sub-programme on life sciences and technologies for developing countries under the 3rd Framework Programme, with a budget of ECU125 million.³⁹ Under the 4th Framework Programme the budget was increased to ECU575 million and the scope of the programme was broadened (Schuch 2005). It remained a separate main programme within the 5th and 6th Framework Programmes, but its relative budget share was reduced. In the 7th Framework Programme many third country related activities were integrated within the ten main S&T fields implemented under the Cooperations programme.⁴⁰ A small share of the budget was earmarked for strategic S&T cooperative activities towards third countries (mainly implemented by Coordination and Support Actions (CSA) under the Capacities programme within the 7th Framework Programme).

This reshaping indicates a mainstreaming of the S&T relations with third countries within the 'regular' framework programme S&T activities. However, it also shows a gradual withdrawal from the distinctive 'research for development' approach of earlier framework programmes. This shift provoked some discussion on the eve of the launching of the 7th Framework Programme. Fears were expressed that third countries with weaker S&T systems might not qualify under the regular open competition which characterizes framework programmes.⁴¹ In addition, it was argued that the specific problems and RTD needs of third countries (mainly developing countries) would not receive adequate attention in mainstream programmes, whose rationale is primarily to strengthen the competitiveness of European industry and to increase the quality of life of European citizens. The first calls for proposals launched under the Cooperation programme within the 7th Framework Programme however, included two topics specifically selected for RTD cooperation with third countries. The success of this strategy will be able to be assessed when the results of response, participation, financial allocation and implementation are available. Doubtless, however, the new strategy puts more emphasis on the dimension of 'excellence' in RTD projects with third countries than previously and promotes a more differentiated 'problem-oriented' approach.

The importance attributed to international R&D cooperation as a means of increasing competitiveness can be identified in another prominent example: the British strategy for engagement in R&D issued by the Global Science and Innovation Forum (GSIF)⁴² (GSIF 2006). Among the objectives set out in this strategic document are two related to research (see GSIF 2006: 33):

³⁸ INCO is the International CoOperation programme.

³⁹ ECU is the European Currency Unit (the forerunner of the Euro)

⁴⁰ Also the People programme provides some support for international RT&D cooperation.

⁴¹ It should be noted that INCO has been sometimes perceived as 'kindergarten' for third countries to prepare them for the real competition in specific programmes (Schuch 2005).

⁴² GSIF members include the Office of Science and Innovation (Department of Trade and Industry), UK Trade and Investment, Foreign and Commonwealth Office, Department for the Environment, Food and Rural Affairs, Department for International Development, Department for Educations and Skills, the British Council, The Royal Society of London and the UK Research Councils.

18. Towards the Introduction of the System of Innovation Concept in Official Development Assistance

- (I) to maintain excellence in the UK research base by ensuring that UK researchers have access to the best science globally and that the UK science base retains its excellent reputation overseas; and
- (II) to ensure that UK researchers have access to the best science of the future by building strategic links with those countries with the fastest growing science bases;

and one related to development (see GSIF 2006: 41):

- (III) to ensure optimal cross-Whitehall science and innovation support for UK international development policy as set out in the recent government White Paper – ‘Eliminating World Poverty: Making Governance Work for the Poor’.

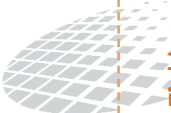
As a consolidated output of the diverse GSIF members it is not surprising that this strategy document aims to bring both ends (competitive RTD and innovation on the one side and research for the poor on the other) under the umbrella of one guiding document. Alignment of the aims of attracting students and researchers from abroad (‘brain gain’) and reducing brain drain (one of the major concerns in ODA) will require major instrumental and tactical effort.⁴³

Of greater concern is the disappearance of the traditional understanding that internationally oriented S&T is the concern of foreign policy and, more specifically, cultural foreign policy. Instead, there is a clear emphasis on safeguarding and increasing the UK’s competitiveness by means of international S&T cooperation. In other words, the rationale for international S&T cooperation has paradigmatically changed from foreign-policy driven to S&T-policy driven. It can be assumed that this will produce instrumental follow-ups and consequences for the governance system itself. No longer confined to a ‘classical’ understanding of S&T, the new strategy highlights innovation objectives, which are clearly directed towards increasing the innovative nature of UK business by ensuring its capacity to internationalize and to safeguard optimal access to the very best science, engineering and technology opportunities worldwide. Moreover, it aims to increase the research intensity of the UK by encouraging R&D investment in the UK from innovative multinational enterprises (GSIF 2006). This explicit notion of inward foreign direct investment (FDI) seems rather novel in the context of the international S&T strategy documents of developed countries⁴⁴ and goes beyond the previous understanding of *nationally* defined systems of innovation, which has been increasingly disputed by a number of distinguished scholars since the mid 1990s.

The question of FDI in R&D was raised in the CREST working group. In the questionnaire on concrete policy measures directed to the internationalization of R&D developed by this working group, emphasis was put on four main analytical blocks.

⁴³ In this respect, the potential for financial transfers from well-paid foreign researchers back to their home-countries and the difficulty experienced by these researchers in finding jobs with good working conditions in their home-countries due to institutional deficits must be taken into account.

⁴⁴ It is a more common topic for instance in the S&T policy deliberations of the new EU Member States.



18. Towards the Introduction of the System of Innovation Concept in Official Development Assistance

1. International collaboration in S&T among institutions (universities, public research institutes and industries);
2. International mobility (inward and outward) of individual scientists aimed at career development and human capacity building;
3. International exploitation of research, and the issue of knowledge protection versus dissemination;
4. FDI in R&D i.e. inward and outward investments in R&D systems.

The interest in these four analytical blocks and the specific questions they raise seem to underline the supposedly huge potential value ascribed to international S&T cooperation as a new factor for competitiveness. It indicates a shift from the 'old' paradigm of international S&T being part of foreign cultural exchange. Whereas the old paradigm refers to basic science and the notion of mutual benefit in spheres far from those of immediate applicable value and economic exploitation, the new paradigm is progressively oriented towards tangible impact.

18.3. The challenged role of S&T in ODA

Since the industrial revolution almost no-one with any influence has questioned the importance of technological change for economic development (Martin and Nightingale 2000). Despite the fact that also nobody seems to disagree with the statement that access to scientific and technological knowledge can be seen as what divides the 'haves' and the 'have-nots',⁴⁵ S&T seems to play a rather secondary role in ODA. It was not by chance that the title 'Why Invest in Science and Technology in South East Europe?',⁴⁶ was chosen for the conference organized by UNESCO, the Slovenian Ministry of Higher Education, Science and Technology and the Austrian Science and Research Liaison Office, held in Ljubljana in September 2006. This provocative title was designed to raise awareness of this situation.

A part of the problematic status of S&T in ODA (evidenced by low budget allocations) might be found in the different understandings of research⁴⁷ (and S&T) in the framework of development cooperation and, even more importantly, in the way that S&T is instrumentally approached in ODA. In terms of the different understandings, three main approaches can be distinguished (Habermann 2006):

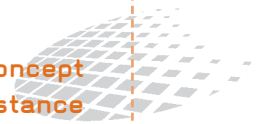
- a) research relevant to development,
- b) development research, and
- c) research for development.

⁴⁵ It is estimated, that the OECD countries alone account for about 75% of global R&D (GSIF 2006) and that the industrialized countries including China, India and East-Asia account for 95% of research expenses (Juma and Yee-Cheong 2005).

⁴⁶ http://portal.unesco.org/en/ev.php-URL_ID=34417&URL_DO=DO_TOPIC&URL_SECTION=201.html [accessed 10.6.07].
<http://www.aso.zsi.at/de/all/aktuelles/1787.html> [accessed 14.9.07].

⁴⁷ In this respect the discussions on 'Mode 1'/'Mode 2', the triple helix and the technology life cycles concept can be mentioned here (for a short overview see Campbell 2005).

18. Towards the Introduction of the System of Innovation Concept in Official Development Assistance



Research that is relevant to development has a rather wide meaning and seems rather inopportune as a concept for decision-making about the allocation of (scarce) ODA money. Evidently, pure academic research can also be subsumed under this heading and the line between it and 'regular' research is difficult to draw. In Austria, as in many other countries, this approach has not encroached on ODA. However, under the framework of bilateral intergovernmental S&T programmes, even between developed and less developed countries, it is regular practice to support projects that are dominantly defined by their pure research excellence. Relevance for development is usually not a selection criterion in internationally oriented S&T programmes.

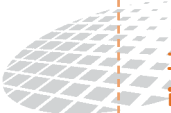
The second term definition, development research, puts development as the research object, and the complexity of development at the centre of the research activity.⁴⁸ Basically, development research aims to understand causes, processes and the intended and unintended effects of different development trajectories (or standstills) at local, national, regional and global levels. In Austria and, again, in most other countries, this approach threatens a niche existence, which is supported neither by S&T policy nor by ODA. This situation is further aggravated by the inherent interdisciplinary and transdisciplinary character of this approach.

The third concept is the most accepted in ODA. Research for development is acknowledged as being problem-driven aiming to provide immediate answers and solutions to pressing issues. In many countries, it more or less follows the input of the Millennium Development Goals (MDGs). The concept of research for development and – to a lesser extent – development research, is also pursued in Austria by the Commission for Development Studies at the Austrian Academy of Sciences (KEF), which aims to bridge the gap between science and development in supporting a development-oriented approach in research and science. The KEF is basically funded by the Austrian Ministry of Science and Research, not by the Austrian Development Agency.

One of the more frequently heard criticisms of this approach refers to its institutional set up. It is argued that, in practice, research with real potential to contribute to sustainable development has so far been restricted to non- or para-university institutions with limited formal competence. Moreover, this situation, already predominant in highly developed countries, is even more pronounced in developing and transition countries, which often copy the research structures found in the developed north (Hurni et al. 2001). Another critical argument refers to the lack of equally balanced partnership approaches between researchers from developed and less developed countries (Habermann and Kommission für Entwicklungsfragen 2005). Evidently this is connected to unequal funding, which provokes a situation in which researchers in developed countries carry out research in less developed countries with only minimal support from local experts. Hurni et al. (2001) claim that the participatory element is weakest in these situations and demand a significant shift from transferring to sharing science.

The research for development concept is also often regarded as arguably one of the most frequent instrument employed under ODA with respect to S&T (and higher education - often incor-

⁴⁸ Habermann (2006) provides a broader, slightly different definition of this term.



18. Towards the Introduction of the System of Innovation Concept in Official Development Assistance

rectly understood as synonymous): the disbursement of fellowship grants. In Austria this instruments consumes 68% (ÖSB et al. 2007) of the money spent on development cooperation in the field of education (including S&T) towards developing the countries of the 'south'.⁴⁹ Most fellowships are granted in S&T fields in which a research for development need seems obvious, e.g. agriculture, forestry and fishery, or local development and health. At least in Austria, most of the fellowships awarded are inward fellowships for young foreign researchers (not necessarily from the Austrian ODA priority partner countries) to study and obtain doctorates at Austrian universities or to attend specifically designed postgraduate courses (such as the international training programme in limnology organized and hosted by the Austrian Academy of Sciences). The major share of the allocated funds is spent in Austria itself (ÖSB et al. 2007).

This instrumental dominance has been heavily criticized in a recent evaluation report on education in ODA in Austria (ÖSB et al. 2007) due to its limited contribution to sustainable, institutionally embedded capacity development.⁵⁰ In this context, the weak institutional footing of fellowships in substantial joint research projects should also be mentioned.

In the new (draft) version of the guidelines for the education sector (including S&T) for the Austrian ODA, the instrument of incoming fellowships is consequently just mentioned as one among more than a dozen other promising interventions. The idea of featuring a long list of potential ways of intervening in the field of S&T can be seen as an attempt not to throw the baby out with the bath water. Because of the extremely low Austrian ODA allocation towards the EFA⁵¹ goals, there is a certain danger that Austria could retreat from its engagement in S&T/higher education. While a partial reallocation of the fellowship budget towards immediate EFA goals (and here first of all towards the least developed countries) would seem adequate,⁵² the current situation could also be seen as an opportunity to reflect on, update and upgrade the role and value of S&T in ODA generally.

The new draft educational guidelines (BMA 2007) hint at such innovative potentials in redefining the function and role of S&T in ODA. First, all three different understandings of S&T in ODA mentioned above are recommended as eligible in the new guidelines and also the research relevant to development approach, which somehow characterizes the general comprehensive and inclusive nature of the draft guidelines. Rather than defining a handful of priorities, the authors⁵³ have tried to provide a broad intervention spectrum in order to respond to the diversity of needs formulated in different spatial and social contexts.

⁴⁹ The Austrian priority development cooperation countries of the south are Nicaragua, Cap Verde, Burkina Faso, Ethiopia, Uganda, Mozambique, Bhutan and the Palestinian Authority. The fellowships, however, are not limited to these countries.

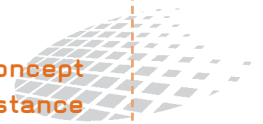
⁵⁰ Capacity can be defined as the ability of individuals, organizations, or societies to set and implement development objectives on a sustainable basis. Individual capacities consist of skills and attitudes, and their translation into organizational capacity. Organizational capacity consists of internal structures, collective staff capacity, and an enabling environment (policy framework and other factors) (Land 2000).

⁵¹ EFA is Education For All, a strategy promoted by UNESCO to ensure that the basic learning needs of every child, youth and adult are met within a generation and sustained thereafter (UNESCO, 2006) with strong emphasis on early childhood care, primary education, gender equality and equal access.

⁵² Evidently, also 'fresh' ODA money should be raised to serve the EFA goals.

⁵³ Monika Langthaler and Attilye Zauner from the ÖFSE supported by Sigrun Bohle and Klaus Schuch from the ZSI.

18. Towards the Introduction of the System of Innovation Concept in Official Development Assistance



The real innovation in these guidelines, however, is the introduction of a fourth structural understanding of what S&T could mean in the system of ODA. This new approach puts the institutional set-up of a system of research and innovation per se at the centre of the ODA interventions. The following draft list of intervention potentials is related to this new approach (BMAA 2007):

- support for a consultative systemic approach to establish and improve tertiary education as well as science systems in partner countries;
- support for regional training and research centres as well as dedicated think tanks in the 'south' and the 'east';⁵⁴
- support for the integration of East and Southeast European partner countries into the European Higher Education and Research Area;
- support for networks of research for development between Austria and its ODA partner countries as well as between the partner countries themselves;
- support for research networks with regional and international relevance;
- support for regional innovation potentials and innovation strategies;
- support for institution building and capacity building in higher education and research;
- development relevant policy advice and consultancy in the field of education cooperation;
- science-industry relations (technology transfer, business-start-ups, regulation and standardization, intellectual property rights (IPR) issues, market research, etc.);
- support in implementing modern technologies in tertiary education and for scientific networking;
- support for relevant training and research programmes in developing countries; and
- promotion of inter-cultural learning and dialogue to exchange knowledge and experiences between Austria and the partner countries.

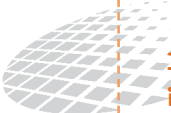
In terms of the initial discussion on the new role of international S&T cooperation as a strategic means to increase (own) competitiveness, such a new structural approach seems courageous though logical and promising if implemented properly. It argues in favour of public investment by a donor country in the productive S&T sphere of an ODA recipient country rather than the regular aid-driven paradigm of counterbalancing the most basic prevalent deficits by providing external (research) inputs.

The decisive point in this argument is whether or not such intervention should be limited to the pure pre-competitive sphere (e.g. institutional development of universities to increase basic research). Especially in East and Southeast Europe, research potential is inherited. There were many attempts, not least by the EC, to safeguard this potential in certain S&T fields (mainly via INTAS⁵⁵ and the INCO-programme under the 4th and 5th Framework Programmes) or to transform former military research competencies into civilian ones through non-proliferation initiatives.⁵⁶ The main weakness, however, was and is the lack of a favourable environment for the applica-

⁵⁴ The East refers mainly to the countries of the Western Balkans and Moldova.

⁵⁵ INTAS is the International Association for the Promotion of Cooperation with Scientists from the New Independent States of the Former Soviet Union.

⁵⁶ e.g. ISTC (International Science and Technology Centre) or STCU (Science and Technology Centre in Ukraine).



18. Towards the Introduction of the System of Innovation Concept in Official Development Assistance

tion of knowledge in the economy via innovation and learning. It is argued, that in the East and Southeast European region money will be wasted (from an ODA, not from a classical research point of view) if it is allocated to the traditionally structured research system, which has in the past failed to contribute to economic growth and well-being, and failed to improve economic incentives, upgrade information infrastructures or to reform education (Goldberg et al. 2006). This requires an integrated innovation-oriented ODA approach, which is technically difficult to realize. More importantly, however, it calls for a donor country's readiness to invest its public money in the productive sphere of another country (rather than its own national system of innovation), and in another country that might become a competitor in the long run.

Whereas primary schooling and adult literacy can be understood primarily as a human right and only secondarily as a means for strengthening economic development, a wise structural investment in S&T systems seems to have a potentially more immediate economic rationale (alongside other motivations such as encouraging an informed civil society dialogue including scientists; training of medical doctors, etc.). Such investment aims to contribute to reducing the increasing gap between the scientific and innovative potentials of industrial and developing countries. The key is effective institutional capacity building. In terms of the above discussion on fellowships, it seems that most support (at least in Austria) is tied to individual capacity building of a limited sustainable character in terms of institution building. Furthermore, most of the existing research for development funding schemes appears not to allow for or to foresee greater long-term support, which is an indispensable prerequisite for effective institutional capacity building (Hurni et al. 2001). This new approach differs from the first and especially third understanding of S&T in the framework of ODA, which is somehow confined to a (more or less) ready made solution offering of research relevant to development or for development, and which – moreover – is very often externally generated and sometimes quite loosely connected to local institutional structures.⁵⁷

The (fourth) structural approach introduced in ODA in the field of S&T has some cognitive similarities with the second one. While the second approach (development research) aims to understand the conditions of development, the fourth aims to directly build on these findings in order to improve S&T conditions in the beneficiary countries through relevant capacity and institution building measures. It should be underlined, that this is not a plea for the establishment of autarkic S&T systems in developing countries. On the contrary; due to scarce resources and the immense resources needed for S&T infrastructures (including running costs), which are a burden on poorer countries' household budgets, we believe that an efficient and effective division of labour at regional and international level is necessary. However, a certain critical mass to access and absorb internationally generated knowledge as well as to generate own locally adapted knowledge is regarded as indispensable to connect to and act in the globalizing knowledge economy. Otherwise the gap between the haves and the have-nots will increase even further in the future and deprive many countries of economic potential and progress. It should be noted, that these deliberations on more structural S&T approaches with-

⁵⁷ There are also other encouraging examples, for instance SIDA/SAREC's programmes to support development of local research capacity through provision of PhD training, laboratory and library buildings, research funds creation, research priority setting, etc.

18. Towards the Introduction of the System of Innovation Concept in Official Development Assistance

in ODA are favoured by more and more experts (e.g. Watkins 2005; Farley 2005) and authoritative institutions such as the World Bank and SIDA.

To sum up, the background to such a fourth understanding of possible ODA intervention in the field of S&T derives from the fact that in a globalizing economy, which is characterized by processes of accelerating world-wide interaction of economic activities, the mobility of production factors, especially capital and technological knowledge is increasingly important. In peripheral countries, knowledge deficits, including the lack of possibilities to acquire and exchange knowledge, are becoming a more and more significant barrier to economic development. In addition, the rapid diffusion of information depends on the availability of new information and communication technologies (ICTs). The 'digital divide' is a decisive hurdle to knowledge based economic development in any of the peripheral countries (Knox and Marston 2001). Thus, the creation and use of physical and virtual knowledge networks by valorizing technology enhanced learning (e.g. eLearning) is important. Access to information, however, is of only limited value if structured absorptive capacities required to understand and to work with knowledge generated elsewhere, are missing. Therefore, adequate local provision of education, training, bridging and research institutions seems indispensable.

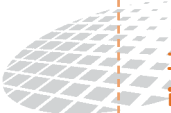
18.4. Austria's new ODA interventions in the field of S&T towards the Western Balkan Countries

Some of the new interventions to which the new draft Austrian education guidelines for ODA refer, have already been successfully tested under the East dimension of the Austrian ODA (see ÖSB 2007). These include interventions related to the start-up of university based business-centres in Tuzla (Bosnia and Herzegovina) and Skopje (Former Yugoslav Republic of Macedonia) and the establishment of a National Contact Point System (NCPS) in Bosnia and Herzegovina to secure for its researchers access to information on and participation in the European Framework Programme for RTD. In addition, Austrian ODA has been heavily involved in reform of the governance system of the two public universities in Kosovo.

The main Austrian interventions in this sphere, however, were implemented under the heading of strengthening the reforms of higher education in the West Balkan countries. These interventions, which were mainly implemented by WUS Austria, consist of a few sub-programmes. A sub-programme related to outgoing fellowships was abolished in 2002 and no fellowships are currently included in the East dimension of the Austrian ODA. The existing sub-programmes include CDP+,⁵⁸ BGP,⁵⁹ eLearning and the Balkan Case Challenge. CDP+ supports curriculum reform in higher education, including grants for purchase of small and medium sized S&T equipment (e.g. microscopes, measuring and testing devices) to improve the scientific and technical education of students (including doctoral students) in the recipient countries' universities. BGP supports brain gain in the Western Balkan countries by identifying and inviting

⁵⁸ CDP+ is the Course Development Programme.

⁵⁹ BGP is the Brain Gain Programme.



18. Towards the Introduction of the System of Innovation Concept in Official Development Assistance

researchers that emigrated from the region to return as guest lecturers in a bid to strengthen the international inclusion of local universities in research and higher education networks. The eLearning initiative is aimed at improving capabilities in the field of distance learning and aims to promote uniform standards in the use of content management systems, etc. in SEE universities. The eLearning initiative potentially has the highest structural effect; the Balkan Case Challenge has the lowest. The latter is in the form of an annual competition for advanced students, and is implemented at national and regional levels.

It can be said that the largest Austrian ODA interventions, in the Western Balkans in the field of higher education reform and S&T, have been defined in a consciously structural manner, which has been acclaimed by the SEE Stability Pact, the World Bank and other expert institutions (e.g. Stability Pact for Southeastern Europe 2006). These interventions include institution building measures (such as the establishment of business-start-up centres), strategic interventions in the field of statutes, rules and regulations (such as the establishment and adherence to statutes at the University of Pristina), standardization measures (for instance under the eLearning initiative) and many structurally embedded capacity building measures (such as reform of university courses and the Brain Gain Programme)

These ODA interventions, however, cannot be easily transferred to other world regions. First, the Western Balkan countries are middle-income countries and differ significantly from the low-income countries of the South. Second, prior to the political, economic and societal crises in the region, they had relatively well developed S&T systems. Third, they are regarded as (potential) candidate countries for EU accession, which gives them privileged status and preferential entry into the European Higher Education Area and the European Research Area (ERA). Finally, despite the rather poor contemporary state of S&T and higher education in these countries (GFF 2006; Slaus and Pisk 2006), they will most likely have to find a future in a technologically upgraded knowledge based economy and society.

The most progressive intervention, which is based on this new structural understanding of S&T in ODA, is being implemented in Kosovo by the Austrian Development Agency and the Austrian Ministry of Science and Research. This project builds upon the umbrella Memorandum of Understanding (MoU) signed between UNMIK – The United Nations Interim Administration Mission in Kosovo – on behalf and for the benefit of the provisional institutions of Self-Government in Kosovo (Ministry of Education, Science and Technology) - and the Ministry for Foreign Affairs of the Republic of Austria and the Austrian Federal Ministry of Education, Science and Culture. It is a multidimensional project aiming to contribute to a sustainable, well governed, knowledge-based higher education system in Kosovo aligned to European practices and standards, including the development of interfaces with research and innovation in order – in the medium and long run – to foster economic progress and reduce poverty. It is related to the MEST strategy in this sector (MEST 2004).

The system of innovation concept that was developed in the 1990s by Lundvall (1998, 1992), Nelson (1993) and many others, constitutes the fundamental theoretical basis for this multidimensional

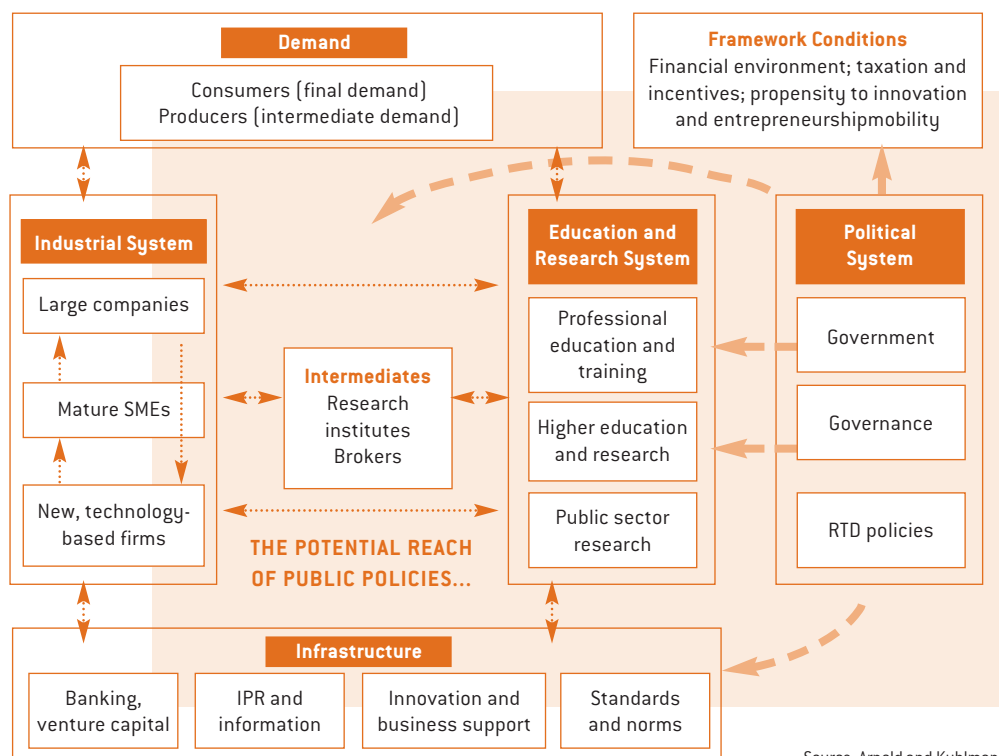
⁶⁰ Renamed the 'Austrian Federal Ministry of Science and Research' after the autumn 2006 elections in Austria.

18. Towards the Introduction of the System of Innovation Concept in Official Development Assistance

mensional project and its strategic direction. It provides a logical interface with the concept of technological congruence elaborated by Abramovitz (1986), common in the discourse on development policies. In the context of donor support for S&T for development, the system of innovation concept is a relative novelty, however, is receiving increasing attention (Farley 2005). A system of innovation can be thought of as a set of actors or entities, such as firms, organizations and institutions that interact in the generation, use and diffusion of new – and economically useful – knowledge (Fischer and Fröhlich 2001). It implies that innovations do not originate as isolated discrete phenomena, but are generated through interactions and feedback loops.

Innovation systems are regarded as knowledge intensive, but are not necessarily limited to scientific knowledge. Knowledge and innovations may be described as technological, organizational or social (OECD 2002). Many innovations emerge from everyday economic activities not connected to the structured activities of scientific research and technological development. As a consequence, innovation policy, defined as ‘public action that influences technical change and other kinds of innovations’ (Edquist 2001: 46) includes not only elements of higher education and research policy, but also other aspects of technology policy, infrastructure policy, regional policy, industrial policy, human resource development and labour market policies as well as areas such as the institutional set up of taxation or markets for finance. Even socio-cultural aspects, such as entrepreneurial behaviour, are taken account of. By applying an immanent systems approach, the concept emphasizes the institutional set-up of innovation systems with a focus on matches and mismatches between elements and subsystems (see Fig. 18.1).

Figure 18.1: A system of innovation

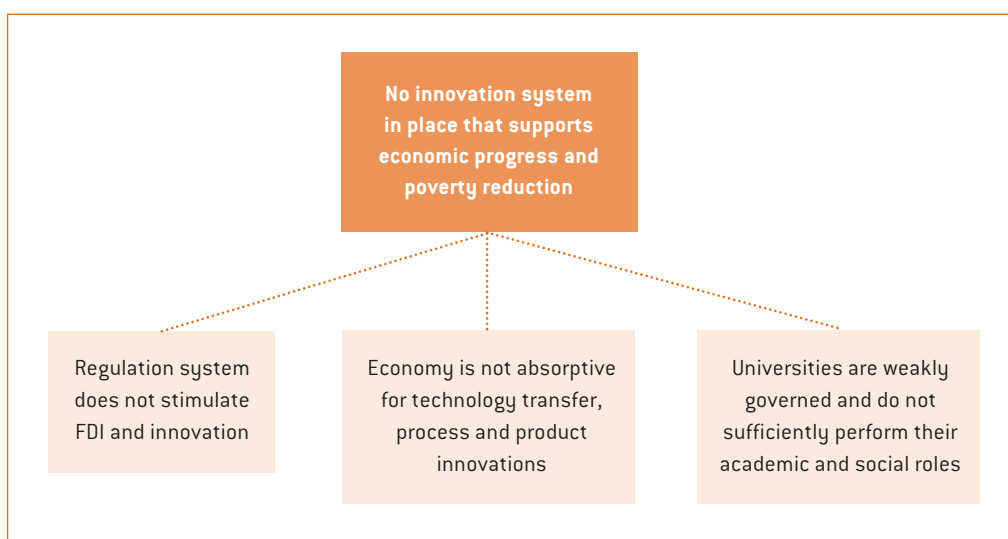


18. Towards the Introduction of the System of Innovation Concept in Official Development Assistance

Doubtless, one of the main elements of an innovation system is the education sector. Whereas the causally directed contribution of primary and secondary education to basic economic development seems to be undisputed by the ODA community, the causal direction with regard to higher education is not. There are arguments that higher education, rather than being the cause of economic well-being and life-style, is its result. The OECD, however, maintains that investment in higher education and research has a positive effect on economic growth and regional competitiveness, as well as on individual employment prospects and well-being.⁶¹ This assessment is supported by all new development theories, which feature competition for endogenously or externally produced new knowledge as a central element in economic progress. In order to access and acquire new knowledge, the availability of absorption capacities in a (national, regional or local) economy is of the utmost importance. In the enhancement of absorption capacities, universities play a central role. The competences of people to acquire and to use new knowledge is essential for the assimilation and exploitation of new technologies. Thus, in an increasingly knowledge based world economy, the quality of education systems becomes a key factor for success in terms of national and regional competitiveness.

In the context of this ongoing discourse in development and innovation theory, the dominant focus of the Austrian ODA project in Kosovo is on higher education. However, in order not to become trapped in a purely elite oriented educational intervention, specific attention is paid to overcoming the interfacial bottlenecks between the field of higher education and other elements of the innovation system.

Figure 18.2: Problem analysis (1st level)



Source: Author

⁶¹ See www.oecd.org/edumin2006 (accessed 20.6.07).

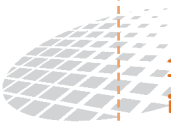
18. Towards the Introduction of the System of Innovation Concept in Official Development Assistance

Three main first level problems for the establishment of a comprehensive innovation system in Kosovo have been identified (Schuch 2006). Firstly, there is no regulation system in place to stimulate a culture of innovation (see Figure 18.2). Secondly, the business sector in Kosovo does not engage in product, process or organizational innovations. Most businesses struggle to survive, and operate in fairly limited (and simple) segments along the value chain. Only a few belong to the production sector. An advanced service sector has still to be developed. State-controlled industries are working within decimated material and other infrastructures. The links to knowledge and technology providers have been cut, often due to lack of finance. Thirdly, local knowledge providers are extremely weak and connections between industry and academia and also with foreign knowledge providers are very poor. The many universities in Kosovo can be described as 'pre-Humboldtian'. Their activities are confined to teaching; they seldom perform the other social roles that characterize the modern university. RTD is not part of their regular practice. Most of these universities are entrepreneurial only in the sense that they are charging substantial tuition fees to support their basic teaching services and pay for their technical and administrative infrastructure.

Based upon this first level problem analysis, the operational programme document provides a more refined analysis (Schuch 2006) and concludes that detailed interventions in all three spheres are necessary to upgrade the entire system. In practice, however, the project is focusing in its first phase (2007–2009) on reform of the higher education system in Kosovo adopting the principles of the Bologna Process and the establishment of institutions to structure and enhance the S&T system. Some activities to develop enhanced interactions between higher education and the local economy to promote the formation of absorptive capacities for technology transfer and innovation in the business sector are included in the first phase. They are institutionally either tied to the Ministry of Education, Science and Technology (MEST) or the University of Prishtina.

Interventions to reform regulatory systems and to support business directly in order to overcome the micro-economic problems that hinder the local economy from being innovative have been excluded from the first intervention phase. However, it is clearly stated that potential follow-up activities should focus on other than university-focused formative elements of a comprehensive innovation system that have more direct catalytic effects on economic progress and subsequent poverty reduction (Schuch 2006). This refers especially to the shaping of a supportive regulatory framework and the enhancement of absorptive capacities in firms for technology transfer, and process and product innovations. A pre-condition for such an approach is a co-evolution of the productive business sector, the producer service sector and public innovation support. Since the generally very limited productive business sector in Kosovo struggles with the requirements of the overall economic transformation phase and day-to-day efforts to solve basic business challenges, the co-evolution of public innovation support and business development seems, for the time being, to be out of reach. Of course, efficient public innovation support requires long-term commitment and a budget above a minimum critical mass.

Currently, the nine defined and financially earmarked interventions under the first phase of the Austrian project in Kosovo encompass activities targeting:



18. Towards the Introduction of the System of Innovation Concept in Official Development Assistance

- the overall higher education system in Kosovo (institutional development, capacity building, policy advice and community-centred operations of the Kosovo Accreditation Agency and capacity building for the Kosovar ENIC⁶²/NARIC⁶³ system);
- the University of Prishtina (capacity building for academic employees and capacity building and subsequent community-centred operations of selected University of Prishtina faculties in terms of upgrading the management, teaching and research qualifications of its staff);
- the establishment of a basic institutional structure for the governance and conduct of RTD in Kosovo (institutional development, capacity building, policy advice and community-centred operations of the Kosovo Council of Research and Technology including the design of appropriate S&T programmes);
- the development of science-industry links (institutional development, capacity building, awareness raising and subsequent community-centred operations of the Centre for Innovation Support and Technology Transfer at MEST);
- the connection of the Kosovar higher education and research system to European processes (institutional development, capacity building, awareness raising and subsequent community-centred operations of the Kosovo Centre for International Higher Education, Research and Technology Co-operation);
- the promotion of collaborative RTD in the region (implemented via the ASO - Austrian Science and Research Liaison Offices);
- MEST's capacity in terms of sector programming.

This is clearly a very ambitious project with many potential pitfalls. Like most structural and constructivist approaches it carries the risk of technocratic seduction. The project is also likely to be challenged by resistance to reforms emerging in already established institutions, and by the uncertainties related to greenfield institutional development processes. It also calls for major political and operational commitment from all the main parties, and especially MEST. What is interesting about this project is not its ambitions, but its new structural approach to S&T, at least under the umbrella of Austrian ODA. It directly targets the institutional set-up of the S&T system and is not primarily aimed at supporting practical research activity (with the exception of the ASO projects).⁶⁴ It is not about research relevant to development, nor development research, nor research for development. It targets the establishment of local structures which should become sufficiently qualified and empowered to identify and formulate their own research needs, organize a division of labour with foreign partners, and conduct some locally needed research using its own capabilities and resources.

⁶² ENIC is the European Network of Information Centres on Academic Recognition and Mobility.

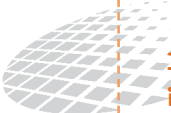
⁶³ NARIC is National Academic Recognition Information Centres.

⁶⁴ Collaborative research projects launched by the Austrian Science and Research Liaison Offices on behalf of the Austrian Ministry of Science and Research.

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19. Cooperation and Innovation Potentials of the WBC

Elke Dall

19.1. Introduction

Science, technology and innovation (STI) are vital for achieving prosperity, employment and economic stability. The WBC can only benefit from a strong science and technology (S&T) sector, which, as in other countries, is one of the key drivers of economic growth.

Investment in S&T development is crucial to increase competitiveness, but must be based on sound political analysis and the setting of priorities. In small countries, in particular, cooperation is vital to increase innovation capacities. An innovation system that facilitates the generation of knowledge, its exploitation and commercialization is necessary. The creation of networks at local and regional levels as well as international cooperation are of particular importance in this respect.

19.2. The starting position in the WBC

The description of the innovation system in any country has to assume a historical starting point. The Central and Eastern European (CEE) countries that successfully integrated in the European Union (EU) were not subject to the same extent to periods of armed conflict and economic and political isolation as the successor states of Socialist Federal Republic (SFR) of Yugoslavia. The destruction of these countries' infrastructures (including the once well-developed S&T infrastructure, and more particularly the private R&D sector) is a particular problem for the ex-Yugoslav states, that has to be tackled. Bosnia and Herzegovina, for example, is struggling with a post-war structure that implemented a total of 14 ministries responsible for science in the country. Human resources have been dispersed (brain drain) or have moved to areas outside the science system (brain waste) and the existing regional and international cooperation in S&T has been interrupted. Croatia is the country that currently is in the best situation in terms of most indicators and the efficiency of its institutions. The previous communist regime in Albania, on the other hand, did not allow the internationalization of science, and the last decade has been characterized by a lack of any rule of law and by economic collapse.

The WBC are now starting to implement reforms to enhance their innovation capacity and innovation systems are emerging in all countries. The institutional landscape is changing, strategy documents and action plans are being developed, laws are being updated and government expenditure on research and development (R&D) is increasing. In some countries, e.g. Croatia, business sector incentives have been successfully implemented. International cooperation to increase innovation capacity has been identified by most countries as a priority. In recent years, bilateral links have been strengthened by all countries, and a significant part of the expenditure on R&D, which is usually a very low percentage of GDP between 0.05% (Bosnia and Herzegovina estimate) and 1.24% (Croatia), is being spent on international cooperation.



19. Cooperation and Innovation Potentials of the WBC

Despite the considerable progress that has been made, there are several issues that urgently need to be tackled in the S&T systems of all WBC, one of which is enhancement of regional and international cooperation.

19.3. S&T cooperation with the EU

Cooperation in S&T with the WBCs is being structured and shaped within the European perspective. Many activities have been initiated by the 'EU-Balkan Countries Action Plan on Science and Technology' which was a three year plan adopted at the Thessaloniki Summit in June 2003, following an initiative of the Greek Presidency of the EU, supported by the EC. The initiative did not have a dedicated budget, but proved a strong basis from which to claim funding. The Action Plan addressed issues related to research infrastructure, human potential, institution building and the promotion of joint research, technology and development (RT&D) activities and innovation. References to the Action Plan were included in several projects funded by the EC's 6th Framework Programme, initiatives from Member States and associated countries and the EC itself.

Dialogue between the EU and the WBC was enhanced in the first half of 2006 through the launch of the Steering Platform on Research for the WBC, by the Austrian EU presidency. It is envisaged that this Steering Platform will be implemented fully when the new instrument suggested in the 'Capacities' Programme of the 7th Framework Programme becomes a reality: a so-called INCO-NET for the WBC that will bring together stakeholders to define cooperation policy orientations and identify S&T priorities. It should promote participation in the framework programme and monitor the performance and impact of this cooperation.

19.3.1. Relations in the 7th Framework Programme

Currently, applications to the 7th Framework Programme for RT&D is an important issue. DG Research has tried to make it financially attractive for the WBC and, as of mid-February 2007, Serbia, Croatia, Former Yugoslav Republic of Macedonia and Montenegro have asked to be associated with the 7th Framework Programme. The Memoranda of Understanding will come into effect on 1 January, 2007, i.e. from the start of the programme. Bosnia and Herzegovina and Albania are also considering association with Framework Programme 7 in order to become more integrated in the European Research Area (ERA).

Return on investments so far has yet to be seen. The human potential in the WBC has been endangered by the brain drain and brain waste mentioned above, the infrastructure needs of research institutes are pressing and the high competitiveness of the framework programme will make it difficult for researchers to coordinate successful project applications. The easiest way to become familiar with and manage the procedures required for framework projects is to be a partner in a successful proposal, which means that the coordination work can be left to a more experienced institution. Currently, potential is hampered by the limited contacts with European research, which need to be built, to be renewed and to be enhanced. Exchange of information must be established and trust must be built. As framework programme project consortia are often established long in advance, joint workshops and smaller projects, such as



implemented in COST or through bilateral programmes, are an important means of enabling contacts as is strategic use of the scientific diaspora.

The rules for international cooperation in the 7th Framework Programme are significantly different from the last programme. The programme covering the thematic areas ('Cooperation') is in principle open to international cooperation partner countries (ICPCs). Specific International Cooperation Actions (SICAs) targeting the region are being implemented, which require the participation of research institutions from the target countries. These actions would seem to be a promising approach to launching specific calls for the region which should be followed up and further promoted.

In several thematic priorities, Specific Support Actions (SSAs) and Coordination Actions (CAs) are in place to identify institutions with the highest potential for innovation and for cooperation, to support these institutions and to develop strategic recommendations. The assistance that is provided is usually directed to managing information flow to enable researchers in the WBC to learn about opportunities in the framework programme and to provide researchers in the Member States with contacts for researchers working in their respective fields.

In general, the EU is furthering reforms through the Stabilization and Association Agreements (SAA), which provide legal frameworks for relations during the period to possible accession. Substantial financial assistance, which in previous years was provided through CARDS (Community Assistance for Reconstruction, Development and Stabilization), will be provided through the new Instrument for Pre-Accession Assistance (IPA). Support for S&T infrastructure and related activities is envisaged, but the breakdown for these specific activities may not be significant as the main objectives of IPA lie in different fields, i.e. environment, sustainable development, trade, etc.

19.4. Bilateral and regional cooperation

The South East European ERA-NET (SEE-ERA.NET, <http://www.see-era.net>) plays a specific role in international cooperation and coordination. It brings together research programme managers from 14 countries. The implementation of a regional Pilot Joint Call in winter 2006/spring 2007 (deadline 31 March, 2007) through the SEE-ERA.NET has been a remarkable success. Following the ERA-NET idea, which was developed within the 6th Framework Programme, this success should be built on and developed into a regional funding programme. The 14 participating countries involved in this initiative for regional networking are developing a strategic approach for the future and also discussing integration of further partners in their network.

Several Member States are currently very active in bilateral S&T cooperation with the WBC, e.g. Austria, Bulgaria, France, Germany, Greece, Hungary, the Netherlands and Romania, as well as Norway, Switzerland and Turkey which are not members of the EU.



19. Cooperation and Innovation Potentials of the WBC

19.5. The Steering Platform on Research

The launch of the platform envisaged a strategic body for interaction between the WBC, the EU Member States, the candidate countries and other states associated with the EU Framework Programmes for RT&D and the EC. Although several activities were launched by the EC under the WBC Platform strategy, there have been no six monthly meetings, allowing for dialogue among all target groups, as planned before the launch. The 'Information Office' of the Platform (SEE-SCIENCE.EU, <http://www.see-science.eu>) has provided support for information exchange in an effort to become a 'clearing house for joint ideas and activities' to establish the Platform to develop analytical support and reports.

The need for coordination of international cooperation activities has been recognized by the Member States and the EU and Framework Programme 7 plans to allocate financial resources for the coordination of a bi-regional dialogue on S&T at policy level and at the level of the SSAs and CAs as well as amongst the National Contact Points (NCPs) and other stakeholder groups.

19.6. Future coordination of cooperation

As mentioned above, INCO-NET is a tool designed to improve coordination by bringing together relevant policy makers, the scientific community, and other EU and third country stakeholders to identify S&T priorities and define cooperation policy orientations. It is also designed to implement specific activities to strengthen participation in the 7th Framework Programme, including support for information points and the conduct of activities leading to the definition of priorities for research collaboration between the target region and the framework programme. In other words, there are three complementary aspects: dialogue, implementation and monitoring and review.

In the best case, priority areas for cooperation will be identified through dialogue based on mutual interests and benefits and taken up by the EU. The implementation of these priorities will be monitored and results and information disseminated in the framework programme. A continuous process of feedback will be required to update policies and priorities to ensure effective coordination.

With a clear perspective for EU accession on one side and greater political willingness and real efforts to foster national innovation capacity and strengthen bi- and multilateral cooperation on the other side, the WBC should be able to overcome their isolation and catch up with the knowledge-based, prosperous economies.

20. Research and Development Needs of the Western Balkan Countries

Davor Kozmus

20.1. Introduction

The drive towards restructuring and modernization of infrastructure, human potential, institution building, joint research and funding of research and development (R&D) activities in the Western Balkan countries is taking place alongside the development of science and technology (S&T) and shifts in education systems related to the launch of the European Research Area (ERA), the Bologna Process and the e-Learning initiative in Europe. The Western Balkan countries are being offered the opportunity to fast track towards full integration in the European research and knowledge system through the synergies provided by the opening up of national systems. However, transforming opportunities into reality is not straightforward. This paper is based on work conducted within the framework of the Southeast European ERA-NET (SEE-ERA.NET)⁶⁵, one of the ERA-NET⁶⁶ scheme projects and highlights some of the areas where action will be needed if the Western Balkan countries are to become integrated players in the future European knowledge society.

We conducted an examination of the main contemporary economic, technological, political and social drives in the Western Balkan countries and their impact on science and research through comprehensive needs analysis aimed at revealing the main priority needs regarding infrastructure, human potential, institution building, joint research and funding.

⁶⁵ SEE-ERA.NET is part of the ERA-NET scheme, and is designed to improve cooperation and coordination of national and regional level activities in Member States and associate states through the networking of research activities and the mutual opening of national and regional research programmes. The main goal of ERA NET is to help to make the ERA a reality by improving coherence and coordination of research programmes across Europe. The scheme is designed to enable national systems to accomplish collectively tasks that would be impossible for them to achieve independently. The ERA-NET scheme therefore has a long-term perspective, allowing for the different ways that research is organized across different Member States and associated states.

⁶⁶ Community action in the field aims at contributing to the creation of the ERA by stimulating and supporting programme coordination and joint activities conducted at national and regional levels among European organizations, and the development of a common knowledge base required for the coherent development of policies. These activities may be in any scientific or technological area, including the thematic priority areas. The aims are to encourage and support initiatives undertaken by several countries, in areas of common strategic interest, to develop synergies among existing activities through coordinated implementation, mutual opening and mutual access to research results, and to define and implement joint activities. The ERA-NET Scheme was set up to accomplish these aims. It aims to make the ERA a reality by improving the coherence and coordination across Europe of research programmes [Cordis: <http://www.cordis.lu/coordination/era-net.htm>, accessed 19.6.07].



20. Research and Development Needs of the Western Balkan Countries

20.2. Methodology

Prior to the needs analysis exercise, discussion workshops were organized with government representatives and senior and junior researchers from the Western Balkan countries. The main goal was to exchange information on national research systems. The Slovenian Ministry of Higher Education, Science and Technology was responsible for coordinating various tasks within this framework:

- to analyse the structure of the national systems of research of all the Western Balkan countries: Albania, Bosnia and Herzegovina, Croatia, Former Yugoslav Republic of Macedonia, Montenegro and Serbia;
- to analyse these countries national R&D priorities;
- to analyse their specific problems and needs and enhance their presence in international, multilateral and European R&D co-operation.

An inductive methodology was used to cover the range of needs, which were grouped into five categories: infrastructure, human potential, institution building, joint research and funding.

20.3. Results of the needs analysis for the Western Balkan countries

The research findings are grouped under the five categories defined above.

20.3.1. Priorities relating to infrastructure

An R&D infrastructure is a basic element in any R&D system (e.g. specialist equipment and laboratory space; electronic databases; buildings; libraries, etc.). One of the main barriers to development in the Western Balkan countries region is the inadequate infrastructure. The improvements required are a major issue for all the Western Balkan countries and failure to address this issue could destabilize efforts in other domains. The construction of a more effective and efficient infrastructure in the Western Balkan countries involves:

- development of a more coherent R&D and innovation system that will optimize the capacities of the existing R&D infrastructure at the level of national research sectors and industry;
- modernization of existing equipment and laboratories;
- access to GÉANT, the main European multi-gigabit computer network for research and education;⁶⁷
- access to prominent scientific journals, electronic journals and literature in libraries;
- access to electronic databases (e.g. Science Direct, Web of Science, ISI databases, etc.) via the Internet;

⁶⁷ The GÉANT project is a collaboration between 26 National Research and Education Networks representing 30 countries across Europe, the European Commission, and DANTE. Its principal purpose was to develop the GÉANT network - a multi-gigabit pan-European data communications network, reserved specifically for research and education use. The project also covers a number of other activities relating to research networking. These include network testing, development of new technologies and support for some research projects with specific networking requirements.



Improvements to electronic networks: A top priority must be the improvement of electronic networks for science, research and education and links to the European gigabit network GÉANT. Croatia and Serbia already have good connections with the GÉANT network (SEEREN 2003). However, the information infrastructure in Albania is completely inadequate to meet the needs of research organizations and researchers, and in Bosnia and Herzegovina is non-existent.

Information infrastructure: The information infrastructure is another important element of the infrastructure, and especially access to electronic journals and scientific databases (e.g. Web of Science, ISI databases, Science Direct, etc.). Researchers from Albania, Bosnia and Herzegovina, Montenegro and Former Yugoslav Republic of Macedonia lack well developed library information systems and services such as eLibrary. They do not have access to literature information resources. This is an important issue and vital to allow researchers to monitor the scientific work of their colleagues in other countries and to keep up to date in their scientific fields (Kozmus 2004: 127). There is an urgent need for connection to GÉANT and electronic libraries. The current information infrastructure in Croatia and Serbia is satisfactory, but there is a need for better access to scientific electronic journals and connections for dislocated academic and research units (faculties, laboratories, institutes) to a common and efficient European electronic network.

Research equipment: In Croatia the level of research equipment is adequate, but equipment funding is not always used efficiently with the result that maintenance of expensive research equipment is not always achievable. In the other Western Balkan countries (Albania, Bosnia and Herzegovina, Former Yugoslav Republic of Macedonia, Montenegro, Serbia) research equipment is outdated, preventing advanced research work that would allow these countries to compete with research institutes from more developed countries. Government representatives and researchers suggested that specific support actions should be implemented with regard to funding for the modernization of research equipment and financial support for training in the use of specialist equipment. Other instruments, such as CARDS⁶⁸ could be used to improve levels of R&D.

Development of new research centres: Development of new research centres at local and regional level and the construction of new technology parks is urgently needed. There are some examples of such centres (in Croatia, Former Yugoslav Republic of Macedonia, Serbia), but legislation often obstructs the full operation of these institutions. There is an urgent need for new legislation relating to the development of technology and innovation parks, which would give such research units and institutions access to national funding.

20.3.2. Human potential

A problem that applies to all Western Balkan countries is the massive and continuous brain drain. Many of the best young and most senior experts have left their countries to seek

⁶⁸ Community Assistance for Reconstruction Development and Stabilization: Council Regulation (EC) No 2666/2000 of 5 Dec 2000 on assistance for Albania, Bosnia and Herzegovina, Croatia and Former Yugoslav Republic of Macedonia.



20. Research and Development Needs of the Western Balkan Countries

employment elsewhere. There is also a problem of brain waste, particularly in Bosnia and Herzegovina and Montenegro where researchers are leaving the public research sector for better paid jobs in the private and non-profit sectors (e.g. in NGOs). As a result of the brain drain being suffered by Albania, Bosnia and Herzegovina, Former Yugoslav Republic of Macedonia, Montenegro and Serbia, the academic and research community in the Western Balkan countries is continuously declining. Talented researchers are only taking up research positions where they can see opportunities for training and mobility. An attractive research environment is very important. A good research infrastructure is a prerequisite for the establishment of centres of excellence and to give researchers an opportunity to develop flexible performance related careers.

The solution to the international brain drain is the creation of high quality research opportunities in the Western Balkan countries. International exchange and mobility of researchers is seen as an important precondition for increasing the qualifications of professors, researchers and students to European standards and to achieve wider European scientific integration. Although this kind of brain loss is considered a positive trend in developed countries, and contributes to increasing the quality standards of private companies and the spread of knowledge to other sectors, efforts should be made to dissuade people from leaving R&D and going into other economic sectors.

20.3.3. Institution building

The Western Balkan countries underwent massive institutional changes in the 1990s and suffered instability due to war, transition to a market economy, and changes in political regime, all of which directly affected the research sector. One of the most important preconditions for establishing a modern R&D system is a sense of awareness of the importance of science and research at national and regional levels. There needs to be a focus on science and RT&D as the motors for competitiveness and quality of life. R&D is crucial for the development of a modern economy

One of the challenges in coming years will be to rationalize and coordinate the various initiatives being implemented by a variety of ministries to foster the R&D activities of small and medium sized enterprises (SMEs) and industry generally. Another important goal is to develop systematic evaluation of science and research in all scientific disciplines. Evaluation of S&T policies, programmes and institutions is increasingly important for the allocation and justification of funding for all R&D players. The following should be implemented:

- evaluation and monitoring systems – to measure the effects of R&D investments, to enable policy makers to monitor SME and industry engagement in R&D activities and the exploitation of scientific results;
- evaluation procedures based on a unified set of criteria;
- evaluation and monitoring as a tool for elaborating and implementing priorities in the Western Balkan countries and development of human potential and infrastructure;
- benchmarking, identifying best practice and conducting impact assessments to ensure transparency and accountability.

20. Research and Development Needs of the Western Balkan Countries



Evaluation related to institution building in the area is poor. Researchers stressed that the current system of evaluation (ex-ante and ex-post) of science and research is inadequate and funds are not distributed according to scientific excellence or achievements. Our work demonstrated that there is a need to implement and foster evaluation systems in all Western Balkan countries. Science, scientists and research activities have been marginalized, R&D has not been a key priority and there is no clear long term strategy for R&D, all of which are obstacles to more intensive research in the Western Balkan countries.

Establishing evaluation procedures and monitoring mechanisms must be a priority for the national governments of Western Balkan countries. This should allow better coordination of activities among national statistics offices and government organizations. Introduction of a set of indicators for benchmarking national research policies is required.⁶⁹

Despite all the problems outlined above there are some examples of good practices in the field of institution building. In addition, training in EU R&D activities for policy makers from national administrations has been very successful. These activities support the development of efficient and effective National Contact Point Systems (NCPS) in the Western Balkan countries and therefore influence the development of the ERA. Education, training and networking of NCPS are well under way and are being enhanced by the ERA-WESTBALKAN project, in which some of the Western Balkan countries (Bosnia and Herzegovina, Former Yugoslav Republic of Macedonia, Montenegro and Serbia) are heavily involved. The Ministry of Education and Science in Montenegro and the Ministry of Education and Science in Albania should be integrated into the ERA-WESTBALKAN project.

Close attention needs to be paid to initiatives in the area of reorganization of the research administration, to provide a favourable legislative landscape that will stimulate the development of R&D capacities and human potential in the Western Balkan countries. The creation of innovation relay centres (innovation and technological parks) and the setting up of related activities to provide some momentum for new research in the Western Balkan countries are urgently needed.

20.3.4. Joint research activities

Since 2000, there have been a number of regional initiatives to enhance cooperation in various areas following the launch in 1999 of the Stability Pact for SEE.

A recent example of successful regional cooperation is the Vinca Institute in Serbia, which is a regional centre for basic and applied research in physics, chemistry and biology, and development of materials and nuclear technologies. This centre has a membership of 15 institutions from Serbia, Slovakia, Hungary, Italy, Bulgaria, Former Yugoslav Republic of Macedonia and

⁶⁹ Benchmarking national research policies, taking an integrated approach to the research activities of individual environments, i.e. within the context of their economic and social effects and determinants, is important for the Western Balkan countries for two reasons. First, it provides some indication of countries' levels compared to the EU Member States. Second, it helps to affirm the concept of science within the framework of a national development strategy and thereby increases the research potential of the Western Balkan countries, which will contribute to the achievement of the ERA.



20. Research and Development Needs of the Western Balkan Countries

Greece (Uvalić 2005). INTERREG – a European programme aimed at encouraging regional cooperation in the Western Balkan countries - is another example of good interregional, cross-border and transnational cooperation. These are examples of good practice in stimulating interregional cooperation, which should increase in the future with increased EU cooperation. Exploiting the potential of prior and existing bilateral R&D co-operation links is very important for the success of the SEE-ERA.NET project. SEE-ERA.NET aims to improve these links among partners and countries, to strengthen the international and European focus of R&D in the Western Balkan countries, to improve the competitiveness of these countries generally, and to support continuing integration into EU institutions.

Government representatives and researchers from the Western Balkan countries pointed out that very little has been done in terms of participation of Western Balkan countries in thematic priorities and that their participation in the European 6th Framework Programme was generally poor, despite there having been opportunities for participation.

The CARDS programme which provides financial assistance from the European Commission has been extremely important for supporting the economic development efforts of the Western Balkan countries although it does not provide direct funding for R&D infrastructure. The Marie Curie fellowship scheme should be emphasized; this provides young scientists with mobility research training grants and research and study opportunities in the EU.

The low level of technology transfer within the Western Balkan countries underlines the need for public support to industry at national and regional levels. A challenge for the Western Balkan countries will be to establish a favourable environment for the business sector to invest in new technologies and product development. There is a need for a coherent national policy that will establish direct and indirect financial support, tax initiatives and allowances.

Despite the difficulties that exist, there are cases where individual research institutes or researchers have been able to establish good links with researchers, private companies or research organizations abroad. We identified such examples of good practice in all the Western Balkan countries. Most international collaboration between Western Balkan countries and foreign partners is based on and conducted through personal relationships. Participation in the EC Framework Programmes and INCO (International Cooperation) calls is very low, with the most successful examples in Croatia and Serbia.

20.3.5. Funding

The decline in financial support from the state and the inability to attract other funding is a serious problem for all Western Balkan countries. The Western Balkan countries are being confronted by increased difficulties in preserving their research capabilities and carrying out world-class research. Funding of R&D activities was the main problem highlighted in our workshop sessions.

In the EU, R&D expenditure as a percentage of total GDP has been stable; in 2003 it was around 1.9% (objective is 3%). Our analysis shows that R&D expenditure in the Western Balkan countries is very limited. It is very low in Bosnia and Herzegovina, where only 0.05% of GDP is devoted



to R&D activities, 0.22% in Former Yugoslav Republic of Macedonia, 0.3% in Montenegro, 0.32% in Serbia, with the highest expenditure as a percentage of total GDP at 1.14% in Croatia. Croatian data from the Central Bureau of Statistics show a decline in investment in R&D from 2000 (1.23%) to 2001 (1.07%), but this negative trend was reversed in 2002 (1.12%) and 2003 (1.14%). A major change in expenditure as a share of total GDP in Croatia can be seen in the business sector. In 1997 this share was only 0.25%. It rose to 0.55% in 2000, declined in 2001 to 0.45%, was 0.48% in 2002 and 0.45% in 2003. This is the highest level of business sector expenditure on R&D activities in the Western Balkan countries.

Funding of R&D activities in the Western Balkan countries is, thus, substantially lower than the EU average. R&D is poorly funded, undervalued and underpaid and the lack of funds has a major impact on the development of the science and research infrastructure and therefore the quality of research in the Western Balkan countries. In the medium term, international donors will remain important sources of financial and technical assistance to the Western Balkan countries, but major initiatives should be taken to find significant internal sources of funding R&D activities in the Western Balkan countries.

20.4. Conclusions

This paper has discussed some of the issues relating to the R&D sector in the Western Balkan countries. Workshops with researchers and government representatives from the Western Balkan countries identified some of the main needs and were the source of suggestions for solving these issues and elicited views on what are the major challenges and targets for the Western Balkan countries in the near term, which include the following.

Infrastructure: A failure to address these needs could destabilize efforts in other areas; the following areas need close attention and relevant actions:

- development of electronic networks among all research institutes and universities in Western Balkan countries with appropriate connections to the main scientific and academic network, GÉANT;
- upgrading of the existing national research and education networks in order to make them compatible with the pan-European electronic network;
- access to E-science journals, E-libraries and electronic databases;
- modernization of research equipment and provision of resources for maintenance of expensive scientific apparatus;
- facilitating and networking existing research infrastructures and building up new research facilities at the interregional level, allowing mobility of scientists and possibilities for shared use of infrastructure.

Human potential: The situation in terms of human resources in R&D for the Western Balkan countries is very difficult. The number of employees in this sector has halved in the last 10 to 15 years. The Western Balkan countries face huge brain drain problems in many scientific disciplines rendering competitiveness and critique in science very problematic. Other scientific



20. Research and Development Needs of the Western Balkan Countries

fields are experiencing a dramatic ageing problem in their research personnel. A programme that will attract and produce new young researchers is urgently needed in order to stimulate and motivate young researchers to remain within scientific disciplines and in their home countries. They should be granted mobility to benefit integration into the global scientific community. In this context, it is important to solve the visa problems encountered by researchers from Albania, Bosnia and Herzegovina, Former Yugoslav Republic of Macedonia, Montenegro and Serbia. Researchers from these countries usually find it impossible to travel to scientific conferences and meetings overseas because of the complicated and lengthy bureaucratic procedures of some EU Member States.

Institution building: The absence of a clearly formulated, coordinated and publicly proclaimed science policy in all Western Balkan countries reflects the fact that the position of science and its development in these countries are not clearly defined. The lack of a clear R&D strategy and policy is responsible for the continued marginalization of research. Only a shift from the rhetoric to the reality will ensure a balance in supply and demand, openness, participation and quality of R&D activity.

Joint research: One of the main challenges to a coherent R&D system relates to the linking of R&D institutes, universities and the private sector. The teaching activities of researchers in universities and research units, the involvement of professors in research projects, and international scientific collaboration, are part of a new type of cooperation pattern in the R&D system. However, we found that these interactions where they exist are mainly occurring at the individual level, with no institutional links being established (except in cases where research institutions have been integrated into universities as a result of R&D restructuring).

Funding: The financing of science is at present far from stimulating or developmental. The Western Balkan countries are not keeping pace with the EU countries. Funding for R&D should be significantly increased to close the gap. At the same time, it must be recognized that the way that financing is organized, i.e. the accumulation and allocation of funds, is not satisfactory. The main source of funding is still state budgets, with very limited financial resources from private companies and industry. The allocation systems in all Western Balkan countries are inadequate, non-selective and unstimulating. The system of evaluation is problematic with failures to adopt internationally comparable rules and standards for gathering and processing data on R&D activities. Funding of R&D therefore is not always in line with scientific excellence and innovation.

Most Western Balkan countries continue to suffer from low or even declining levels of public investment in R&D, low involvement of the private sector in research, inadequate R&D infrastructure and out of date equipment, poor access to electronic networks and very limited access to the scientific literature, huge brain drain problem, lack of motivation for young researchers to stay in science, lack of knowledge and experience in how to apply for international funding, poor success rate in European framework programmes, poor efficiency and distribution of available public funds, etc. We can conclude that the Western Balkan countries face many and complex problems in the area of R&D. The national governments of the Western Balkan countries must play an integrating role in managing the knowledge in their economies

20. Research and Development Needs of the Western Balkan Countries



and making technology and innovation policy an integral part of their overall economic policies. There must be corporate governance and a well functioning legal and regulatory framework, with good financial support mechanisms, assistance for innovative SMEs, protection of IPR and, last but not least, means of attracting people to stay in the research sector. These are priorities for the building of a coherent R&D system in all Western Balkan countries.

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21. The EU–Balkan Countries Action Plan for S&T: Achievements, Weaknesses and Ways Forward

George Bonas

21.1. Introduction

This paper focuses on an initiative of the Greek EU Presidency which was supported by the European Commission (EC), the Ministers for Research in the Western Balkan countries, in the EU15 Member States and in the associated countries. The Ministers met in Thessaloniki - Greece in June 2003 to adopt the 'EU–Balkan Countries Action Plan for Science and Technology (S&T)'. Adoption of this plan was a high level political initiative aimed at integration of the Western Balkan countries in the European Research Area (ERA). The duration of the plan was three years; thus we can make an assessment of its achievements at political and operational levels, its weaknesses, and possible ways forward following its completion.

21.2. The Action Plan for S&T

This Action Plan⁷⁰ can be seen in terms of a list of priorities for intervention designed to increase integration of the Western Balkan countries in the ERA. The type of interventions recommended include:

- renewal and improvement of the infrastructure;
- improvement of human potential in research, technology and development (RT&D);
- institution building activities;
- promotion of joint RT&D activities.

In each domain, topics of particular importance were identified. In the implementation of the Action Plan, it was agreed that existing structures and multilateral, regional and bilateral initiatives, such as the EC's 6th Framework Programme, CARDS (Community Assistance for Reconstruction Development and Stabilisation), INTERREG, UNESCO, COST and the numerous bilateral cooperation agreements between the Western Balkan countries and EU Member States and candidate countries, should be explored.

⁷⁰ The full text of the Action Plan is available at: <http://www.gsrt.gr/ActionPlan> [accessed 21.6.07].

21. The EU–Balkan Countries Action Plan for S&T: Achievements, Weaknesses and Ways Forward

21.3. Main achievements

The adoption of the Action Plan created strong momentum for enhanced scientific and technological cooperation between the EU and the Western Balkan countries, and also among the Western Balkan countries themselves. S&T was recognized as a key element of economic growth and a forerunner of integration of the Western Balkan countries in the ERA and the EU. It was no coincidence that some few days before adoption of the Action Plan the Thessaloniki Summit (21 June 2003) had re-confirmed the status of ‘potential candidates’ for EU membership on the Western Balkan countries.

Preparation and adoption of the Action Plan strengthened the links among research policy makers and research administrators in the Western Balkan countries and several EU Member States and candidate countries. These links have proved beneficial for the establishment of research consortia and joint participation in RT&D projects. These links and the cooperation that has occurred, have paved the way for policy oriented initiatives such as the Southeast European ERA-NET (SEE-ERA.NET) project⁷¹ (aimed at the coordination of bilateral cooperation activities in the region) and the launch of a Steering Platform⁷² to stimulate, monitor, coordinate and support cooperation in RT&D between the countries of the EU and the Western Balkans.

At the operational level, the Action Plan provided the political background for the EC’s publication of specific calls for proposals addressed to capacity building in the Western Balkan countries, in the context of the 6th Framework Programme, in addition to joint RT&D activities. Alongside this, the Action Plan provided solid justification for financial support for several projects in the field of E-infrastructures through the Information Society Technologies (IST) initiative in the 6th Framework Programme, INTERREG and NATO. These projects (SINSEE, SEEREN, SEEREN2, SEE-Grid, SEEFIRE, and others)⁷³ have contributed significantly to reducing the digital divide and integrating the research communities in the Western Balkan countries into the ERA.

21.4. Weaknesses

Despite the undeniable success of the Action Plan in strengthening S&T cooperation between the EU and the Western Balkan countries at the political level, and in implementing several important activities at the operational level, its contribution to the key objectives of infrastructure renewal and restructuring of the national research systems has been limited. The main reason for the limited success in these areas is lack of financial tools to support activities. These activities were supported mostly by the 6th Framework Programme and, to a lesser

⁷¹ The Southeast European ERA-NET, SEE-ERA.NET: <http://see-era.net/> [accessed 21.6.07].

⁷² For information on the Steering Platform for Western Balkan countries see ‘Information Office for the Steering Platform on Research for the Western Balkan Countries’ [<http://www.see-science.eu>, accessed 21.06.07].

⁷³ See the ‘Greek Research and Technology Network – GRNET: www.grnet.gr [accessed 21.06.07], as well as: www.seeren.org (South Eastern European Research and Education Network, accessed 21.06.07), www.see-grid.org (South Eastern Europe Grid-enabled e-Infrastructure Network, accessed 21.06.07), www.seefire.org (South Eastern Europe Fibre Infrastructure for Research and Education, accessed 21.06.07).



21. The EU–Balkan Countries Action Plan for S&T: Achievements, Weaknesses and Ways Forward

extent, by INTERREG and NATO. None of these financial instruments carried the necessary funds to support in-depth renewal of the research infrastructures in Western Balkan countries or the restructuring of their research systems. These goals were beyond the scope and mandate of these instruments. It was for this reason that support from development assistance programmes, such as CARDS, was highlighted in the Action Plan. However, despite efforts being made to mobilize this support, it was not forthcoming for various reasons including:

- the differences in the Action Plan's 'decision making groups' (i.e. the Directorate General for RTD, the research ministries in the EU Member States and the Western Balkan countries) on the one hand, and CARDS (Directorate General External Relations, the Ministries of Foreign Affairs in the EU Member States and the finance ministries in the Western Balkan countries) on the other. Communication between these two groups was not always at the level anticipated;
- the programming period for CARDS (2002-2006) and the time frame of the Action Plan (2003-2006) did not coincide: when the Action Plan was adopted the regulations for CARDS had already been approved and there was no provision for research related activities.

It should be noted that similar sorts of difficulties were encountered in the attempted S&T cooperation of the EU with the Mediterranean countries (Barcelona Process) and the Black Sea countries (BSEC Action Plan), where synergies between the political initiatives and the financial instruments were not optimized.

21.5. Current environment and way forward

One of the aims of the Action Plan was to raise awareness about the need to consider S&T as a key element for economic growth in the Western Balkan countries, and to draw attention to the domains agreed by ministers as priorities for intervention. The awareness campaign included contacts with various EC services and with the administrations of the EU Member States and the Western Balkan countries. As a result of these efforts it is evident that any breakthrough in terms of integrating the Western Balkan countries in the ERA will only be achieved through the combination of two major European financial instruments:

- the Instrument for Pre-accession Assistance (IPA, the successor to CARDS), which should act to promote the renewal of research infrastructures and the restructuring of research systems;
- the EC 7th Framework Programme, which should provide support for joint RT&D activities and for researcher mobility.

The distribution of tasks would optimize the complementarities between these instruments, increasing synergies and enhancing the impact of their interventions. For this combined approach to be successful, coordination at three levels will be necessary.

1. At the level of the EC, the Directorate General for Enlargement (responsible for IPA) and the Directorate General for RT&D should engage in regular exchange of information to increase the efficiency of their interventions for the Western Balkan countries. The IPA regulations, to be finalized in 2006, should include research related activities.

21. The EU–Balkan Countries Action Plan for S&T: Achievements, Weaknesses and Ways Forward

2. At the level of EU Member States, information on the most important activities and needs of the Western Balkan countries should be communicated regularly by the ministries responsible for research to the representatives in the governing body of the IPA (usually the Ministries of Foreign Affairs) in order to facilitate support for these activities through this instrument.
3. At the level of the Western Balkan countries, sound proposals for research related activities should be prepared by the ministries responsible for research and submitted to the Ministries of Finance responsible for defining the national priorities to be supported by the IPA. It is clear that despite the efforts of the EC and Member States, if clear requests from the Western Balkan countries for support for research related activities are not formulated, they will not materialize. Currently, only Serbia has formulated an explicit request, which was directed to CARDS and unfortunately met with no success. It is reasonable to expect that Serbia will resubmit its request to the IPA, and it is hoped it will meet with more success. The other Western Balkan countries should follow Serbia's example.

Among the types of activities that could be supported by the IPA, it would be interesting to explore the idea of 'dual' use facilities. For instance, most of the Western Balkan countries in view of European integration need to increase their analytical potential e.g. for environmental and customs related purposes, which will require state-of-the-art equipment that could also be used for research purposes.

During the negotiation and implementation of the 7th Framework Programme, continuous policy dialogue among the EC (Directorate General RT&D), EU Member States and the Western Balkan countries would contribute to the optimization of activities in relation to the Western Balkan countries, to be supported by framework programme initiatives.

21.6. Conclusion

The 'EU–Balkan Countries Action Plan for S&T' produced significant momentum in the cooperation between the EU and the Western Balkan countries, and among the countries in the latter region. There have been some achievements, mainly at the level of political cooperation, but also at the operational level, based on funds via the 6th Framework Programme. Unfortunately, the lack of financial support from CARDS meant that there was no major progress in terms of renewal of the research infrastructure or the restructuring of the research systems in the Western Balkan countries.

Nevertheless, the Action Plan has raised awareness about the need to support S&T as a tool for economic growth in the Western Balkan countries. This new awareness is coinciding with the launch of a new financial instrument, the IPA, which, in combination with the 7th Framework Programme for RTD could help to boost integration of the Western Balkan countries in the ERA.

22. From the EU-Western Balkan Countries Action Plan to the Full Integration of the Western Balkans into European RTD Activities

Manfred Horvat

22.1. Introduction

Starting from 2000, the Western Balkan Countries (WBC) have been on the agenda of many conferences, meetings and working groups involving mainly ministers and high level officials from EU Member States, associated countries, the WBC and the European Commission (EC).⁷⁴ The process towards integration started with a first workshop involving policy makers from the region with representatives from the WBC, neighbouring countries, the EC, and the South East European Cooperative Initiative (SECI) held in Vienna in December 2000. The conclusions of this meeting⁷⁵ summarized the main needs of the WBC and suggested a set of specific actions to support the WBC in their rapprochement towards the European Research Area (ERA).

Three subsequent initiatives were and still are of specific importance at both the political and practical levels for the integration of the WBC. First, in 2003, the Greek EU Presidency succeeded in a well designed process in preparing the EU-Western Balkan Action Plan⁷⁶ which was adopted by the Council of Ministers in Thessaloniki in June 2003. Second the SEE ERA-NET initiative was established to co-ordinate the bi-lateral research, technological development and demonstration (RTD) programmes between a number of Member States and associated countries and the WBC, and to prepare for joint calls for proposals and later for a joint RTD programme.⁷⁷ Third, the WBC were prioritized by the 2006 Austrian EU Presidency, which led to the establishment in June 2006 of the Steering Platform on Research for the WBC.

Accompanying Measures and Specific Support Actions, such as CROSTIM part the 5th Framework Programme and ERA-WESTBALKAN in Framework Programme 6 contributed to prepare the ground for participation in European RTD activities at the operational level by supporting the creation of National Contact Point Systems (NCPS) in the WBC. From the experience of earlier accession countries it has become clear that participating in the EU RTD Framework Pro-

⁷⁴ For a detailed account of the developments see: Horvat, M. and Bonas, G., 'Integrating Western Balkan Countries into the European Research Area', in Gajdusek, M.F., Mayr, A.C. and Polzer, M. (eds.) (2006), *Science Policy and Human Resource Development in South-Eastern Europe in the Context of European Integration*, Austrian Federal Ministry of Education, Science and Culture (bm:bwk), pp. 17-25.

⁷⁵ Busek E., Horvat M., Kneucker R., Stoklaska, A. (2001), 'Vienna Memorandum on the Western Balkan Countries in Future European RTD Activities'. Vienna, January.

⁷⁶ See paper by G. Bonas in this volume.

⁷⁷ See paper by P. Mayr in this volume.

22. From the EU-Western Balkan Countries Action Plan to the Full Integration of the Western Balkans into European RTD Activities

grammes needs a well organized system of contact points for information and assistance on all aspects regarding the contents, the rules for participation and the criteria for preparing potentially successful project proposals.

22.2. Developing a committed community of common purpose

All these activities, the large numbers of ministerial and other meetings, the Action Plan, the support actions to create functioning EU RTD contact point systems, and SEE ERA-NET played an important role in developing a stable and committed high level community of common purpose supporting integration of the WBC research community into the fabric of European research. These activities supported the WBC policy makers quite substantially in their task of developing appropriate policies and strategies for participation in the ERA. All these measures succeeded in raising awareness in the EU about the WBC. Also building personal contacts and networks as a social infrastructure for continuously improving WBC participation in EU RTD activities has proven extremely important – and efficient. For the future, it will be very important for the Steering Platform on Research for the WBC to become active and carefully monitor the integration process, suggesting new targeted measures and initiatives where appropriate.

22.3. Needs and issues related to research policies and initiatives for the WBC

In the course of the deliberations involved in the above mentioned initiatives and activities, a set of issues was identified that will need to be tackled as part of the further developments. Some of these issues have already been addressed successfully, but there are still many items on the agenda that will have to be solved as soon as possible.

From the beginning, it was agreed that a systematic approach was needed to improve the RTD environment in the WBC and to develop capacities for transnational research activities. The adoption of the Action Plan was a major achievement and the follow up activities ensured that WBC issues remained on the agenda and some advancements were made. In Thessaloniki, ministers agreed that the WBC should be awarded special status as 'potential candidate countries', a move that was supported in a high level meeting in the European Parliament in February 2005. However, unfortunately, this was never mobilized and the WBC are considered in the same way as any third country around the world. This is a very unsatisfactory situation.

Since 2000, ministers and high level officials have continually made requests for the establishment of a monitoring committee or steering platform for the WBC. As mentioned above, the Steering Platform on Research for the WBC was finally established during a ministerial meeting in Vienna, by Commissioner Potočnik in June 2006. However, apart from a press release the EC has not issued a single official document on the Steering Platform, and its official status and role remains unclear. Needless to say, there have also been no follow up activities. This issue will be addressed in more detail later.



22. From the EU-Western Balkan Countries Action Plan to the Full Integration of the Western Balkans into European RTD Activities

There have been some positive developments, however. Specific accompanying measures and support actions have led to the establishment of NCPS with trained and knowledgeable staff in the different WBC. The information and assistance activities of the NCPS have supported participation in Framework Programme 6, and the results of the WBC in this framework programme are certainly due to these activities. This has contributed to laying the ground for even greater participation in Framework Programme 7. A continuing area of major concern is the involvement of WBC industry in European research activities. However, this problem is likely related to general industrial and economic developments in the WBC and cannot be separated from these processes.

In Framework Programme 5, and more frequently in Framework Programme 6, the request for specific calls for proposals for the WBC has been adopted by the INCO programme and also in some of the thematic priorities, such as Information Society Technologies (IST). Compared to 2000, there is certainly much greater awareness of the need to close the gap with the European geopolitical landscape and the ERA in particular, and integrate the WBC into European RTD activities. This awareness is important, but there is a need for concrete actions.

One of the most important issues is the RTD infrastructure in the WBC. Modern science, research and technology development require adequate hard and soft infrastructures including especially up-to-date experimental equipment, computers, electronic networks, data bases and libraries. This issue has been discussed on many occasions over the last more than six years, but progress is at best limited.

One exception in this context is the SEEREN⁷⁸ project, which aims at connecting the Research and Education Networks of the WBC with the European high-speed electronic network GÉANT. Building on this project and its successors, grid applications have been developed (SEE-Grid). These projects, supported by the EC's IST Programme, have contributed substantially to reducing the separation between the WBC and EU Member States in terms of electronic networking for RTD purposes.

However, in other areas of technical equipment there is still an urgent need for joint actions involving all possible responsible Community and other initiatives. On many occasions, it has been quite rightly emphasized that the infrastructure issue cannot be solved by the EU framework programmes. There is a need for cooperation and synergies with Community structural instruments such as CARDS and now IPA.⁷⁹ In addition, also the European Investment Bank (EIB) and/or the European Bank for Reconstruction and Development (EBRD) could perhaps contribute to the solution of these fundamental problems. However, it seems that the cooperation and coordination across different EC services is very difficult. It could be said that the WBC have problems and the EC has Directorates General!

⁷⁸ <http://www.seeren.org/>, accessed 18.07.07.

⁷⁹ IPA - Instrument for Pre Accession. See: http://ec.europa.eu/enlargement/financial_assistance/ipa/index_en.htm, accessed 18.07.07.

22. From the EU-Western Balkan Countries Action Plan to the Full Integration of the Western Balkans into European RTD Activities

Finally, it must be remembered that cooperation with UNESCO and UNDP has been beneficial and certainly offers opportunities for further development and exploitation.

22.4. The WBC in the 6th Framework Programme and the challenges of the 7th Framework Programme

Researchers from the WBC participated in the 6th Framework Programme. Although the level of participation may have been far from satisfactory,⁸⁰ some first experience has been achieved and the WBC have progressed along the 'learning curve' in the area of European RTD activities – at the levels of policy making and concrete collaborative research activities. The experience gained so far will disseminate and diffuse into the science and research communities of these countries. It should be emphasized that this 'experience' extends to those proposers – that is the vast majority – that were involved in proposals not recommended for funding. Experience from other countries shows that initially unsuccessful proposers have a much better success rate than newcomers in later calls for proposers. It is of crucial importance to learn from this experience and try to make step by step improvements. This means also, that it is essential that experiences are collected and analysed in research organizations in order that they can be exploited and learnt from. The EU RTD framework programmes are very much training and learning laboratories for transnational RTD activities.

The international RTD activities are organised differently in the 7th Framework Programme. Cooperation with third countries – INCO – has become an integral part of the thematic priorities under the 'Cooperation' Specific Programme. In the specific international cooperation scheme under the 'Capacities' Specific Programme only coordination and support actions are possible.

The 7th Framework Programme themes are now open for international cooperation. On the one hand this is good news as it opens up opportunities for third countries. On the other hand, however, as experience from the 6th Framework Programme has shown it is very difficult for third countries to get integrated into the mainstream European RTD activities, not least because they are exclusively oriented towards benefiting EU Member States. However, the opportunities exist and should be utilized as far as possible, especially because the WBC are, and have to be seen as, potential candidate countries and, in the context of the enlarged ERA, should be attractive partners. In addition, research has always been avant-garde - in the best possible meaning of the term – for EU enlargement.

However, there are some Specific International Cooperation Activities (SICA) that should be tailored to specific third countries and address specific thematic research sub-areas of particular importance to the third countries concerned. This is a very important issue for the WBC.

⁸⁰ First interim general results are described in Horvat and Bonas (2006) see footnote 74. Detailed analyses will be prepared when the final contract data are available from the EC.



22. From the EU-Western Balkan Countries Action Plan to the Full Integration of the Western Balkans into European RTD Activities

In previous years and on many occasions, especially in ERA-WESTBALKAN and in SEE ERA-NET, the priorities of WBC regarding thematic areas for European cooperation have been discussed and identified. The following list of priorities summarizes the outcomes of these deliberations:

- Health
- Agriculture and food
- Information and communication technologies (ICT)
- Material sciences
- Civil engineering
- Environment, integrated water management
- Energy efficiency
- Socio-economic research and humanities.

This list of themes could be used as a first very general guideline. However, it should be pointed out that this list is very similar (almost identical) to the general themes of the European RTD Framework Programme. This means that it will be necessary to identify more detailed sub-areas and their specific importance for the WBC in order to prepare for the thematic work programmes and for calls for proposals for SICA in the 7th Framework Programme, targeting the WBC. There is an urgent need to address this issue, as soon as possible and in all possible fora, in SEE ERA-NET, in the new action ERA-WESTBALKAN plus and, of course, in the Steering Platform.

There are other opportunities available to the WBC in this new framework programme. Researchers from the WBC may apply for Starting Independent Research Grants under the 'Ideas' Specific Programmes. Also the Marie Curie Fellowship Scheme under the 'People' Specific Programme offers attractive opportunities. Unfortunately, in the 6th Framework Programme, the Marie Curie fellowship scheme was hardly utilised by researchers and research organizations from the WBC. This is unfortunate because this scheme offers excellent instruments that can and should be used in a strategic way to establish and develop research links and sustainable cooperation. Therefore, improving and optimizing the use of the 'People' Specific Programme should be high on the agenda of policy makers, of the NCPS and also the managements of research organizations, universities and industry.

Under the 'Capacities' Specific Programme, the Research Potential scheme and the previously mentioned INCO scheme offer specific opportunities for the WBC: activities for improving the capacities of research entities in the WBC for participating in Framework Programme 7, as well as the further development of the ERA-NET scheme and INCO-Net actions for coordination of policies and policy development.

There are still many weaknesses and deficits that need to be overcome. The research infrastructure needs substantial actions and inputs for improvement and development. Barriers to mobility and cooperation have to be broken down. Awareness raising on relations between EU RTD, technological development and innovation, competitiveness and growth remains important. However, the seven years of the 7th Framework Programme should provide opportunities for systematic and consequent strategies and activities supporting the integration of the WBC

22. From the EU-Western Balkan Countries Action Plan to the Full Integration of the Western Balkans into European RTD Activities

into European research activities. And, despite the problems, it must be emphasized that substantial progress has been made since the start of these activities in 2000.

22.5. Integrating the WBC – the need for joint activities

As in previous enlargement rounds, integration of the WBC in European research activities is not a task just for the EC or the WBC on their own. Making an enlarged ERA encompassing the WBC a reality, involves joint commitment and action from all parties:

- the EC;
- the Member States, the associated countries, and the candidate countries; and
- the WBC.

The EC must ensure that the WBC remain high on the agenda of all relevant Commission services and that targeted actions are planned and implemented wherever possible. This will be especially necessary in the context of the infrastructure, where decisive action across all Directorates General and including all relevant Community instruments will be crucial. There is a need to make the step from discussion to action.

Also EU Member States must make more effort to integrate the WBC into the ERA, or as it might be more aptly described the European Research, Knowledge and Innovation Area (ERKIA). The WBC should be a regular item on the agenda of the Council and the preparatory bodies, such as the Research Group. Regular communication between the members of the Research Group and the science and research counsellors of the WBC in Brussels should be institutionalized. The member state's delegates on the Programme Committees should communicate with their high level colleagues in the WBC. Twinning arrangements might be useful in this context. And finally, full integration of the WBC NCPS in the NCP networks at all levels will provide an important expert and social infrastructure to support the integration of WBC researchers in European RTD consortia.

Also, there are several tasks for the WBC themselves to fulfil. Most importantly, their research and technology policies, laws and programmes must be adapted to the requirements of European RTD cooperation. The NCPS need to be stabilized and further developed. Raising awareness among the science, research and technology communities about the opportunities offered by the 7th Framework Programme is a significant and important task. Supporting the development of specific strategies and support structures in universities and research centres will be necessary to improve the performance of the WBC in the 7th Framework Programme.

Mobilizing industry, including SMEs, will be difficult, but is essential in order to exploit the full benefits of European RTD cooperation. This may necessitate specific national support programmes in order to encourage progress in that area.

Finally, targeted measure will be necessary to increase the visibility of WBC research in Europe. It is obvious that in the rest of Europe there is little awareness of the WBC as potential partners



22. From the EU-Western Balkan Countries Action Plan to the Full Integration of the Western Balkans into European RTD Activities

for research cooperation due to the political developments in that region. However, the positive and encouraging developments in economic cooperation should increasingly be accompanied by strengthened links in research, technological development and innovation. It must not be forgotten that in the past the Yugoslavian science and research community was a highly valued partner in European science and research. Every effort should be undertaken to renew this integration under new circumstances and in the context of many new and promising opportunities. The Steering Platform on Research for the WBC is the most appropriate instrument for synergizing and coordinating the efforts of all parties.

22.6. The Steering Platform on Research for the WBC – still to be mobilized

Following the joint efforts of the WBC, EU Member States and the EC, the Steering Platform on Research for the WBC was launched by Commissioner Potočnik in Vienna on 26 June 2006. There are strong expectations for the key role of the Steering Platform in strengthening research cooperation between the EU Member States, associated states and the WBC. The participants at the Vienna meeting were impressed by the enthusiasm and commitment shown by the Commissioner. Since that time, the 7th Framework Programme has been launched, which probably absorbed all resources. However, now that this programme is on track it is time to make the Steering Platform a reality; it should become a powerful instrument supported by the Commission services, EU members and associated states, and the WBC.

Due to the new opportunities and the challenges for international cooperation within the 7th Framework Programme, concerted actions will be necessary to strengthen relations between the WBC and the EU, and to develop appropriate measures and instruments to support their integration in the RTD policy development framework and collaborative activities. The Steering Platform must become an efficient and effective structure and a vehicle to support and monitor the WBC's integration in the ERA. After the lengthy discussions and high commitment of many actors, it is essential that the WBC involvement in the 7th Framework Programme is a success.

Below is an outline of what the Steering Platform should enable:⁸¹

- facilitating interaction between WBC, Member States, associated states, and the EC;
- acting as think-tank and motor for WBC integration into the ERA;
- identifying and promoting the needs and demands of the WBC;
- providing input for Framework Programme 7 Work Programmes and Calls, especially for SICA;
- promoting synergies between the 7th Framework Programme and other instruments;
- ensuring interaction, cooperation and synergies with other WBC fora;
- exchanging information on experience and best practice – benchmarking;
- promoting collaborative learning and joint actions;

⁸¹ See also e.g. Horvat and Bonas (2006), footnote 74.

22. From the EU-Western Balkan Countries Action Plan to the Full Integration of the Western Balkans into European RTD Activities

- stimulating and monitoring the integration of WBC into the ERA, including advice for promotion at national levels in Member States, associated states and the WBC;
- working towards EU accession for WBC.

This is a long and challenging list. Therefore, there is an urgent need to get started. This has become a credibility issue for all involved partners and actors.

The necessary next steps, which are overdue include:

- clear commitment of the Commissioner and the EC services;
- developing guidelines ensuring efficiency and effectiveness;
- support from the EU presidency;
- a work programme for the first phase with clear priorities for joint actions;
- efficient communication channels with the EC 'research family' and other Directorates General;
- mobilization and awareness among Member States and associated states.

Activation of the Steering Platform will be crucial to the success of further efforts to integrate the WBC in the European RTD activities.

22.7. Concluding remarks

For more than six years the WBC have been on the agenda of European RTD policy makers. In principle, the EU RTD Framework Programme and other Community instruments provide a challenging, but also a very favourable environment for collaborative research integrating the WBC. The WBC have the potential to contribute to the further development of the ERA, because of both their geo-political position and their excellent human resources for RTD. However, there are still many barriers to overcome and decisive efforts will be necessary to reduce the infrastructural, organizational and other deficits that are present. Substantial investments, including financial ones, will be necessary to close the gap between WBC RTD performance and that in other parts of Europe. However, the benefits of integrating the WBC into the ERA will soon demonstrate the high added value of such investment, which is strategic in nature. The Steering Platform on Research for the WBC will provide an excellent organizational framework for supporting these developments.

23. Why Invest in Science in SEE?

Peter B. Mayr

23.1. Introduction

The idea of developing a European Research Area (ERA), not just for the EU, but also for Europe, was launched as a major strategic goal by the European heads of state and government at the Lisbon Council in March 2000. The ERA aims at improving the coordination and coherence of European research and is part of an overall agenda to create the most dynamic and competitive knowledge-based society in the world.

Framework programmes (for Research, Technology and Development – RT&D) of the European Commission, General Directorate for Research, were aimed at fostering research cooperation at project level by bringing together universities, research agencies and companies. The European research landscape would be very different without this intensive cooperation between researchers. Under the 6th Framework Programme, the first steps were taken towards European coordination and cooperation at programme level through the networking of national research programmes and the bringing together of managers from ministries and funding agencies. Through the ERA-NET scheme within the 6th Framework Programme, the EU provides targeted support for European-wide coordination of national and regional research programmes. An open call for ERA-NET proposals was published in December 2002; in 2006 some 68 ERA-NETs were up and running in many different fields, with a total Community budget of €183 million. The popularity, success and wide range of the ERA-NETs in operation testify to the great interest in European cooperation.

23.2. Article 169

Article 169 of the EU Treaty allows for participation of the EU, on an equal basis, in new research and development (R&D) programmes undertaken collaboratively by several Member States. The main objective is to go beyond mere national and regional programmes and achieve integration in a single joint initiative. Article 169 programmes must be implemented by a specified number of member and associated states (the number depending on the research discipline or topic) to assure sufficient critical mass, and are funded by integrated financial support. The EU contributes by funding the joint research programmes.

Recent experience shows that only a few ERA-NET projects have managed to implement Article 169 by launching joint calls for projects administered by one institution using the 'real common pot' system of funding, without national *Just Retour* mechanisms.⁸² The first successful Article 169 action, the European and Developing Countries Clinical Trials Partnership (ECCPT), was launched in 2003.

⁸² Presentation by the European Commission at the UK Presidency conference on 'The Coordination of National Research Programmes: Opportunities and Barriers' in Manchester, 21 October 2005.



23.3. Southeast European ERA-NET

The Southeast European ERA-NET (SEE-ERA.NET) is a horizontal ERA-NET that aims at structuring and expanding the ERA to the Western Balkan countries - Albania, Bosnia and Herzegovina, Croatia, Former Yugoslav Republic of Macedonia, Montenegro and Serbia. It was set up to coordinate and support RT&D activities conducted at bilateral level. The project, funded by the EC, was launched in September 2004, and integrates mainly, but not exclusively, bilateral inter-governmental programmes between the 17 consortium partners, all of them ministries or funding agencies. Through a targeted process of cooperation and coordination, added value should be achieved for the research communities of all 14 participating countries.

The SEE-ERA.NET consortium⁸³ intends to use its experiences and advancements with respect to the coordination of multilateral RT&D cooperation, to create a solid basis for further concrete cooperation beyond the life-time of the project, with or without future Article 169 funding.

23.4. Benefits of SEE-ERA.NET

The aim is to re-shuffle the existing, nationally funded schemes using a needs analysis of international RT&D cooperation conducted from the viewpoint of collaborating researchers, especially those from the Western Balkan countries. The project is designed to support better exploitation of existing bilateral RT&D programmes through a network of specialized RT&D programme managers and high level national political decision makers. It will enable the systematic exchange of information on bilateral RT&D programmes and examples of best practice at project level. It also aims at fostering a European wide understanding of the current state of research systems in the Western Balkan countries.

One of the biggest challenges for the 14 collaborating European ministries and funding agencies is the conceptualization and implementation of a multilateral, joint regional RT&D programme with a multilateral pilot call for proposals, the Regional RTD funding programme for Southeast Europe (ReP-SEE). This new scheme can be co-funded by the participating national ministries, funding agencies and the European Commission.⁸⁴ One of its benefits will be the creation of an internationally recognized project proposal review system. SEE-ERA.NET's internal political strategy is to increase the quality and transparency of the project evaluation

⁸³ The SEE-ERA.NET Consortium includes Albania (Ministry of Education and Science), Austria (Ministry for Education, Science and Culture Centre for Social Innovation (Co-ordinator), Bosnia and Herzegovina (Ministry of Foreign Affairs), Bulgaria (Ministry of Education and Science), Croatia (Ministry of Science, Education and Sports), France (Ministry of Foreign Affairs, French National Centre for Scientific Research - CNRS), Germany (Federal Ministry of Education and Research, International Bureau of the Federal Ministry of Education and Research at the German Aerospace Centre), Greece (Ministry of Development - General Secretariat for Research and Technology), Hungary (National Office for Research and Technology), Former Yugoslav Republic of Macedonia (Ministry of Education and Science), Montenegro (Ministry of Education and Science), Romania (Ministry of Education and Research), Serbia, (Ministry for Science and Environmental Protection), Slovenia (Ministry of Higher Education, Science and Technology).

⁸⁴ The potential cooperation partners in the EC are the DG for Research and the DG for Enlargement. At the time of writing this paper, the relevant funding programmes had not been ratified at European level.



23. Why Invest in Science in SEE?

process by creating a joint project evaluator database, which can be used to peer review future project proposals.

SEE-ERA.NET supports better understanding of European procedures in RT&D cooperation. It helps to improve both the scientific and managerial basis for the establishment of collaborative research at transnational regional level as well as at the level of the future Framework Programmes for RT&D. In terms of the managerial level, representatives and experts from the West Balkan countries involved in SEE-ERA.NET gain experience from their colleagues in terms of future involvement in NCPS (National Contact Point Systems) networks and Programme Committees.

Finally, the researchers supported under the yet still isolated bilateral RT&D programmes will be brought together ('partnering') to exchange scientific knowledge, and to prepare and train them for RT&D cooperation at European level (Framework Programme for RT&D, COST, EUREKA, etc.).

23.5. The SEE-ERA.NET joint calls for RT&D proposals

All these activities are actively accompanied by joint calls for project proposals. All 14 SEE-ERA.NET Member States decided in October 2006 to open up their existing national funding schemes to each other.

23.5.1. The first joint call for RT&D proposals pilot phase

A joint call pilot phase was launched at end November 2006 to remain open until end March 2007, for multilateral research collaboration between institutions and universities in the 14 countries. The design of the call is based on research on the priorities and needs of the Western Balkan countries with a view to their better integration into the ERA. In this experimental or test phase of SEE-ERA.NET, funding bodies are looking for small and short-term bottom up research proposals in the scientific fields of:

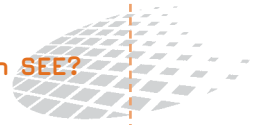
- Environment: Environmental Technologies;
- Information and Communication Technologies: Applications Research;
- Food, Agriculture and Biotechnology: Sustainable Production and Management of Biological Resources from Land, Forest and Aquatic Environments.

This call was published under <http://www.see-era.net/pjc>.

The SEE-ERA.NET consortium decided that the multilateral project proposals would be evaluated by external peer-reviewing according to scientific excellence. The implementation of this pilot call will be monitored by a SEE-ERA.NET external monitoring expert.

23.5.2. The real call for RT&D proposals

The experience gained from the implementation of the pilot phase will be directly considered in the programming of the following real calls for RT&D proposals under the above mentioned ReP-SEE.



23.6. Contribution to policy developments

Due to the nature of the project consortium a close relationship between the EC (DG Research, DG Enlargement and the Joint Research Centres) and other key players in the Western Balkan countries, such as the Stability Pact for Southeast Europe, UNESCO-ROSTE, the World Bank, the European Bank for Reconstruction and Development, the European Investment Bank, is foreseen and has in part already been created. The interaction of these organizations with SEE-ERA.NET will provide more opportunity for exchanging views, creating joint initiatives, lobbying at various political levels and coordinating actions to contribute to policy development.

For example, the SEE-ERA.NET consortium has lobbied for education and research at the juncture between external assistance and internal policies of the EC. After SEE-ERA.NET awareness raising visits to Brussels and talks in the respective ministries in the Western Balkan countries, the consortium supported the EC's proposal to open up the IPA to regional projects in the field of education and research.

The SEE-ERA.NET consortium is convinced that regional coordination activities and joint long-term strategies and investments in regional projects in education and research will help to strengthen higher education and RT&D institutions, and also to support the rule of law at national level, reform public administrations, carry out economic reforms, promote respect for human as well as minority rights and gender equality, support the development of civil society and advanced regional co-operation, and contribute to sustainable development and, thus, help to reduce poverty.

23.7. Conclusions

SEE-ERA.NET targets a 'white spot' on the landscape of the emerging ERA. It supports both European and Member States' policies in the field of S&T. The promotion of knowledge exchange, personnel and technological innovation in order to foster socio-economic progress throughout the Euro-Mediterranean area is a stated and important ambition and mission of the EU.⁸⁵

SEE-ERA.NET provides a framework for dialogue on and coordination of bilateral and multilateral RT&D relations with the West Balkan countries.

The general aims of future joint activities towards RT&D cooperation are:

- to contribute to the economic and social development of the Western Balkan countries as a region;
- to facilitate the active participation of the Western Balkan countries in EU programmes;
- to enhance the mobility of young researchers and to increase networking.

⁸⁵ EU-Balkan countries Action Plan in Science & Technology adopted at the Ministerial Conference in Thessaloniki on 26 and 27 June 2003.



23. Why Invest in Science in SEE?

SEE-ERA.NET is the only EC networking project for integration of the Southeast European countries into the ERA. However, it is a well-established and successful network comprising 14 ministries and 3 agencies in 14 European countries, including the Western Balkan countries, and works directly at the level of policy makers. SEE-ERA.NET provides new funding opportunities for scientists and already existing networks in Southeast Europe by opening up a European-wide perspective for scientific cooperation.

The project consortium has been used as a strategic and operational target for the involvement of the region in the 7th Framework Programme of the European Commission

SEE-ERA.NET has established a review system for research projects incorporating assessment procedures that are transparent, fair and dedicated to scientific excellence.

Future visions include:

- linking of SEE-ERA.NET to other thematic ERA-NETS and international funding bodies. The exploitation and dissemination of results and future cooperation beyond the lifetime of the SEE-ERA.NET project among the participant (and other) countries is under discussion;
- enlargement of SEE-ERA.NET to include key stakeholders in the fields, in Cyprus, Italy, Norway, Turkey and Switzerland is planned;
- integration of UNESCO BRESCE and World Bank activities is being discussed.

However, it must be remembered that the Western Balkan countries are in the process of restructuring their countries' innovation systems as well as their economies and therefore also their national research systems. On the one hand, this makes some current and future project activities problematic; on the other hand, it is already seen as an opportunity for more flexibility than in some of the 'old' and 'new' EU Member States. The diversity of the national research systems in the 14 participant countries must not be underestimated in promoting coordination processes. Harmonization of the legal and administrative framework conditions of these countries will be a major challenge, but the first steps are promising and adoption of a flexible approach should build a good basis for future activities.

24. The Rationale for Business Sector Investment in South Eastern Europe

Rudy Kozak

Within the increasing impact of the global economy the countries of former Eastern Europe, and its subset of South Eastern Europe (SEE) are gaining economic importance. The trend towards near-shoring, as an alternative and/or addition to off-shoring, will add to their importance in the coming decade. For many global companies, SEE with its rapidly improving economic legislation, business friendly environment and ever-higher labour productivity, is a logical location for their business. While their reasons are mostly economic, they are also business driven. This paper looks at Hewlett Packard's (HP) efforts to be close to SEE clients through the location of activities in the region .

In 2006, HP opened two Global Services Centres in SEE, one in Sofia and one in Bucharest. These centres are employing hundreds of people, mostly engaged in back office functions such as technical support, contract administration, preparation of quotations and estimates, and credit and collection services. The decision to locate in Bulgaria and Romania was a deliberate choice based on the good economic climate, satisfactory infrastructure, developing labour market, and very importantly, good supply of human resources. The people that HP is employing are mostly young graduates with around five years experience, with expertise in economics, finance and technical areas, and with good language skills. These two new centres encompass 14 different languages. The situation is a win-win scenario – benefiting HP, the employees and the local universities.

HP has established programmes in three universities in these two countries in order to teach information technology (IT) related topics. This has involved specialist training for 18 professors and the active involvement of the local HP offices in Bulgaria and Romania.

It is too early to judge the success of this aggressive strategy for HP in terms of these new outsourcing centres which currently employ nearly 1,500 people. However, the level of commitment of all the staff involved, and the work ethics in these two countries are beyond all expectations. Obviously, there are cultural differences which had to be catered to, which was achieved through the design of development programmes for new staff. These programmes mainly focus on language training, communication skills and, for a small percentage of extremely talented individuals, development of management skills.

As part of its global citizenship initiative, HP has undertaken various philanthropic schemes including cooperation with universities and local research organizations, and with local governments in an effort to overcome the digital divide in the region. For example, there is an initiative involving HP and UNESCO in the Balkan region which is aimed at halting the brain drain that began after the war in the region. HP has donated IT equipment to eight local universities,



24. The Rationale for Business Sector Investment in South Eastern Europe

complemented by a management programme organized by UNESCO. It is hoped that this will allow researchers and professors to tap into internationally funded projects and to share experience with colleagues around the world.

Another interesting example is a programme that is underway in Malta where HP has equipped ten centres that are running courses to teach new small business owners how best to exploit IT in their businesses. This initiative was constructed with the close cooperation of the Maltese Ministry of Investment, Industry and IT as part of their plan to give the wider population of Maltese citizens and business people access to IT. The great value of HP's contribution lies not just in the provision of the necessary hardware, but more especially in the design and content of the accompanying training programmes, which are based on the company's international experience.

If the SEE countries are to become a viable alternative to off-shoring, which will greatly improve the social and economic conditions of these countries' citizens, investments in education, science and research will be required. HP is willing and able to help with these key requirements.

In 2001 the Ministry of Education and Science in Romania decided to provide secondary and high schools with complete IT solutions, to be used to improve teaching and learning. Since then, 28,000 computers and servers have been installed across the country and 5,000 teachers have been trained, and have delivered over 1,000 multimedia lessons. This initiative has received international recognition, including an award for best practice, which was presented at an E-government conference in Brussels in November 2001. The key to the success of this initiative was the Romanian government's decision to implement a turn-key project that included hardware, software and training, and project management by a consortium of well known companies. Several other initiatives in the region which provided only hardware, have failed to produce tangible results.

HP focuses on simplifying technology experiences for all of its customers – from individual consumers to the largest businesses. With a portfolio that spans printing, personal computing, software, services and IT infrastructure, HP is among the world's largest IT companies.

HP has been present in SEE through local subsidiaries employing over 500 staff and now has an extended presence through the Global Services Centres which employ approximately 1,500 people. HP has been doing business directly or through over 700 local companies. We are excited about both the short and long term prospects of this region and are planning not only healthy business expansion but also ever-closer cooperation with government and research and education institutions.

25. Strengthening Scientific Cooperation and Capacities in SEE: UNESCO BRESCE Action⁸⁶

Iulia Nechifor

In its role of international broker, UNESCO, through its Venice Office (UVO) – Regional Bureau for Science and Culture in Europe (BRESCE)⁸⁷ contributes to the enhancement of the co-operation between its European Member States and to the fostering of capacities in the field of natural sciences and culture. The UVO's mandate was made very specific in 2001, when the Office was entrusted by Mr Koïchiro Matsuura, Director-General of UNESCO, with the task of developing UNESCO's activities in South Eastern Europe (SEE) and supporting the scientific communities in this sub-region in order to adapt their institutions to the fundamental political and economic transformations taking place.

As a result of the transition and unrest, the region had fallen massively behind in science, and was suffering from a collapsed infrastructure and rampant brain drain. Scientific cooperation, networking and the use of shared resources and equipment were seen as the only practical way forward for Balkan science. The strategy was threefold and included: a bottom-up approach related to identifying and responding to the real needs of Member States; the building-up of partnerships with national authorities and regional and international partners involved in the development of the SEE region; and the provision of conditions for valid regional and national ownership of these activities in order to ensure their sustainability.

Some examples of the activities undertaken within this framework are provided below, in an attempt, on the one hand, to provide an overview of BRESCE's activities and results since 2001 in the field of science policy and capacity building, and on the other hand, to provide information required for potential further actions by and in cooperation with UNESCO BRESCE.

25.1. Advocating and supporting scientific co-operation

The World Conference on Science (WCS) organized in Budapest, Hungary (26 June – 1 July 1999) by UNESCO in cooperation with the International Council for Science (ICSU), identified sustainable development as being one of the most important goals for the 21st century, which

⁸⁶ This contribution should not be seen as an exhaustive description of BRESCE's activities towards SEE countries, but rather as a selection of examples related to science policy and capacity-building in natural sciences. Additional information, in particular with regard to the activities developed in the field of environmental sciences, can be obtained at www.unesco.org/venice (accessed 18.07.07) or by emailing: veniceoffice@unesco.org.

⁸⁷ The UNESCO Office in Venice changed its name in 2003, when it became the UNESCO Regional Bureau for Science and Culture in Europe (BRESCE). Previously, the Office was known as the Regional Office for Science and Technology in Europe (ROSTE).



25. Strengthening Scientific Cooperation and Capacities in SEE: UNESCO BRESCE Action

required fundamental changes to our ways of thinking and acting. The 'Science Agenda' adopted at that conference stated that UNESCO 'should develop concrete initiatives for international scientific co-operation ... in particular on a regional basis'.⁸⁸ In the post-conflict situation that characterized the SEE countries and based on good practice elsewhere (see article by Erdelen in this volume), UNESCO underlined the central importance of networking and sharing of expertise and resources.

Acting as a catalyst in relation to its fields of competences, UNESCO BRESCE facilitated a dialogue among countries of the SEE region. One of its main accomplishments has been the promotion of scientific co-operation as a tool for both the strengthening of national science and technology (S&T) systems and promoting political stabilization in the region.

The 'Venice process' of rebuilding scientific co-operation among the SEE countries, and between them and the rest of Europe, was initiated in December 2000, and officially launched at the Venice Conference of Experts on 'Rebuilding Scientific Cooperation in South Eastern Europe' (24-27 March 2001). This conference brought together some 80 participants from 20 countries along with several important international, European and national scientific organizations and non-governmental organizations (NGOs). It recognized that scientific co-operation among SEE countries could and should be an important element of the stabilization process in the region. Moreover, regional cooperation in the field of life sciences, environmental sciences, computer science and information technologies, material sciences and sustainable development have been identified as important actions that need to be implemented not only to solve important problems common to all the countries in the region, but also to revitalize national S&T systems.⁸⁹

These recommendations met with unanimous approval from the Ministers responsible for Science and Technology from the countries concerned, at the Round Table organized on 24 October 2001 within the framework of the 31st General Conference of UNESCO, which included participation from senior representatives of EU Member States and many international governmental organizations and NGOs. With a view to implementing the Final Communiqué adopted by the Ministerial Round Table,⁹⁰ BRESCE has made efforts to provide financial support and encourage regional networking in life sciences, environmental sciences, sustainable development, astronomy, to reduce the brain drain and to support communication services. Moreover, the Venice initiative for the reconstruction of scientific co-operation in SEE has contributed in several ways to the efforts of the SEE region to organize itself with a view to joining the European Research Area (ERA). UNESCO, a specialized United Nations agency with science development as part of its mandate, was one of the first organizations to successfully bring together, on an equal footing, the countries of SEE which have different status vis-à-vis the EU, to discuss this important issue.

⁸⁸ UNESCO (2000) *World Conference on Science: Science for the Twenty-First Century: A New Commitment*, Paris: UNESCO.

⁸⁹ For details of this Conference, see UNESCO ROSTE (2001) *Reconstruction of Scientific Cooperation in South East Europe. International Conference of Experts (24-27 March 2001). Proceedings*, Venice: UNESCO ROSTE.

⁹⁰ See UNESCO ROSTE (2001) *Rebuilding Scientific Cooperation in South Eastern Europe: Round Table of Ministers of Science (Paris, 24 October 2001)*, Venice: UNESCO-ROSTE.

25. Strengthening Scientific Cooperation and Capacities in SEE: UNESCO BRESCE Action

Some examples of regional scientific co-operative projects realized with BRESCE's support are described below.

- As a result of an expert mission carried out in 2003 on behalf of UNESCO by Prof. Alexander Boksenberg of Cambridge University, which looked at the main astronomy research institutions in the region, a dedicated programme entitled 'Enhancing astronomical research and observation in SEE and Ukraine' has been developed with financial support from the Italian Government. A SEE Astronomical Research Network has been created and its statutes have been defined by its members.⁹¹ The network has established a coordination mechanism for astronomical research activities in the region, the Sub-regional European Astronomical Committee (SREAC), which has a rotating presidency and secretariat. The organization of an important number of scientific astronomical events in the region has been supported by this framework, and some have benefited from financial support from BRESCE.⁹²
- Based on the successful example of the Astronomy Network, BRESCE offered support for the creation of a Human Genetics and Biotechnology Network,⁹³ which had its first meeting in March 2006 hosted by the Research Centre for Genetic Engineering and Biotechnology of Skopje.
- A network for Risk Assessment and Mitigation was created on BRESCE's initiative and with its financial support in 2007 by the National Astronomical Observatory of Greece.⁹⁴

Besides its support for scientific networking, BRESCE has contributed to the realization of several important training programmes in terms of human resources and institutional capability. Various summer schools, conferences and events have received support, e.g. the 'Four Seas Conference in Physics'⁹⁵ organized every two years by Physics without Borders, which brings together more than one hundred young physicists from the SEE countries, and summer schools in Green Chemistry, Biochemistry, Biotechnology, etc. Currently, BRESCE is pursuing an active programme in support of increased cooperation among the scientific communities in SEE.

⁹¹ The following institutions are members of the SEE Astronomical Network: the Institute of Astronomy (Bucharest, Romania), the Rozhen Observatory of the Bulgarian Academy of Sciences (Rozhen, Bulgaria), the Astronomical Observatory of Belgrade (Serbia), the Astronomical Research Centre ('Canakkale Onsekizmart' University, Turkey), the Observatories of Nikolaev, of the Kiev University and of the National Academy of Sciences (Ukraine).

⁹² Details are available at: <http://www.astro.bas.bg/SREAC> (accessed 18.07.07).

⁹³ The following research institutes took part in this initiative: the Centre for Molecular Diagnosis and Genetic Research (Tirana, Albania), Institute for Genetic Engineering and Biotechnology (Sarajevo, Bosnia and Herzegovina), Laboratory for Molecular Pathology (Sofia, Bulgaria), 'Rudjer Boskovic' Institute (Zagreb, Croatia), Molecular Biology Department, 'Hygeia' Hospital (Athens, Greece), Research Centre for Genetic Engineering and Biotechnology, Skopje (Former Yugoslav Republic of Macedonia), University of Bucharest (Romania), Institute of Human Molecular Genetics and Genetic Engineering, Belgrade (Serbia), University Medical Center Ljubljana (Slovenia), 'Hacettepe' University, Ankara (Turkey).

⁹⁴ Besides the National Astronomical Observatory of Greece, the network includes: the State Meteorological Institute, Sarajevo (Bosnia and Herzegovina), the Geophysical Institute, Sofia (Bulgaria), the Department of Geophysics, University of Zagreb (Croatia), the Seismological Observatory, Podgorica (Montenegro), the National Institute for Earth Physics (Romania), the Seismological Survey of Serbia, the 'Kandilli' Observatory and Research Institute, 'Bogazici' University (Turkey). Research Institutes from neighbouring countries are expected to join the network.

⁹⁵ See for example, <http://www.psf2.org> (accessed 18.07.07), http://portal.unesco.org/en/ev.php-URL_ID=18799&URL_D0=D0_TOPIC&URL_SECTION=201.html (accessed 18.07.07) and <http://archives.arte-tv.com/heβδο/archimed/19981215/ftext/sujet6.html> (accessed 18.07.07).



25. Strengthening Scientific Cooperation and Capacities in SEE: UNESCO BRESCE Action

25.2. The sharing of research infrastructures: a possible alternative

Another line of action being supported by BRESCE concerns one of the most striking aspects of the research and development (R&D) situation in the countries of the sub-region: the lack of modern research infrastructures. The scientific infrastructure of the SEE countries – institutes and laboratories – was largely obsolete or rendered inactive. Subsequently, at the beginning 2000, investment in scientifically based industries had all but dried up, exacerbated by reduced investment in S&T.

BRESCE, which is not a funding agency, advocated that one solution to these problems would be the identification of the region's existing major research infrastructures, which, if they were up-dated, could be used by the scientific communities from all the countries in the region. A UNESCO BRESCE Working Group on Research Infrastructures coordinated by Prof. Pierre Papon (France) and including experts from all the SEE countries concerned, has identified these research infrastructures and the thematic networks indispensable for maintaining and developing the breeding ground for region-relevant expertise. The Working Group's assessment process produced significant results in terms of identifying several large and medium-size national infrastructures, which with (modest) upgrading could play a regional role in training and research, e.g. a NMR spectrometry centre (Slovenia), a 3-D acoustic imagery facility (Croatia), an astronomical observatory (Rozhen, Bulgaria), a particle accelerator in Serbia, etc. It is within this broader context that BRESCE has contributed to the modernization of the 2m telescope at the Rozhen Observatory in Bulgaria by the acquisition of a VersArray 1300B CCD camera. The Rozhen Observatory has thus become a regional research facility, and is being used by astronomers from all countries in the region within the framework of the SREAC network mentioned above.⁹⁶

25.3. Human capital: the 'strength' of SEE countries

It has been acknowledged on various occasions that the high level of education of their people was probably the main strength of the SEE countries. Economic transition led to a massive loss of expertise. In addition to the phenomenon of 'brain drain' caused by educated people leaving to work in other countries, there has been a problem of 'brain waste' – individuals leaving S&T professions for more profitable jobs in the private or informal sector (see for example, contributions by Sulstarova, Uvalić and Kultača in this volume).

BRESCE has tried to address the problem of brain drain in two ways: first, by providing assistance to young people from SEE countries to enable them to be associated with and to take part in discussions and major events organized by the EC and other EU fora, related to careers in research, e.g. 'Early Stage Mobility in Europe. Meeting the Challenges and Promoting Best Practice' (Lisbon, 2004) and 'MCFA Contribution to the Career Programme of the EuroScience Open

⁹⁶ For details concerning the Rozhen Observatory, see www.astro.bas.bg/SREAC (accessed 18.07.07).

Forum' (Stockholm, 2004).⁹⁷ Second, BRESCE has implemented a programme aimed at reducing the brain drain phenomenon and complementing existing international and European schemes providing financial support to scientists from the sub-region. This programme includes the creation of a Clearing House for Research Career Paths in SEE, a five year Summer School and Training Scheme, travel grants to enable research partnership to be established, etc.

A positive example is the UNESCO-BRESCE programme funded by Hewlett-Packard on 'Piloting Solutions for Alleviating Brain Drain in SEE'. The programme has proved very successful in providing assistance to seven key universities in the SEE countries to establish active research groups using modern Grid computing technology, and linking with expatriate researchers. More recently, the project has resulted in these higher education institutions becoming part of world class research networks, e.g. the Gelato Federation (a grouping of the world's leading research institutions developing and using Linux on the Itanium platform), the 'SEE Grid-enabled eInfrastructure Development', a major programme for South Eastern Europe funded by the European Commission.⁹⁸

25.4. Promoting political commitment to S&T

Although S&T is universally understood to be a crucial resource for competitiveness and long-term growth, and an essential ingredient of sustainable development, it is not necessarily high on the national development agenda in post-conflict situations (including those in SEE). There was and there still is a clear need to raise awareness of the importance of science for the general evolution of the economy and society. BRESCE is working to raise awareness of the importance of investment in S&T as a viable strategy for national and regional development. Various meetings and international gatherings have been organized to discuss the role of science, technology and innovation in the transition economies, the most significant of which include: the workshop on 'European S&T Policies and the EU Enlargement' (Venice, May 2000), the international symposium 'Basic Research in the Modern Innovation Process: Institutionalization, Performance, Integration' (Kiev, Ukraine, December 2003), Conference, and the Round Table of Ministers of Sciences on 'Reconstructing Scientific Cooperation in SEE' (respectively March and October 2001), the workshop 'Making Links, Building Bridges. Science Matters in SEE' (Stockholm, August 2004)⁹⁹, the International Conference and Ministerial Round Table 'Why Invest in Science in SEE?' (Ljubljana, September 2006), the workshop 'Enhancing STI Policy in SEE: Statistics and Indicators Systems' (Skopje, March 2007), the Conference of the Academies of Sciences from South and Central European countries: 'Global Science and National

⁹⁷ Gabaldon, T., Horta, H., Meyer, D. M. and Pereira-Leal, J. B. (eds.) (2005), *Career Paths and Mobility of Researchers in Europe. Proceedings of the Conference ESRM2004 (Lisbon 2004) and the MCFA Events at ESOF (Stockholm 2004)*, Göttingen: Cuvillier-Verlag (volume published with BRESCE's financial support).

⁹⁸ Details concerning the various research projects launched at national level as well as their outcomes are available at http://portal.unesco.org/en/ev.php-URL_ID=19337&URL_DO=DO_TOPIC&URL_SECTION=201.html, [accessed 18.07.07]. Further information on the SEE Grid Project is available at: www.egee-see.org, accessed [18.07.07].

⁹⁹ Details including presentations can be found at the following web address: http://portal.unesco.org/en/ev.php-URL_ID=22525&URL_DO=DO_TOPIC&URL_SECTION=201.html, accessed 18.07.07.



25. Strengthening Scientific Cooperation and Capacities in SEE: UNESCO BRESCE Action

Policies. The Role of Academies' (Chisinau, Republic of Moldova, May 2007),¹⁰⁰ the 1st SEE Science Policy Forum 'Science for the Future, Science for Society. The Parliamentary Perspective' (Romania, June 2007).¹⁰¹

The assessment of the S&T system in Bosnia and Herzegovina and the meeting for discussion of the UNESCO-BRESCE *Report Guidelines for a Science and Technology Policy in Bosnia and Herzegovina*,¹⁰² were important events in the field of science policy. The meeting, convened by BRESCE in October 2005 in Sarajevo, facilitated consensus among the various political entities concerning a first national S&T strategy. This action was a good example of how UNESCO can help this country to reinforce its competences at State level, by offering a neutral platform for discussions among representatives of all political entities of Bosnia and Herzegovina.

BRESCE put at the disposal of the SEE Member States reports and assessment studies on various science policy subjects, in its Science Policy Series, which includes: *Science, Technology and Economic Development in SEE* (October 2005), *Guidelines for Science & Research Policy in Bosnia and Herzegovina* (March 2006), *Accessing and Disseminating Scientific Information in SEE* (September 2006), *Science Statistics and Indicators in Systems SEE* (February 2007).

25.5. Conclusions

Although far from exhaustive, the above contribution provides an overview of UNESCO BRESCE's efforts in the enhancement of scientific capacities in SEE at a time when such help has been vital. UNESCO BRESCE has demonstrated its ability to adopt an important role in science policy advocacy and formulation, to act as an international broker and platform for neutral dialogues and to become a pole for the enhancement of capacity-building and improvement of the researchers' career paths. Since BRESCE's first action in the field of natural sciences in favour of the SEE countries in 2000, the situation in this sub-region has changed radically. Several countries have become members of the EU, others are in the associated and stabilization phase, or are looking to acquire this status in the very near future. However, the restructuring of the higher education, science and research systems, the promotion of innovation processes, the improvement of researchers' careers paths and gender mainstreaming in S&T, questions related to science communication, science and society, interdisciplinary research and the promotion of an integrated approach to sustainable development issues, as well as the development of regional and international cooperation, remain important priorities for future action. UNESCO and its Venice Office shall therefore (re-)orient and adapt activities in the field of S&T according to requests addressed by the Member States of SEE and the new challenges they are facing.

¹⁰⁰ See details at: http://portal.unesco.org/en/ev.php-URL_ID=37648&URL_DO=DO_TOPIC&URL_SECTION=201.html (accessed 18.07.07).

¹⁰¹ For further information, see: http://portal.unesco.org/en/ev.php-URL_ID=38256&URL_DO=DO_TOPIC&URL_SECTION=201.html (accessed 18.07.07).

¹⁰² Papon P., Pejovnik, S. (2006), *Guidelines for a Science and Research Policy in Bosnia and Herzegovina*, UNESCO BRESCE Science Policy Series N° 2, Venice.

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PART IV

**National Science and Innovation
Policies in South Eastern Europe:
Current Policy Challenges**

*Addresses by Ministers and High Level Representatives
responsible for S&T*

HIGH LEVEL ROUND TABLE, LJUBLJANA

29 SEPTEMBER 2006

Bosnia and Herzegovina

*Communication from the Ministry of Civil Affairs
of Bosnia and Herzegovina delivered
by Ammar Mirascija*

Mr Chairman, Excellencies, Ladies and Gentlemen,

Please allow me first to thank you for giving me this opportunity to address you on behalf of Ministry of Civil Affairs of Bosnia and Herzegovina. Allow me also to extend our gratitude to our hosts as they have provided us with the unique chance to discuss a number of important issues and plan future steps.

I would also like to extend to you highest regards and best wishes from the Minister of Civil Affairs of Bosnia and Herzegovina, Dr Safet Halilovic, who was unfortunately not able to attend this important gathering.

As is known to most of you, Bosnia and Herzegovina, due to a very complicated and unique constitutional design, has some very specific issues to resolve prior to its transition and final accommodation to EU standards. I will take some time to explain the context in which the Bosnian science and technology (S&T) sector has been reviving in the post war period.

Bosnia and Herzegovina as a state is composed of two entities, the Republic of Srpska and Federation of Bosnia and Herzegovina, and Brčko District. The Republic of Srpska is highly centralized, while the Federation of Bosnia and Herzegovina consists of ten cantons and is therefore a very de-centralized entity. Each canton has its own parliament and government, so basically there are 14 governments within the country.

There is no Ministry of Education and Science at State level, but each entity and most of the cantons have their own ministries, which deal with these issues, and have their own independent policies towards this sector.

The Ministry of Civil Affairs of Bosnia and Herzegovina, through its Department for Education, Science, Culture and Sports, has the primary role in coordinating those policies within the country, but its recommendations and decisions are not binding, as it has no power to impose decisions, and no funding is envisaged for the S&T sector in the State budget. At the international level, the Ministry has a mandate to take over the international obligations, but without any instruments or mandate to pursue their implementation.

The EU membership ambitions of the country and the overall political consensus over this goal, have enabled a number of reforms, and transfers of authority and competence from entity or lower levels to State level. Since the S&T sector is not recognized either by the government or by the European Commission as the key partner in the Accession Process, this area remains untouched by the reform processes and therefore still subject to future constitutional change.

If political consensus on the necessary constitutional changes is obtained after the October elections, there is a good probability that Bosnia and Herzegovina will get a single Ministry of Science and Technology. Before that, however, major disagreements over the competences and the role of this future ministry will have to be resolved. A number of political factors support the idea of a full transfer of responsibilities in this area to the new ministry, but there are also strong political powers which oppose this idea, and are insisting on a rather vague coordinating role for this ministry.

The same disagreements and dilemmas surround the debate on the State Law on Science, as its first version is being drafted.

In order to achieve full compliance with EU standards in this area, it is clear that Bosnia and Herzegovina, along with its State level authorities needs to take over full responsibilities for the area. Translated into practice, this requires that the newly established ministry should start working in its full capacity in order to provide a genuine revival of the S&T sector, primarily through reconstruction of the scientific infrastructure and revitalization and the development of the human resources.

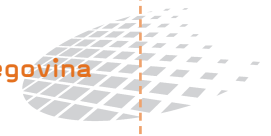
In spite of all existing obstacles, and with very limited resources, the Ministry of Civil Affairs of Bosnia and Herzegovina, has managed to incorporate the S&T sector, as a separate item, within the Mid-Term Development Strategy of Bosnia and Herzegovina, as a precondition of overall social development.

The Ministry of Civil Affairs has also managed to include S&T as one of the national priorities for future IPA funding.

The re-establishment of the research, technology and development (RT&D) system in Bosnia and Herzegovina presumes the creation of a National Strategy, backed up, fully supported and implemented by the State.

In this regard, we welcome the recommendations of the very good and accurate UNESCO-ROSTE *Report Guidelines for a Science and Research Policy in Bosnia and Herzegovina* which, among other things states that rebuilding the scientific and technological potential of Bosnia and Herzegovina will require the adoption of a 'road map' with three general mid-term objectives:

1. training of a new generation of scientists in Bosnia and Herzegovinan universities or abroad;
2. development of research infrastructures (experimental equipment, computers, information networks and libraries) to international standard; and
3. reinvestment in industrial research in a limited number of sectors (as a priority, in those sectors that export a large fraction of their production).



The UNESCO-BRESCE Report also supports the idea of establishing a State Research and Development Ministry, creating a State Agency for Science and Research, setting up an inter-ministerial Committee for S&T activities as well as the Advisory S&T Committee, and establishing a State Fund for research and development in Bosnia and Herzegovina .

The follow-up to this Report was the Strategy Proposal by the Academy of Arts and Sciences of Bosnia and Herzegovina entitled 'Strategy for the S&T Development of Bosnia and Herzegovina', which will be presented soon.

The Report also states that the Bosnia and Herzegovina scientific community should be able to join the European research area (ERA) and to be more involved in international scientific cooperation. Further it recommends the following: that the Bosnia and Herzegovina scientific community be strongly involved in regional and European cooperation in research projects, funded by the European RTD Framework Programmes; for the duration of the 7th Framework Programme, the EU should devote funds through an ad hoc international programme for the Western Balkan Countries (WBC); Bosnia and Herzegovina should participate in the COST and EUREKA programmes.

Having said all this, we particularly welcome the Initiative launched under the Austrian EU Presidency and the European Commission, the Steering Platform on Research in WBC. This initiative is linked with the vibrant and productive SEE.ERA-NET Project in which Bosnia and Herzegovina is already participating.

I thank you very much for your attention.

Bulgaria

*Albena Voutsova, Director, Scientific Research Directorate,
Bulgarian Ministry of Education and Science*

Ladies and Gentlemen,

1. The main features of the Funding system in Bulgaria are the following:

The Bulgarian R&D funding system embraces a mix of various instruments: institutional, programme/project-based funding; international and other sources. There is still a tendency for imbalanced funding, i.e. - higher share of institutional funding compared to competition-based funding. However in the last years a positive trend can be observed in terms of increasing the programme-based share of allocated funds for science and research activities. The weaknesses of our system are the following:

- compared to other EU countries in terms of research and development (R&D) investment, Bulgaria is lagging behind the EU-average with about 0.5% of GDP spent on science and research. But, according to official statistics we are ranked near to some Member States such as Greece; Slovakia and Poland and previously Latvia and Cyprus;
- relatively feeble increase in the partnerships between academic research and industry which reflects on the insufficient development of a national innovation system (NIS);
- the share of institutional funding is three times higher than other sources – too many permanent staff consuming institutional funds and virtual absence of temporary research staff;
- co-existence of various research funding mechanisms which increases the possibility of duplication of scarce funds;
- absence of thorough benchmarking and international evaluation with realistic feedback to policy-makers and fund-providers, which consequently hampers efficient decision-making processes.

Among our major achievements, the following can be cited:

- increased funding with more than 6% of the programme/project-based funding for the last two years;
- better project culture - this influences the attraction of other funding sources;
- improvement in the flexibility of the resources mix;
- better internationalization of science through better and more effective participation in EU framework programmes and other Union and supra EU R&D initiatives;
- opening of new temporary research positions for young researchers through funded projects and programmes;
- more financial and prestige stimuli for research teams through the targeted programmes and projects (awards)



2. The restructuring of the S&T system is necessary for the following reasons:

- the system is too fragmented and not robust;
- cannot be changed easily without a top-down approach;
- very sensitive to the status quo – possible negative reaction from society.

Some lessons learnt:

- immediate necessity for implementation of new financial schemes;
- give new opportunities through new programmes and initiatives;
- increase intra and international cooperation;
- create friendly oriented milieu for formation of dynamic bodies.

Some achievements:

- recognition and support for new centres of competence - more than 23 in total;
- more R&D alliance on programme base;
- establishment of new partnerships between universities and small and medium sized enterprises (SME) and/or universities and academic institutions aiming at forming a stable knowledge triangle: education - research - innovation.

3. S&T policies: Weaknesses:

- insufficiency of good inter-institutional coordination;
- insufficiency of critical success factors aimed at acceleration of economic growth and at introducing further steps for timely development of new market niches (e.g. information and communication technologies (ICT), new and renewable energy sources, such as bio-fuels);
- insufficient coherence of policies and strong implementation of open method of coordination (OMC) which results in neglect of new and emerging research domains and reflects negatively on national competitiveness and comparative advantages;
- favouring national champions can create conditions that hamper achievement of full added value.

Next steps:

- cope with compartmentalization as a consequence of the segmented approach introduced (for instance elaboration of 'win-win' bottom up strategy in order to enlarge the revenues from collaboration);
- support for more qualitative research;
- discourage 'blue-skies' research;
- develop better brain gain schemes (including the national science diaspora) and better balanced research mobility;
- effective use and access to the research infrastructure - in and out;
- visible and appealing research profile.

4. Knowledge-based Economy

The Barcelona targets were set long ago but few of us are close to achieving them. Bulgarian case:

- lagging behind the European Member States;
- demand for R&D results is still insufficient;
- excellent knowledge which does not always lead to excellent innovation rate and fast market realization.

Latest achievements :

- new national schemes and programmes aiming at high-quality research;
- preparatory grants – mutual learning experiences;
- adoption of 3% annual plan – more investments in research;
- launching targeted programmes for research infrastructure in priority areas;
- new schemes for early stage researchers and post doctoral students.

5. Conclusions:

- trust in quality and competence;
- trust in young skilled generation;
- improve effectiveness and efficiency and gathering more real results;
- increase accountability;
- keep it simple!

Former Yugoslav Republic of Macedonia

*Sulejman Rushiti, Minister of Education
and Science*

Distinguished Colleagues, Excellencies,

Let me express my gratitude on behalf of the Government of the Republic of Macedonia to the organizer of this event, which enables us to cooperate and exchange experience in scientific research and technology development. I use this opportunity to announce that the new government will have a new approach to education in general and will be focused on research and development and science in particular

Since our programme is aimed at improving the economy, and strengthening it, we are conscious and convinced that upgrading the economy means upgrading education and upgrading our capabilities of science.

Our goal is to encourage cooperation between business and schools and cooperation between industry and science.

We have new challenges. We have started to work on the implementation of our programme, which in the field of education means new curricula, upgrading the knowledge level and improving the statistics.

We are conscious that we will need a lot of support from our friends, from experienced countries and organizations who have provided valuable help to our country through the implementation of projects: COST, Framework Programme 6, NATO, UNESCO, IAEA, JICA, TEMPUS, CEPUS, and Education Modernization, etc. all of which we are thankful for.

Our aim is to intensify the ongoing programmes designed to increase the dynamics of the reforms, and start to implement new phases that will bring us closer to European integration.

Since it is my first attendance at such a meeting let me once again express my gratitude and my pleasure at the opportunity to meet my distinguished colleagues and gain from the huge experience that exists in this meeting.

I want to finish with the words: 'we are willing to cooperate'.

Thank you.

Greece

Christos Vasilakos, Representative, Ministry of Development

Ladies and Gentlemen,

On behalf of the Greek Minister of Development, Mr. D. Sioufas, I would like to thank you for organizing of this conference and the High Level Round Table, where the Ministers and representatives have the opportunity to address important issues in regard to the Science in South Eastern Europe (SEE).

Greece has a strong interest in research in the SEE, especially participating in many of the International Cooperation Actions in the context of the 6th Framework Programme.

I would like to address some visions concerning the EU-SEE countries' cooperation in the field of research and technology.

Firstly, the traditionally very diversified Balkan region was until recently divided into areas of strong competing external political influence. The integration of the more prosperous countries of Europe has generated for the people of the Balkan region the hope of a shared future in peace and sustainable growth. The European Union (EU) should not leave this region isolated in the struggle to overcome internal contradictions and to survive in an increasingly competitive international context.

In Europe, the transition from an industrial era to the knowledge economy coincided with the transition of the planned economies of Eastern Europe to market economies. This left the countries of the Balkan region in very dissimilar situations. For example, Greece has been a full member of the EU for more than 20 years, with increasing rates of growth. Bulgaria and Romania are working to achieve the accession requirements and Turkey, the pre-conditions requirements. The five States of Albania, Bosnia and Herzegovina, Croatia, Serbia and Montenegro and F.Y.R.O.M. are in the process of coming out of the political and economic instability experienced because of previous crisis situations.

Europe has a strong interest in contributing to the welfare of the people and the economies of the region to overcome these difficulties. This is in order to increase the living standards, to extend the capabilities of the internal market and to enhance the competitiveness of Europe in the international scene, compared to its main competitors. Such interest needs to be transformed into actions and measures approved by all involved parties. The resulting cooperation should be based on mutual understanding and in the perspective of full participation of the SEE region in the European Research and Innovation Area (ERIA) and therefore the European RT&D activities and networks, as soon as possible.

In this respect, science, innovation, research and technological development are seen to be an essential tool for future economic stabilisation and growth in the region. The European Commission is promoting EU S&T co-operation with the five countries of the Western Balkans as well as with the candidate countries, with the key objective to contribute to their political and economic stabilization.

The recent political and economic crises in the countries of the region have affected their RTD capacities dramatically. The main reasons for this effect include: the sudden change from almost exclusively state directed economies and research capacities to market economies; the exceptional reduction in national expenditures on RT&D; the loss of critical mass due to the formation of new states; and the simultaneously important brain drain.

It is now necessary to undertake coherent actions for the reinforcement of the RT&D and innovation capacity in each country and in the region as a whole.

To this end, the importance of RT&D for economic growth and the resolution of problems in each country should be put forward at the highest political level of all countries in order to facilitate the necessary initiatives and mobilization of funds.

The Greek political agenda includes, inter alia, priorities to stimulate research and innovation activities in the SEE countries. The Greek proposals for the final Communiqué are the following:

- The implementation of a SEE Charter for S&T, which may be adopted in the next Forum.
- To promote mechanisms for strengthening SEE cooperation and networking among innovation policy makers.
- To ensure or to improve access to information, technology transfer and networks and to the pan-European research infrastructures.
- To strengthen the potential and capabilities for full participation in ERA, the 7th Framework Programme, CIP and the other European programmes (e.g. EUREKA) seeking in particular the increased participation of the business sector, mainly small and medium sized firms.
- To support the establishment of and/or upgrade electronic networks for science, research and education and their link to the European gigabit network GÉANT.
- To stimulate the mobility of scientists and researchers as a means of sustainable research cooperation within the region and with other aspects of the ERA, including the activities of the JRC.

It is now time to act, the 7th Framework Programme will give you many opportunities to achieve your goals.

Thank you.

Montenegro

*Slobodanka Koprivica, Deputy Minister,
Ministry of Education and Science*

On behalf of the Ministry of Education and Science of Montenegro I would like to express gratitude to the organizers of this Conference who invited the representatives of Montenegro to take part.

As part of our overall economic reforms, we are at the beginning of the education and research reform system. Certainly, the reform process in Montenegro is faced with numerous problems and obstacles, characteristic of a country in transition.

The funds allocated for science and research are still insufficient to carry out the reconstruction of scientific-research activities, which implies provision of laboratory equipment, possibility to carry out competitive projects, initiation of a mobility process.

What is also very important to stress is that the research community in Montenegro is small and that it is of vital importance to preserve it and keep it open to the Region and the EU, because it is the only way for the research community to stay alive and become involved in the creation of a knowledge-based society.

I have to stress that our major problem is to retain our most competent researchers. We are doing our best to prevent brain-drain, but I am afraid that it is going beyond our control.

With the aim to reconstruct the system of research, technology and development (RT&D) the new Law on Scientific Research activities was adopted last year.

In accordance with this Law, the Government has already established the national Council for Science and Technology (S&T). The Council consists of representatives of Government and of the research community, including the Minister of EU Integrations, the Minister of Education and Science and the Minister of Finance. This body is in charge of writing a proposal for S&T strategy for the next eight year period. This strategy should determine S&T priorities, which will be financed from the Government's budget, define annual budgetary increases, as a percentage of GDP, allocated to S&T for a prescribed period, and implement monitoring of the strategy. The proposal should be opened for public discussion and the final text submitted to Government for adoption.

We should in reality establish a national policy for achieving short- and medium-term goals, taking into consideration our decision to become part of the European integration and the obligations that arise from this decision, as well as inclusion in the ERA.

We in the Ministry believe that without such a document, it will be very difficult for us to decide precisely what is needed, and follow the process in this area.



It is encouraging that in the last two years the number of bilateral projects has increased considerably. The area of bilateral cooperation is of great interest to Montenegro. Bilateral and multilateral RT&D cooperation will give Montenegro the possibility to create links with the internal RT&D market, and enable much greater participation in European research endeavours, thus enhancing research perspectives in bilateral and multilateral activities. The RT&D strategy in Montenegro is oriented towards improving research capacities by reinforcing S&T potential, supporting and mobilizing human and material resources, disseminating scientific information and research results, facilitating communication and improving the responses to the socio-economic needs of the country.

Increased networking through bilateral and multilateral cooperation would enable exchange of personnel and results, carrying out of joint experiments, hosting scientists from abroad for teaching, training and other research activities, the possibilities to diffuse and to exploit research results, and the hiring of new young researches to reinforce human potential.

The Ministry's plan for the next year is very ambitious. This means that in the next year the financial allocations for this area could reach 0.4% of GDP for this year.

I think that negotiations with the Ministry of Finance will be complex and difficult, but taking into consideration the whole situation, I think that awareness of the importance of investing in the knowledge sector is increasing among ministries, as is pressure from the public, and especially from the scientific research community.

It is my opinion that the time for development of our society has arrived, and that the government and the public have embarked on intense discussions about the development of a society based on knowledge, and that knowledge should be one of the key resources in Montenegro.

I spoke before about our responsibilities for further development in this area in Montenegro, and how and to what extent we can accomplish them by ourselves. Of course, I think that international programme support should provide a contribution, but I do not believe that it will be possible to support Montenegro if we do not establish goals in our national policy for S&T and disseminate the results achieved through our own efforts.

Thank you for your time!

Montenegro

Milena Savovic, Ministry of Finance

Ladies and Gentlemen,

In Montenegro, we are coming to the end of a three year stand by arrangement with the International Monetary Fund (IMF). This arrangement included some specific fiscal adaptations, such as reducing the budget deficit year on year, for 1% of GDP until Montenegro can manage to achieve a balanced budget. During the period of the arrangement with the IMF, the government was not allowed to undertake more than \$32 million of loans from commercial trade per year. The necessity for creating a current fiscal environment resulted in a request to government for tax reductions; this puts the obligation on government to reduce expenditure. Also if the investment needed to improve the poor water supply, electricity, infrastructures, etc. are taken into account it is not difficult to see the scale of the challenge facing the Ministry of Finance.

In terms of the current situation in education and science, in 2006 we allocated more than 70.7% of the total budget expenditure of the Ministry of Science, which is responsible for distributing this money to the final consumers. However, most of this amount goes to salaries, administration, taxes and various contributions to current expenditure on material services; very little is left for research and development (R&D). The Ministry of Finance recognizes the huge importance of investing in science and research and with the help of reforms to the huge administrations to make them smaller and more efficient and flexible, we will create better conditions, and will be able to increase salaries for training staff and improving the climate for investments in science and research.

This is the policy that we hope to implement in the next period, which I, and indeed all of us hope, will bring a continuous increase in the allocations for R&D.

Romania

*Alexandru Aldea, Vice-President, National Authority
for Scientific Research, Ministry of Education
and Research*

Mr Chairman, Ladies and Gentlemen,

During these two days of discussions I have come to realize that we share not only a geography and history, but also the same problems and difficulties in developing the research and development (R&D) system.

The difference perhaps is that in our countries the public was and maybe still is not prepared to understand that R&D is essential for long term economic and social development; which in the stringent economic conditions that prevail at the moment, is understandable.

I also realize that, for us, as policy makers and administrators of science, it is important to be aware of general trends and global aspects, and also to be aware of the concrete problems of the scientific community, to know what real life looks like.

In Romania, we made an important step forward in that the R&D budget for 2006 doubled compared to 2005; although the absolute figures may not be very impressive, this increased budget stirred things up at all levels. We had to think how to spend the money in responsible and clever ways, to move from rhetoric to action, and to identify the real problems and be pragmatic.

The major aim is to increase the visibility of the R&D sector, keeping in mind that, in this period of globalization, visibility means international visibility. To this end we have mobilized all the relevant forces, public and private, in order to achieve the critical mass necessary to obtain visible results. In other words, we are trying to build up a Romanian Research Area as a component of the European Research Area (ERA).

The tool we have devised is a special research programme called the 'Programme of Excellence in Research' which is a competitive scheme; the projects were submitted in English, the topics were based on those in Framework Programme 7 and the evaluation was done electronically. There have been some immediate consequences in the form of higher salaries (making research an attractive profession), the acquisition of medium-expensive equipment, and future mobility of researchers. At the same time some young Romanian researchers working abroad have expressed a wish to return to Romania.

Another very important aspect is the evaluation and ranking of the research institutions. The principle we apply for ranking is to measure output versus input of the research activity and, together with the scientific community, we have identified a limited number of indicators. A pilot exercise has been performed and we are ready to launch the ranking operation on the scale of the whole system.



There are of course some weak points. First I have to say that the contribution of the business sector to research and innovation is still very low. This is a special topic of discussion, and often in discussing this aspect we put the cart before the horse. We have to remember that innovation should be demand based. Of course, here the finance ministry may play an important role through fiscal measures.

Another concern is related to human resources since the level of the research depends on the quality of the people; one cannot fill the technological gap without filling the educational one. In the period of transition, many young gifted people moved into domains other than the scientific one. For this and other reasons the quality of education in the scientific fields decreased and recovery is an absolute urgency.

In terms of the problem of strengthening cooperation in the region, I think that this can be achieved via two channels. On the one hand, it is our duty to identify the instruments (such as SEE-ERA.NET) and to improve their functioning. On the other hand, different research teams should get to know each other, establish contacts and identify mutual interests. I am distributing some CDs with the topics, abstracts and teams of 500 research projects running under the Romanian Programme of Excellence in Research.

I very much appreciate the initiative and efforts of the UNESCO Office in Venice in organizing this meeting which is important for clarifying our future lines of action for the enhancement of R&D capacities.

Thank you.

Slovenia

*Jure Zupan, Minister of Higher Education,
Science and Technology*

Ladies and Gentlemen, Excellencies,

I know quite a lot about the problems of this region, and would really like to do more to resolve them. I am sure our ministries will do all that can be done to strengthen the ties between the countries in this area.

I see this as an opportunity to discuss the problems that we all have and examine the solutions proposed. I hope that solutions can be found to all the problems that we are faced with.

I would like to begin with what we have done in Slovenia and go on to talk about how we can jointly solve some of the problems that are arising in all of our countries.

In December 2005 we launched the so called five year 'national research and development programme'. There are four aspects of this plan that in my opinion are most important and will probably influence the politics of science and technology in the whole region.

The first point, which, from our point of view is the most important one, is the European research and higher education area. In Europe, we talk about European Research Area and the Higher Education Area, but we know that research and education are one area. Thus, we have prepared and have decided to unify in one law, both these activities of research and higher education. It is expected that in the coming months this law will be discussed by students and universities before it is finalized and takes on administrative power. We strongly believe that universities must do research and that researches must teach if the knowledge is to be disseminated and improved.

The second point which we would emphasize is related to the so called 'research and innovation programme'; research and teaching must reach out and be applicable to industry, and to the economy, to encourage innovation. Therefore, we have given to all our research institutions the possibility to open higher education courses, and they are now developing the first Bologna programme which is being offered at universities.

The third goal which is well known is 3% of GDP invested in research. Because we are looking at higher education and research as one objective, in this five year plan we have set the objective of 5% of GDP for research, development and education, divided across the public and private sectors. The public sector should receive 2.3% (1% for research, 1.3% for higher education) and the private sector should receive 2.7% (2% of GDP for research, 0.7% for higher education). This is the general goal that we want to pursue in the next 5 years.



The fourth point which is particularly relevant for this meeting is related to cooperation ties, in which we include not only the multilateral ties at European level, but also bilateral ties which are very significant because first, among our researchers and higher education professors, we know that personal ties between institutions and countries are very important. In the SEE countries, there is a large potential in education, in research capacity, research personal, which should be maintained and advanced.

I would like to briefly outline Slovenia's contribution in this context. First of all, we are building national contact points, which is very important. We are offering six month fellowships for post graduates in our universities. This is organized via AD Cultura and the Slovenian Science Foundation.

Many Slovenian institutions and universities have Marie Curie host status which means that they can offer fellowships of six months to one year or even longer for graduate and postgraduate students. This is a scheme that is in the current Framework Programme and has been part of previous programmes and is open to students and professors who would like to spend some time working in a Slovenian university. We are looking for highly educated people undertaking postgraduate and undergraduate studies for six months or one year.

In the last 10 years, Slovenia has been involved in 800 bilateral projects. We would like to shift these bilateral projects to a higher level, and include greater mobility for researchers, involving travel to the countries in the region and exchanges for periods of a week. We would like to allocate more money to this to enable real projects to be undertaken, especially in cooperation with industry, which may mean participation of one research or education institute and one industry firm for instance. Collaboration could include three entities but should include at least one university and one firm. We already have such agreements with Israel and Norway, and would like to extend this activity to include other countries.

The information service system, COBISS, is operating in Bosnia, Croatia, Serbia, Montenegro and Macedonia, and is maintaining all the scientific publications in our system enabling them to be easily evaluated. It is also connected with website presentations.

Furthermore, there are the ERA WESTERNBALKAN countries projects and finally there is the issue of a 'referee list'. We are in the process of compiling a list of referees from different countries for exchanges. We have referee agreements with Croatia, Austria, Germany, and we will also include some people from the USA because we believe that refereeing should be done at the international level. This kind of exchange would be welcome for any of the countries to participate.

Finally, I would like to thank Mr. Erdelen and I urge all of those interested in cooperation to increase the possibilities for it.

Slovenia

Mateja Vranicar, Ministry of Finance

Ladies and Gentlemen,

I would like to point out another aspect of funding. Today we have spoken merely about the direct public funding of research and development (R&D), but so called 'indirect funding' by government is also very important. By 'indirect funding' I am referring especially to benefits that are available to the R&D sector through the different instruments of national tax systems. I am involved in tax and customs policy in the Ministry of Finance in Slovenia, and I would like to give you an example of some good indirect funding that is in place in the Slovenian tax system. I want to highlight a particular example of the tax incentives that are included in Slovenia's corporate income tax, although there are other examples of tax incentives for R&D in other areas of the Slovenian tax system. Under the present corporate income tax law in Slovenia, there are two special tax incentives that are intended specially for investment in R&D.

The first is an incentive for the employment of researchers. These are the workers with PhD degrees and the incentive is offered to companies - to employers who employ these kinds of workers, but only as long as the employee has not previously worked in the economic sector. The incentive amounts to a 30% deduction from the taxable base for the first 12 months of employment of such an employee.

The second and more important tax incentive is a special tax incentive for investment in R&D by companies that would be liable for payment of corporate income tax. This incentive was introduced in the 2005 tax law and was applied for the first time in 2006. Although there are no available empirical data, I want to explain how this new incentive operates. It has two components, a general component that applies to *all tax payers*, who are allowed to deduct 20% of their investment in R&D from their taxable base; eligible costs that can be deducted are the following: the amount invested in internal R&D activities; purchase of R&D equipment; and R&D services provided by external providers. If the companies are situated in areas of Slovenia with low income per capita, then an additional 10% or 20% deduction may be allowable, but this part of the scheme has not become operational yet because it is classified as State aid, it thus was not taken into consideration by the European Commission yet; work still needs to be done in this area.

The importance of this latter incentive is shown by the fact that in the proposals for corporate income tax for 2007, this is one of the few tax incentives that was retained. Most other major incentives in the corporate income tax system have been abolished due to the fact that the government wants to simplify the tax system and to make it more transparent, and more neutral, in terms of the economic decisions required of the actors in the economy. However, government decided to retain this special incentive for investment in R&D in the tax system, demonstrating government's recognition of the importance of this kind of investment for the development of Slovenia.

Turkey

Nüket Yetiş, Acting President of TÜBİTAK

Mr. Chairman and Distinguished Guests and delegates of the Conference,

I just want to start my presentation by rephrasing the theme of this Conference. 'If we don't invest in science in our region, what would happen?' Already we are investing in science in the other regions of the globe; that's why we are losing our regional competitiveness, as well as the quality of life. Does it really make a difference to invest in R&D? The answer is yes. The one who invests more in R&D and has more scientists gets the first rank; they are much more competitive.

I would like to summarize our National Science, Technology and Innovation Initiative. The mission of that initiative is to coordinate all partners and actors of the system, to work together to increase quality of life in the Turkey, to find solutions to our problems, to increase the competitiveness of the nation as well as to enhance scientific literacy within society.

We have three basic strategic objectives: The first one is to increase GERD, Gross Expenditures on R&D, to increase the demand for R&D and innovation and also to increase the number and the quality of R&D personnel. We have very clear and robust targets: We would like to have 2% by the end of year 2010. And also, we would like to increase the number of full time equivalent researchers to 40,000. And we have established performance indicators just to check if we are really doing well for these targets.

How much Turkey is spending for R&D? For the year 2004, it is about 1.6 billion Euro. And about 20% of that comes from direct public funding. It is not the total funding but it directly goes to the projects of science, technology and innovation. And after this initiative had been launched, our direct funding to research and development and innovation increased considerably.

Of course, we had the challenge and we still have the challenge of increasing demand for science, technology and innovation. We are trying to use two instruments: The first one is to support scientific, technological and innovative activities of the industry, the private sector. And their funds also increased since the start of this initiative. And also we have just established about a year ago a new programme, what we call it as "Public Institutions Research Programme". What does it mean? We ask performers; universities, industry and public R&D institutions to come together with interdisciplinary teams and to find for their activities a customer that is one of the public institutions either from a public agency or ministry. They will cooperate with their customer and create a kind of project proposal with the customer. Then they should apply to TÜBİTAK after the panel discussions and evaluations, we fund about 100% of it. After they get the money, they make the research and innovation and then submit the results to the customers either as prototype or service systems.

The other challenge was the capacity: human resources, infrastructure, national and international relations and also scientific literacy within the country. The number of researchers is a problem throughout the globe. We also have the same problem in Turkey. That's why we increased our fellowship programmes and it has almost tripled or quadrupled. We support academic curiosity-based research in universities and since we have changed the whole system, international standards and the peer evaluation systems, the trust in the system has increased and the number of proposals coming from the universities increased more than four times. And we opened those programmes not just only for the universities, but also for the industry and the public institutions. And now we have an accumulated projects coming from academia which is about 3,300.

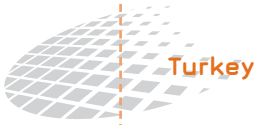
We have lots of bilateral agreements and we have multilateral relations. And fortunately Turkey is a member and also the founder of those multilateral agreements and multilateral associations. We are in association with the EU Framework Programmes as well. In the region, we have already about 55 bilateral projects and 60 projects for FP6 of our national coordination office. We have very good relations with the countries in the region.

Just to show you the potential of Turkey: Number of scientific articles is increasing exponentially, we are ranked globally at the 19th rank and increasing. But we don't have such a big success for the patents. Unfortunately, local patent applications and number of patents are very low at the moment. That's why we have a brand new programme for promoting patent applications in Turkey.

What can we do together? We can use bilateral relations, we have some international fellowship programmes. For the researchers who would like to come to Turkey, we can provide scholarships up to a year or more. And also we can send researchers to your institutions and universities. We have an important role to play together in FP7, COST, EUREKA and the other programmes as well. We would arrange, organize together some workshops, scientific meetings, etc.

I want to invite all delegates of your country to the October Seminar which is a kind of FP7 Training Seminar on how to prepare and manage FP7 projects. The ones who would like to come or send somebody to those programmes, we put all the information for you. We are also going to have another programme during the December of this year. It is a joint activity with Bulgaria, Romania and Turkey. Again with the participants from the countries you have seen. We are going to pay two experts coming from those countries if they would like to come to Turkey. And we have another occasion, it is a brokerage event, it is in the beginning of the year 2007. If you would like to join that activity please just contact us.

What we have achieved at the moment? We have a strategic approach, we have our strategic plan, and action plan, we have greater financial resources that's why I would like to thank our Ministry of Finance for that resources. And we have established international standards and norms that the OECD and most of the countries are using. We have created new programmes and enhanced previous ones. We have many mechanisms for every type of activity at the moment. We have restructured the evaluation and selection systems including international



panel systems. We have performance monitoring and assessment systems for post-project or post-programme activities. We have enhanced the administrative and legal infrastructure. Believe me, it is much more difficult to have a flexible administrative and legal environment in our country but again I would like to thank all of the ministers and the government that they have done a lot. But we still have challenges. We have increased and we are going to continue to increase national and international collaboration.

That's all I would like to say at the moment. Thank you.

Intervention by Janez Potočnik¹⁰³

European Commissioner for Science and Research

Ladies and Gentlemen,

I am very pleased that I have the opportunity to be here with you for the closing session of this Conference.

At first sight, this would seem to be a very easy speech to make. After all, I am in my own city talking about my own portfolio, research. And this conference touches on how research can help economic development, another area I have a great interest in.

But this is actually a difficult speech, for several reasons. The first is that I am the last speaker, so you may have heard it all before! The second is that I feel some difficult decisions need to be made if this region is to develop as it can.

You have heard the arguments over the past two days. There are many different angles, but only one bottom line: Europe needs to invest more in research and better exploit its research potential.

This is a message that has agreement in all corners of Europe.

In the EU, we have made the analyses which prove this point. We have reached a broad political consensus. Though we have been looking at the current EU, this message holds true for wider Europe.

Why does Europe need research?

Put simply,

- we can no longer live off the back of natural resources: we do not have enough and many are not sustainable
- our competitive efforts need to take into account the environmental needs and the sustainable development strategy,
- and competing on the basis of cheap labour and low social security is neither desirable nor realistic in the globalised economy.

¹⁰³ The text is reproduced as accessible at: <http://europa.eu/rapid/pressReleasesAction.do?reference= SPEECH/06/551&format=HTML&aged=1&language=EN&guiLanguage=en> (accessed 10 August 2007).

Our quality of life depends on knowledge. Modern economies are no longer exclusively based on manufacturing; the services economy plays an important role. These services are valuable because they show knowledge generating income.

The EU took action at European level at the Lisbon Summit in 2000. You may have already heard what was decided there - to make Europe's economy the most competitive knowledge-based one in the world.

But throughout the last six years, research has played a continuous role. Whether stimulating the economy, improving the environment or securing the quality of life, research has been on the political agenda.

At EU level, we have now something we can call an integrated research policy. This identifies actions not only in research, but many related areas. Research is most successful not in isolation, but linked to areas such as education, industry, finances and public procurement. When these all work together, we get closer to achieving our overall objectives.

And this is where it gets difficult. South Eastern European countries have to follow the same path as the EU has.

This means:

- getting together with all the stakeholders
- designing an integrated research policy and
- setting national targets on how much public funding will go to research; and how to increase human resources capacities.

Public investment in research in the South Eastern European countries is still very low, compared to the EU average of 1.9%. This is why you need to start drawing up a plan to progressively increase the public contribution to research.

This will require some skilful work by Ministers of science, research and education. They have a central role to play. They will need to demonstrate to their Prime Ministers and Ministers of Finance that more research funding is a good investment. Even though the benefits might sometimes be long term.

It's not just the level of funding that is important. It is also how it is spent.

Here I can offer some suggestions on how to make the most of the funds you have:

- National science budgets need to focus on excellence. This is the best preparation for cooperating with EU research partners.
- Governments need to encourage collaboration and networking with the EU. They could do this by helping their institutes to improve their infrastructure and human capacity.



- Update national equipment and laboratories. But don't duplicate facilities. Research infrastructures are expensive. So consider regional research centres, by pooling the region's resources.
- Avoid fragmentation in funding. Don't provide funds just for the sake of it – have clear justifications for each euro. For example, don't feel obliged to maintain an institute which no longer provides any benefits.
- Introduce a fair level of competition into research national funding. Show transparency. Include international experts in the evaluation. Funding should not only be fair, but should be seen to be fair.
- Set priorities in the thematic areas: play to your strengths and strategic interests. Create niche markets.

South Eastern European countries have a strong scientific base. Please don't lose it by failing to investing in research.

There are already good examples in the region.

Croatia's research policy was examined as part of the accession negotiations. It was considered sufficiently developed to facilitate integration into the European Research Area.

When the Former Yugoslav Republic of Macedonia requested EU candidate country status, the Commission's opinion highlighted that the country lacked a vision for development of a research policy. FYROM's Government's response was to immediately start working on a National Programme for research and development for 2006-2010.

Not only was the decision quickly taken - it also addressed the right issues. These include:

- better coordination among the different ministries involved in research and technology
- considering more public spending on research and
- strengthening links between research and industry.

It goes without saying that these plans then need to be implemented!

This process is ultimately all about integration. Your integration into the EU is fundamental. That is not just my opinion. European leaders at the European Council in June said *the future of the Western Balkan Countries lies in the European Union*.

Research policy is an important tool to facilitate this integration.

This is one of the reasons why I am committed to make the conditions very attractive for South Eastern European countries to be associated to the next Framework Programme, FP7. I am thinking particularly of the financial contribution required.

I said this when the Steering Platform for Western Balkan Countries was launched in June in Vienna. And I am pleased that since then, some of you have taken up my offer!

Integration requires cooperation. FP7 is the perfect vehicle for this. Cooperation can take place beyond national borders, and regardless of historical and political obstacles.

Cooperation in research needs longer lead times. FP7 has taken this into account, running for a longer, seven year period.

Collaborating in the programme will lead to cooperation with researchers and scientists from all over Europe and the world. Not only will you obtain more knowledge transfer, but also increased market access opportunities.

Research can lead to innovation, which leads to jobs and growth.

FP7 will be taking a lead in this. It will support major public-private partnerships in key technology areas. “European Technology Platforms” are designing strategic R&D agendas in these areas. The Technology Platforms are industry-led groups where all major stakeholders are represented. Their R&D agendas look to the long-term European development of key technologies, based on real business needs.

In the interest of your industry, you should actively consider participating in some of the Technology Platforms.

But to make the most of these new opportunities, action is again needed from the region’s national Governments. The right conditions, which stimulate investment in research and innovation, need to be in place.

As you may know, we have a target of seeing 3% of the EU’s GDP dedicated to research. What you may not know is that 2% of this needs to come from private sector.

It is clear that we cannot force private businesses to invest in research. There is no stick, but we can use carrots: we can make the conditions favourable for research investment.

For example, Governments could:

- take fiscal measures allowing deductions of a substantial part of the investment
- or permit a tax credit
- Or they could exempt employed scientists from social taxes.

Some may say ‘Our first concern is not research, it is developing the economy.’ But to neglect one for the other would be a mistake. Because one leads to the other.

Again, this is an area where public authorities can play an important role. Here are a few suggestions of areas where they could be proactive: They could:

- put research and innovation high on their own political agendas, so that investors see a favourable climate for innovation



- stimulate SMEs, the backbone of our economies, to innovate; for example by providing training for sectoral SME associations on how to include research in their daily business decision-making
- favour technology driven products and services through public procurement
- give preference, when attracting foreign investment, to innovative companies who are ready to transfer technology
- or provide training to make managers more entrepreneurial, including knowledge on research, patents and licensing products

When I refer to investment in research by private sector, I do not mean only in traditional sectors, such as pharmaceuticals, the automotive industry or manufacturing. Countries with a more service oriented economy should promote research efforts in areas relevant for them.

For example, Montenegro or Albania, who depend a lot on tourism, could encourage research in the leisure sector. This way they can be in a position to offer, for example, well equipped, safe and modern leisure facilities to their tourists.

In your pre-accession phase to the EU, I cannot underline enough the importance of industry investing in research. This requires determination and partnership.

This brings me to my final point: how to encourage industry-university research and partnerships?

There needs to be a place where the two can interact. So **creating science parks** is a good first step.

This is particularly relevant for the South Eastern European countries. There is a lot of excellent research with high standing physicians and engineers at the region's universities. For example, when I visited the Institute of Physics in Belgrade, I was impressed with the research campus and I saw room for spin-offs. And other cities, for example Priština and Sarajevo, are known for their excellent universities.

But in this region, as well as in the EU, we need to see the **modernisation of universities**. This would lead to better interaction between education, research and innovation.

Research and innovation are really all about people. So Governments need to **make scientists' career perspectives more attractive**. A good salary is one element. But so is the ability to move easily from private to public institutions without losing social benefits, such as pensions. And to have good research facilities

Talking of mobility, I am aware of the visa problems encountered by the countries in this region. Although this issue lies with the individual EU Member States, I do remind them at every Competitiveness Council how important it is to transpose the short term visas for scientists' package. The Commission is in the meantime looking at a global visa solution for your countries.



Intervention by Janez Potočnik

Ladies and gentlemen,

Research has given us previously unimaginable advances. We can communicate across continents, break down the human body to a gene code and create the smallest ever instruments.

But I would like to tell you today what I consider to be the two most basic elements in advancing research. They are a table and some chairs. I may be simplifying but I am sure you will agree that the first step is to get the people together. Only so can research start moving forward.

There is no magic solution to development. But in this region you do, at least, have the benefit of learning from the experiences – and mistakes – Europe has made so far.

One of those mistakes was not having invested enough in the last decades in knowledge – be it in research, innovation or education. We are still paying for that today.

So I urge you all to take the tough decisions needed to play your part in building and nurturing knowledge in your own countries. It is the best way to make this region attractive to investors, customers and its people.

In doing so, you will help your integration into the European Research Area and the European Union.

As you can imagine, I would especially love to see research play a lead role in helping develop this region. And the EU is ready to support wherever we can.

You have the tools at your disposal. Now is the time to act.

Thank you.

High Level Round Table

Science and Innovation Policy in South Eastern Europe and in Slovenia

29 September 2006, Ljubljana, Slovenia

FINAL COMMUNIQUE

Ministers and representatives responsible for science and for finance from South Eastern European countries and Slovenia met in Ljubljana, Slovenia, on 29 September 2006, at the invitation of UNESCO (Venice Office), the Slovenian Ministry of Higher Education, Science and Technology, and of the Austrian Science and Research Office in Ljubljana.

The High-Level Round Table was preceded by an International Conference 'Why Invest in Science in South Eastern Europe?' in which theoretical issues and practical approaches regarding science and innovation management at international, regional and national levels were presented and discussed by distinguished experts, representatives of European and international institutions, as well as the private sector.

The participating Ministers and representatives acknowledged that:

1. Knowledge creation and diffusion are increasingly important for the enhancement of innovation, sustainable economic development, and social well-being; and increased investment in science, research and quality education is essential for achieving the Millennium Development Goals adopted by the UN Millennium Summit in 2000.
2. Based on their well educated workforce, rich traditions in the promotion of science and technology, South Eastern European (SEE) countries possess the fundamental assets needed for building the process towards knowledge societies and for reaching regional sustainable development by placing science and technology (S&T) at the forefront of national and regional development policies.
3. Countries within the SEE region are at very different stages of development concerning the state of their economy, technology, and research and development (R&D), in particular with a view to reaching EU standards.
4. Although considerable improvement of R&D systems has been made in the last decade by some of the SEE countries, modernisation of science and innovation systems is still needed in others.
5. By its very nature, science transcends political borders and geography, acting as a catalyst for sharing intellectual endeavours among national communities; enhanced regional cooperation (in particular in scientific fields of common interest and the sharing of major research infrastructure) is therefore an important means for the reinforcement of both S&T capacities and cooperation among SEE countries.

The participants recognized that, in order to create sustainable development and social welfare within South Eastern Europe, specific measures are necessary at national level with a view to:

- continuing or initiating overdue development and enhancement of S&T policy and innovation systems by: a) improving the overall status of S&T in governmental policy priorities; b) creating the legislative and institutional framework to foster R&D with a particular emphasis on industrial demand for and business expenditures on R&D; c) fostering the modernization of R&D infrastructure;
- further supporting quality education, in particular higher education, and the development of universities as important nodes of emerging knowledge-based economies;
- continuing to foster research collaboration, scientific cooperation and technology development within and outside the SEE region;
- supporting further development of human resources also by attracting more women and youth and taking appropriate measures to reduce brain drain from science and research;
- raising awareness and public understanding of science;
- making extensive use of existing and new platforms for dialogue among decision-makers and society at large.

The participating Ministers and representatives called upon international organisations, in particular UNESCO and sister Organisations, funding agencies, as well as European institutions to:

6. support SEE countries in the development and the implementation of quality science, technology and innovation policies;
7. contribute to the training of decision-makers in STI policies, including foresight techniques to set priorities for funding and crafting of policies and to disseminate best practices in STI policy and management;
8. support actions to put STI at the top of the national/regional development agenda;
9. support SEE governments in improving the performance of administrative, legislative and financial infrastructure of STI systems, including the improvement of the access to information technology and networks, and to the pan-European Research Infrastructures.
10. support SEE governments in increasing intellectual property assets development and management, technology transfer, public-private partnerships to promote science-based innovation, and in the creation of science/technology parks;
11. create incentive programmes, supportive of fundamental, long-term research to ensure that universities and public laboratories can continue to explore knowledge frontiers on a broader front and remain reliable sources of objective scientific expertise;



12. promote greater regional and international cooperation in S&T as essential means to meet global challenges such as economic growth, social cohesion, improved health, sustainable development, enhanced safety and security, and to promote peace and dialogue in the region;
13. help to strengthen the potential and capabilities for full participation in ERA, FP7, CIP and the other European programmes (e.g. Eureka), seeking in particular increased participation of the business sector, mainly SMEs.
14. support the exchange of researchers, academics and students, overcoming visa problems, and encouraging mobility schemes between Western Balkan countries and the European Union Member States;
15. consider the idea of a permanent global Forum of Ministers of, or those responsible for, Science and Technology to be held on a regular basis under the auspices of UNESCO.

General Conclusions

Slavo Radosevic, Rapporteur

The main aims of the International Conference 'Why Invest in Science in South Eastern Europe?' were:

- to contribute to a better understanding of the interrelation between investments in science and knowledge and socio-economic development in general, specifically with regard to the present situation in South Eastern European (SEE) countries;
- to provide a knowledge base for policy-makers to improve the allocation of funds for investments in science and research and to identify accompanying measures which would lead to enhanced socio-economic development in the SEE countries as well as in other parts of the world.

In both these respects, the Conference was successful. High level experts in S&T and innovation policy presented the state of the art in comprehension of the role of S&T in socioeconomic development, and the role of S&T in the SEE region. This provided an excellent platform enabling evaluation of current and future initiatives in the SEE region. The Round Table of Ministers further contributed to a better understanding of S&T policy in the region, particularly in relation to schemes for funding S&T, and served as a very good platform for motivating and improving decision-making over the funding of S&T in the region.

The main conclusions of the Conference are set out below.

1. An increasing role of knowledge in economic development and globalization of S&T provides a broader context and generates pressures for SEE countries to enhance the role of their S&T systems in their countries' socio-economic development.
2. Current economic features pose severe constraints on the development of S&T in the region. We can hope that with the continuation of the current levels of recovery and growth these constraints will be significantly reduced and will make room for strong policy actions. Weak innovation demand and support systems are the biggest bottlenecks to a stronger contribution from S&T to growth and social development in the SEE countries. Constraints on the demand side are being further reinforced by constraints on the supply side through continuous and strong processes of external and internal brain drain and ageing in the R&D sectors of SEE.
3. A key challenge for all SEE countries is to abandon R&D confined within the framework of science and innovation policy and expand the policy focus to include other elements of national innovation capacity, such as absorption capacity, diffusion, and transfer and demand for RTDI. The abilities of individual countries to follow such a prescription differ greatly. The differences between countries in these respects are substantial.



4. Differences in the levels of S&T across the region should be perceived as an opportunity rather than an obstacle. They will enable the establishment of joint RTD projects among partners with different S&T profiles and different capacities.
5. Based on experience in the developed countries, such as Canada, a gradual boosting of targeted public investment in knowledge creation (competitive grants for centres of excellence) should be a priority.
6. 21st century universities are developing in the direction of entrepreneurial universities which nurture expanded links with large firms and local SME networks. Their restructuring is based heavily on the Triple Helix model. However, the emergence of this model in the SEE region is constrained not only by weak universities, but also by weak firms and very weak local demand for local RTDI. The third pillar – government – is engaged in establishing innovation governance and often in restructuring a fourth actor, R&D institutes.
7. SEE universities have so far been unable to respond to these new challenges. The capacity to grow local spin-offs is quite complex, especially in the small and semi-developed research systems of the SEE countries which are faced with numerous missing factors. Partnerships among universities and R&D institutes, via consortia, may be a specific SEE response to the need to enhance research and innovation capabilities.
8. An important partner that could contribute to the restructuring of universities is firms, both local and foreign. Top blue chip companies in the region are aware that they will not be able to sustain the inflow of new people unless they support local universities. In this respect, projects such as the joint Hewlett Packard-UNESCO initiative to alleviate the brain drain in SEE are examples that should be replicated on a much larger scale.
9. In general, cases of good practice across the world suggest that the localization of R&D investments is strongly dependent on public–private partnerships and on good infrastructure including transportation.
10. Although open conflict is now relegated to the past in the SEE region, there is still scope for Science for Peace initiatives. The success elsewhere of such projects developed by UNESCO suggests that it is mainly due to a package of elements involving the coming together of various stakeholders.
11. Examples of good practice show that the effective introduction of new tools to advance research and innovation requires the involvement of finance ministries and the ministers of finance.
12. Analysis of S&T and innovation policies in the new EU Member States and candidate States suggest that benchmarking and continuous monitoring and evaluation are essential in the development of research and innovation policy capacity. There is need for national as well as regional initiatives in this respect.



General Conclusions

13. Lack of real long-term commitment to S&T and instability in the organizational sets ups of governments hinder the adoption of normative measures towards increasing the role of R&D in economic development.
14. A review of the changes in individual SEE countries shows very large differences in levels of development and pace of restructuring of RTDI systems. The R&D systems in Bosnia and Herzegovina, Albania and to an extent Former Yugoslav Republic of Macedonia are the most disadvantaged. These countries are still trying to establish functioning R&D systems and primarily addressing science policy. Reforms in other countries range from still very initial and limited changes, as in the cases of Serbia and of Montenegro, to very much EU driven and inspired changes in other countries (Romania, Croatia, Bulgaria). In these three countries and Turkey there has been a visible attempt to shift the focus from conventional science policy to innovation policy.
15. There has been limited progress on key issues for the integration of the Western Balkan countries into the European Research Area (ERA). The international stakeholders are aware of the need to support S&T in the SEE region for integration into the ERA and as a tool for economic growth. The infrastructure requires major improvements and the S&T systems need to be restructured. Key factors that have contributed to the current unsatisfactory state of the Western Balkans are internal conditions and limited and inadequate sources of external funding, e.g. EU FP6, InterReg, NATO and in particular lack of support from CARDS. It is essential that the RTD component within CARDS activities is increased.
16. International assistance in enhancing S&T in the region is still very limited. Most donors do not have a single home for RTDI. Many actors work across different networks in a rather uncoordinated way. This creates segmentation and duplication. There is an absence of overall purpose and strategic direction.
17. Individual national initiatives, such as the Turkish 2005 National S&T Initiative, have introduced a new momentum. If this initiative is successful it could become an example of good practice for other countries in the region.
18. The Conference demonstrated that there is now a much better understanding of the region's RTD needs. These are primarily related to infrastructure, human potential, institution building, joint research and funding.
19. The Conference showed that there is large scope for individual country initiatives at bilateral levels. Slovenian initiatives, which include six month fellowships, bilateral projects, information services and joint referee systems, could be used as examples of good practice.
20. The Conference participants agreed that although the benefits might be quite long term, an increase in R&D funding is essential if the SEE countries, and the Western Balkans in particular, are to be prevented from falling further behind in economic development. How-



ever, these funding increases should be accompanied by a strong focus on excellent but also relevant research. This will necessitate fair competition, priorities, transparency and international experts.

21. The Ljubljana Conference seems to have been an important milestone in the development of international cooperation in this area in the region. The Final Communiqué provides a clear agenda for further action.

ANNEX I

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List of Figures

- Figure 1.1** Quality of pillars of competitiveness of SEE economies
Figure 1.2 Assessment of demand and supply for local RTD in SEE
Figure 1.3 R&D personnel employed in R&D in SEE Europe, in head counts
Figure 1.4 GERD as percentage of GDP in SEE countries
- Figure 2.1** The four Ps
Figure 2.2 Pasteur's quadrant and the rationale for policy intervention
Figure 2.3 National innovation system concept
Figure 2.4 Recent trends in the development of MAPs
Figure 2.5 European Innovation Scoreboard country groupings, 2005.
Figure 2.6 Innovation governance system in selected EU countries
Figure 2.7 PRO-INNO Europe initiative: structure of activities
- Figure 3.1** FDI in transition countries, 2000-2005 (US\$ billion)
Figure 3.2 Gross domestic expenditure on R&D (% of GDP), 2000-2003
- Figure 6.1** Share of medium and high technology activities in manufacturing value added
Figure 6.2 Share of medium and high technology goods in manufactured exports
- Figure 12.1** Revealed competitive advantages in Bulgarian import and export (1999–2004)
Figure 12.2 Relative share of the innovative enterprises in Bulgaria and EU-15
Figure 12.3 Relative performance of science systems in EU8+2 (countries' share in the region's citations compared to their share in the regions total population)
Figure 12.4 Level of entrepreneurship (number of enterprises per 1000 inhabitants)
Figure 12.5 Structure of R&D expenditure by sources of funds
Figure 12.6 Life-long learning (share of population aged 25-64, engaged in education and training)
- Figure 13.1** Institutional set up for R&D and innovation in Croatia
Figure 13.2 Structure of the Croatian Programme for Innovative Technological Development (HITRA) programme
Figure 13.3 Croatia and EU 25 composite indicators: divergence from average, 2001
Figure 13.4 Croatia and EU10 - new Member States composite indicators: Divergence from average, 2001
Figure 13.5 Gross domestic expenditures on R&D in Croatia
Figure 13.6 Gross domestic expenditure of R&D (GERD), 2003



Annex III: List of Figures

- Figure 13.7** Number of researchers (FTE) per 1000 labour force in Croatia and EU 25, 2003
- Figure 15.1** Economic gaps between Romania, the other new Member States and EU average, 2005
- Figure 15.2** Romania's innovation performances relative to the EU average, 2005
- Figure 15.3** How will public R&D intensity reach the Barcelona target?
- Figure 15.4** How will business R&D intensity reach the Barcelona target? (BERD as share of GDP)
- Figure 16.1** Structure of Science, Technology and Innovation system in Serbia
- Figure 16.2** GERD and BERD in Serbia, as % of GDP in period 1980–2004
- Figure 16.3** Income from R&D activities in R&D organizations in Serbia 1980–2004
- Figure 16.4** Absorptive Capacity – Aggregate Indicator for EU member countries (for year 2000) and Serbia (for year 2004)
- Figure 16.5** R&D supply – Aggregate Indicator for EU member countries (for year 2000) and Serbia (for year 2004)
- Figure 16.6** Correlation between labour productivity of economy and GERD (as % of GDP) in Serbia
- Figure 17.1** European Innovation Scoreboard - 2005 Summary Innovation Index (EC 2005).
- Figure 18.1** A system of innovation

ANNEX III

List of Tables

Table 1.1	Factors of supply for RTD in SEE countries
Table 1.2	Factors of demand for RTD in SEE countries
Table 1.3	Dominant sectors in R&D funding and performing
Table 1.4	Relative problem of brain drain in SEE compared to other countries
Table 5.1	Knowledge-based Regional Economic Development
Table 6.1	Competitive Industrial Performance index.
Table 6.2	Selected determinants of industrial performance 1998
Table 16.1	Researchers by sectors of performance, year 2001
Table 16.2	Authors from Serbia – Production of R&D papers in international refereed S&T journals
Table 16.3	Resident patent applications in Serbia: distribution by applicant type and total patent applications in country
Table 16.4	SWOT analysis of S&T and Innovation system in Serbia

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List of Contributors

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List of Contributors

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