SCIENCE AND TECHNOLOGY IN THE WESTERN BALKANS

Edited by Elke Dall

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Foreword

This publication consists of seven reports compiled by the Information Office of the Steering Platform on Research for the Western Balkan countries, reviewing the condition of Science & Technology (S&T) in the Western Balkans: Albania, Bosnia and Herzegovina, Croatia, FYR of Macedonia, Montenegro, Serbia and Kosovo/UNMIK.

The objectives of these studies are to enhance our understanding of the innovation systems and to give an overview of the modern input and output indicators in the S&T systems, to identify significant S&T institutions and other key players important for S&T policy making, and to present relevant S&T policies and strategies.

Although all the Western Balkan countries (WBC) are challenged by similar issues, every country has an individual approach to S&T policy making due to historical experiences, cultural and public understanding of science, general economic development of the country, or current political situation. In general, the S&T systems are hampered by the overall lack of resources, and the fact that S&T policy is not high on the list of priorities of the respective country policy agendas.

The main deficiences in the area of research, innovation and technological development that can be recognised in all of the Western Balkan countries are:

- the domination of the public sector over the private sector in S&T
- a focus on academic basic research
- a frequent lack of integration between research agendas and other policies
- the lack of funds directed at research
- an insufficient involvement of the private sector
- the inefficient development and implementation of strategies and laws in this field.

The European Union (EU) plays an important role in the process. On the road to joining the EU, the Western Balkan countries are striving to meet the standards and objectives that are a prerequisite of this membership. The accession to the Seventh Framework Programme for Research and Technological Development (FP7) is an important step in this process (at the time of writing of this report, Albania, Croatia, FYR of Macedonia, Montenegro and Serbia are Associated Countries to FP7 and Bosnia and Herzegovina is in the process to negotiate the accession).

In addition, other European Union programmes provide opportunities for financial support of the economies of the Western Balkans countries and in particular, their research, science and technology sector. The Instrument for Pre-Accession (IPA) is one of these funds, which plays a beneficial role in assisting these countries. Further financial support is provided by the European Investment Bank, the European Bank for Reconstruction and Development, the World Bank, and so on.

The Information Office of the Steering Platform (www.see-science.eu) attempts to act as an information point, which provides updates from several programmes and projects, disseminates event announcements, calls for papers and proposals and other relevant news items. Further resources include reports on mobility, on innovation infrastructures and a so-called needs-offer-matrix which discusses the most pressing needs of the countries and the different funding sources on offer. The project see-science.eu received funding from the European Commission's Sixth Framework Programme (FP6) and ends in April 2008, but the activities of the Information Office will be continued on an even larger scale: the Western

Balkan Countries INCO-NET (www.wbc-inco.net) is a follow-up project with 26 partners lasting till December 2011.

We invite the reader to contact us in order to provide additional information and updates. The following reports were originally designed to summarise the main available resources in 2006 and have been brought up to date by local actors on a continuous basis. But as the field is rapidly developing and the Western Balkans are undergoing permanent institutional and structural changes we discover new features on a daily basis. We would like to thank our local cooperation partners for the precious support provided and we hope to play a similarly useful role in the ongoing S&T processes in the Western Balkan countries.

Elke Dall
Vienna, March 2008

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ON RESEARCH FOR THE WESTERN BALKAN COUNTRIES
see-science.eu

Science and Technology Country Report

ALBANIA

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1 Introduction

This country report is produced by the "Information Office of the Steering Platform on Research for Western Balkan Countries" and reviews the situation of Science and Technology (S&T) in Albania.

The report summarises the main papers published by the United Nations Educational, Scientific and Cultural Organisation (UNESCO), the South-East European ERA-NET (SEE-ERA.NET), the Austrian Gesellschaft zur Förderung der Forschung, the Academy of Sciences of Albania and several independent scholars on the issue of S&T in Albania. For the complete table of references please see References in chapter 7, starting on page 47 of this report.

The objective of this study is to enhance our understanding of the national innovation system in Albania. An overview of the situation in S&T regarding the main stakeholders, input and output indicators, the national strategies and priorities, and the main documents and laws in the field is given below.

The 'system of innovation' approach was taken into account when compiling this report, and it covers important factors influencing the development, diffusion and the use of innovations, as well as the relations between these factors. It does not place emphasis on individual firms or research organisations, but rather on innovation as an interactive and interdependent process.

Relevant organisations in this respect are higher education institutions, scientific institutes and centres, governmental agencies, private companies etc., interacting to create knowledge and innovation. The macro-level of the system is analysed using indicators such as R&D personnel ratios, R&D expenditure, patent application intensity rates, etc.

The report was compiled in autumn 2006 by the Information Office, by Ms. Elke Dall and Ms. Maruška Bračić, Centre for Social Innovation, Vienna, Austria and then reviewed by Mr. Peter Mayr, Centre for Social Innovation, and Mr. Edmond Agolli, Ministry of Education and Science, Albania. A brief update was carried out in summer 2007 by Mr. Jure Zrilič, Centre for Social Innovation. The final review in autumn 2007 was carried out by Mr. Gjergji Gjinko, Ministry of Education and Science and Mr. Salvator Bushati, Academy of Science, Albania.

1.1 Albania - A Brief Profile

Albania lags significantly behind its Balkan neighbours in the transition towards a modern, open-market economy. The transition has proven difficult as successive governments have tried to deal with high unemployment, widespread corruption, a dilapidated infrastructure, powerful organised crime networks and a disruptive political environment. The 1992 elections in Albania ended 47 years of communist rule under Enver Hoxha, although the latter half of the decade saw a quick turnover of presidents and prime ministers. Although the country has made progress in its democratic development since 1991, deficiencies still remain. During the NATO bombing of Yugoslavia in 1999, nearly 500,000 ethnic Albanian refugees from Kosovo spilled over the border, imposing a huge burden on Albania's already fragile economy. Despite continuous economic growth, the country remains one of the poorest in Europe, hampered by a large informal economy and an inadequate energy and transportation infrastructure (European Commission, 2006a).

The Republic of Albania is a South Eastern European country with a population of 3.2

million inhabitants (44% urban and 56% rural). The administrative division of the country consists of 12 prefectures, 36 districts and 374 communes/municipalities. In 1998, a new constitution was adopted to replace the interim constitution of 1991. The new constitution conforms to international democratic standards and guarantees democratic freedom, notably political pluralism, freedom of expression and religion. Albania is a parliamentary republic and the last parliamentary elections took place in July-August 2005 (the next elections are scheduled for mid-2009). Overall, the parliament functions satisfactorily, although political life in Albania continues to be turbulent. In terms of foreign relations, Albania has played a positive and constructive role in regional issues, particularly regarding Kosovo, southern Serbia, the Former Yugoslav Republic (FYR) of Macedonia and Montenegro. Albania participates actively in several regional cooperation activities and is also a party to most international human rights treaties. In 2000, the country abolished the use of the death penalty in peacetime (European Commission, 2006a).

In 2003, the nominal GDP of Albania reached EUR 7.4 billion (about EUR 2,300 GDP per capita) and 25% of the population were living below the country-specific poverty level. However, Albania's cumulative growth has reached an annual average of 5.7% due to the implementation of largely successful stabilisation programmes, structural transformation and remittances sent home by migrants. Agriculture has declined to 25% of GDP, industry and construction account for 23.4%, while the contribution of the service sector to GDP has risen to 54.6%. The economic situation was exacerbated by the continued weak export performance, which has resulted in a persistent external deficit (European Commission, 2006a).

Agriculture, which accounts for about one quarter of GDP, is held back because of frequent drought, the need to modernise equipment, clarify property rights etc. Furthermore, energy shortages and inadequate infrastructure contribute to Albania's poor business environment, making it difficult to attract and sustain foreign investment (CIA, 2006).

In 2004 and 2005 the real GDP growth rate was 5.5% while in 2006 5.7%. Unemployment in Albania is high, though not as high as in BiH or FYR of Macedonia. Unemployment rate in 2004 was 14.4%, 15,2% in 2005 and even smaller in 2006 - 14% (OECD, 2006). The privatisation of SMEs has been completed, but political uncertainty and the low level of interest from strategic investors have delayed large scale privatisation. Regarding the macroeconomic situation, 2004 tax revenues were projected to increase to 20.2% of GDP, but they remain the lowest in the region. However, on a more positive note, the absence of substantial inflationary pressure and the continuing nominal appreciation of the Lek (Albanian national currency) presented the opportunity for the relaxation of monetary policy (European Commission, 2006a).

Table 1.1: Country Profile 2005 [1]

Country Profile, 2005	
Population (millions)	3.2
Population growth (annual %)	0.6
Life expectancy at birth, female (years)	78.5
Life expectancy at birth, male (years)	72.6
GDP (current US$) (billions)	8.38
GNI per Capita, Atlas method (Current Euro)	2.580
GDP growth (annual %)	5.5
GDP implicit price deflator (annual % growth)	1.8
GERD as % of GDP (2005)	0.19

[1] Source: World Development Indicators 2006

Value added in agriculture (% of GDP)	22
Value added in industry + Construction (% of GDP)	23.4
Value added in services (% of GDP)	54.6
Inflation, consumer price (annual %)	2.4
Foreign direct investment, net inflows (% of GDP)	3.1
Unemployment, total (total labour force)	15.2
Time required to start a business (days)	41
Internet users (per 1000 people)	60

1.2 Relations between Albania and the EU

Albania participates in the Stabilisation and Association Process (SAP) along with other countries of the Western Balkans. In 2005, the European Council adopted a revised European Partnership for Albania, identifying short and medium term priorities which the country should address. The partnership also serves as a checklist against which to measure progress, as well as providing guidance for EC assistance. The EC priorities reflect Albania's stage of development and are tailored to its specific needs. Albania is expected to respond to the European Partnership by producing a National Action Plan with a timetable and details of how it intends to address the European Partnership's priorities. Progress in implementing these priorities is monitored regularly by the European Commission, notably through the annual Progress Reports and through other structures set up under the SAP, in particular the Consultative Task Force (European Commission, 2006a).

The signing of the Stabilisation and Association Agreement (SAA) in Luxemburg on 12th June 2006 is considered a milestone on Albania's path towards EU membership. It outlines a set of political and economic criteria that the government is expected to meet. The deal also clears the way for greater trade liberalisation and a more competitive market that will both challenge Albanian business and present new opportunities. Ratification of the SAA is expected to take about two years - eventually replacing the 1992 Trade, Commercial and Economic Cooperation and Interim agreements. The implementation of the SAA will also require Albania to progressively liberalise its market over a maximum period of 10 years (European Commission, 2006a).

Albania has benefited from national and regional financial assistance under the Community Assistance for Reconstruction, Development and Stabilisation (CARDS) programme and a far-reaching contractual relationship with the EU, including trade preferences through the Stabilisation and Association Agreement. Regional dialogue and cooperation are also important elements in gaining financial assistance (European Commission, 2006a). More than EUR 315 million were earmarked for Albania through CARDS between 2001 and 2006 (European Commission, 2006b). As a result of the Community's reform of external aid, the CARDS programme was replaced by the new Instrument for Pre-Accession Assistance (IPA) in 2007. The major objective of the IPA is to streamline all pre-accession assistance into a single framework, and to unite both candidate and potential candidate countries under the same regulations. The instrument consists of five components, the first two of which are open to potential candidate countries: the Transition Assistance and Institution Building component and the Cross-Border Co-operation component (European Commission, 2006a).

On 18th September 2007, the European Union (EU) and five West Balkan nations (among them Albania) signed nine agreements on visa facilitation and readmission, which will bring the two sides closer in cooperation in migration and movement of persons. The signature of the agreements is an important political decision toward closer cooperation between the

two sides closer in cooperation in migration and movement of persons. The signature of the agreements is an important political decision toward closer cooperation between the EU and the Western Balkan countries in the sensitive areas of migration and movement of persons (see-science.eu, 2007).

In the last fifteen years, Albanian society has reached a remarkable unity regarding the concept of Euro-Atlantic integration. Political parties, intellectuals, business people and citizens all agree on the need to join the European Union. However, little research or public debate has been carried out regarding the technical implications of this endeavour, possibly due to the sensitivity of the topic. The complexity of the process remains largely opaque both to policy-makers and to society (AIIS, 2006).

2 Contemporary Institutional Landscape

Albania has been undergoing radical changes and transitions since the dissolution of communism at the beginning of the 1990s. Although still comparatively isolated from international cooperative initiatives programmes and lacking adequate institutions and support structures.

There are currently four main elements in the Albanian national innovation system: government ministries, S&T institutes (each of which is associated with a ministry), S&T institutes and centres of ASA and the higher education sector. As Albanian industry develops, it will import technologies, initially associated with production equipment and processes, before adapting and developing its own technologies. In the public sector, foreign donors are major sources of finance for the purchase of technologies. Although many of the Albanian institutes run by government ministries describe themselves as research institutes, it appears that the bulk of their activities focus on scientific and technical services. Thus, the Albanian national system of innovation can be primarily defined as the S&T service system (as defined by UNESCO). Primary policy interest should consider S&T investment and measure S&T inputs and outputs (UNESCO/UNDP, 1996).

Further progress in the reorganisation of system of the scientific research, the creation of national research centres, the introduction of standards and performance indicators, and the improvement of the infrastructure and legal framework are absolutely necessary (Dall, 2006).

2.1 Main Stakeholders Involved in Policy Making in Albania

The main governmental body responsible for R&D activities and the general administration of Albanian national S&T programmes is the Ministry of Education and Science (MoES). The ministry's agenda is based on institutional and programme-based funding. It consults the government, aiming to act as an information point for the scientific community, and is responsible for national, multilateral, bilateral agreements programmes and other activities and actions. It also supports the implementation of S&T programmes in universities, ministries and other public and private institutions (Government of the Republic of Albania, 1994).

However, it must be noted that the responsible department is severely understaffed. The records up to 2006 show that, with agriculture being one of the most important sectors in the economy, the Ministry of Agriculture and Food is one of the main players in formulating scientific research policy in the national Agriculture and Food programme. The following ministries (often with research institutions attached) can also be considered as important

stakeholders in the Albanian national innovation system: the Ministry of Energy; the Ministry of Health; the Ministry of Culture, Youth and Sports; and the Ministry of Construction and Tourism (Gjinko, 2007).

The Albanian government acknowledged the need to amend existing laws and at the end of 2005, a group of experts was set up with the aim of defining and carrying out necessary changes in the innovation systems, including the creation of a Council of Higher Education and Science. The Council for Scientific Policy and Technological Development, which was composed of seven ministers and eight scientists, no longer exists and so the following duties actually are under the responsibility of the Council of Higher Education and Science: defining and managing S&T policy, approving orientations and priorities, making recommendations on draft laws and draft decisions to be submitted for consideration and approval by the People's Assembly and the Council of Ministers, carrying out the periodic evaluation of the achievements of the S&T policy, and so on. The Ministry of Education and Science itself is responsible for formulating S&T policy and national R&D programmes in order to implement this policy, drafting the budget proposal for S&T activities, and holding and distributing funds (ICBSS, 2006; Agolli, 2007a).

In March 2006, a conference on the Reform of the Albanian Higher Education System in the European Area was co-organised by the Council of Europe and the Albanian Ministry of Education. This was the opening conference for the Albanian master plan for higher education. The Albanian government has made the educational reform one of its top priorities - this comprehensive reform is supposed to be achieved through the elaboration of a master plan (Council of Europe, 2006).

Developments and trends in higher education in Europe, in particular within the Bologna Process (Albania acceded to the Bologna Process in September 2003) will be an important element in implementing the master plan, and the Council of Europe will provide the international expertise (Council of Europe, 2006). Far reaching reforms and the implementation of new laws should significantly contribute to the improvement of the existing situation in the field of higher education.

The main actors carrying out research and development projects have been: research institutes/centres of the Academy of Sciences; research institutes/centres, and scientific stations/incubators of ministries; higher education institutions; R&D units in the private sectors of industry, and NGO research institutes and research centres. Higher education and science are mostly treated separately, and PhD programmes are often disorganised.

Most of the Albanian R&D performance is concentrated in the centres and institutes under the auspices of the ministries, the Academy of Sciences (ASA), higher education institutions and the government sector, which together account for about 97% of R&D performance. In contrast, private sector R&D is marginal. There are no specific funds or agencies in Albania that are responsible for financing R&D activities - instead, a national competitive R&D programme operates on behalf of the ministry, and organises cooperative processes with the Academy of Sciences and other research institutions concerning priority setting for the national programme (ICBSS, 2006).

The Academy of Sciences (ASA) was founded in 1972 and represents the most prestigious and most important scientific institution in the Republic of Albania. The ASA is an independent institution, which includes 13 scientific institutions/centres within its system (half of which belong to the natural and technical section and the other half to the section of human and social sciences) (ICBSS, 2006). It performs studies and applied research in different

domains of Albanology, social, natural and technical sciences; assists in discovering new domains of studies and research; provides suggestions and necessary expertise to the higher government institutions in resolving problems considered as important for the country's development; promotes and encourages the active participation of associations, scientific foundations and outer collaborators in scientific activity, etc. (Agolli, 2007b). The publishing house *Shkenca* (Science) also plays an important role, especially in the publication activities of the ASA. Over 270 researchers work in the academy and its institutions: they create clear research programmes, closely linked to the actual problems of development in the country, and formulate clear procedures for planning, controlling and evaluating scientific activity (ICBSS, 2006).

Some institutions provide an important national contribution: for example, the Institute of Informatics and Applied Mathematics (INIMA) was formerly in charge of developing the LAN in all the institutions of the ASA (among others), and played a positive role in the creation of the National Academic Network (with its contribution to the Political Board and Technical Group of NAN). INIMA is a reference partner for international networking activities in this field. In recent years INIMA has been involved in several EU-funded projects, including SEEREN, SEE-GRID, and SEEFIRE[2] (TERENA, 2005).

24 other research institutes are under the authorities of the ministries. Research institutes within the Ministry of Education and Science ought to present a balanced combination of R&D activities, fulfilling an important role in the provision of services and monitoring activities in specific fields. The transformation process form an institutional system, designed to function in a centralised economy, to a system that functions in a market-economy represents a constant challenge. Regarding the financial aspects, the majority of these institutions mainly rely on the state budget, with little secondary income. The main part of the budget is destined for wages, leaving little for the provision of infrastructure. Unfortunately, not all of these institutes meet the required standards and the financial situation does not allow for the renewal of equipment. The institutes are often fragmented and lack qualified personnel, as well as clear and well oriented programmes operating under market-economy conditions (Gjinko, 2007).

In higher education institutions, the main R&D activities are carried out in Humanitarian, Economic, Social-juridical and Medical sciences, and in Natural and Technical sciences. They are mainly concentrated in the University of Tirana, the Polytechnic University of Tirana, the Agriculture University of Tirana, University of Vlora, the University of Shkodra, and partly in the University of Elbasan. The small share of R&D in the higher education sector is mainly due to the lack of direct financing. Hence, higher education institutions in Albania are mainly oriented towards teaching processes, while scientific research remains limited and is mainly possible through foreign cooperation initiatives (ICBSS, 2006; Agolli, 2007a). The University of Tirana, which was originally composed of ten faculties, was split up in 1991 when the engineering faculties were brought together under the Polytechnic University, leaving the University of Tirana with seven faculties covering Human, Economic, Natural and Medical sciences.

According to the National Report on Bologna Process, there are currently 12 public and 15 private universities in Albania. The total number of students for the academic year 2005-2006 was 52,283 (30,777 females), of these, 50,567 have enrolled in public universities; for the 2006-2007 was 86,178 (45,586 females), with 82,161 in public universities. All activity of the public and private higher education institutions have been managed by the same Law on Higher Education with the same standards about study plans, programmes and curricula for both private and public higher education institutions (Theodhori, 2006).

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[2] Please see the List of Acronyms, chapter 8.

Table 2.1: Enrolment in higher education institutions 2005-06 and 2006-07 (Gjinko, 2007)

	2005-2006		2006-2007	
	total	female	total	female
Total	52,283	30,777	86,178	45,586
Public	50,567	29,826	82,161	43,468
Non public	1,716	951	4,017	2,118

According the new Law on Higher Education in the Republic of Albania (more details are given in chapter 5.1 Legal Framework for National R&D System), the MoES develops the new scientific research system in Albania by reconstructing most of the existing research institutions in the universities (as institutions, centres and departments) and by introducing several new research institutions, these are: the Interuniversitary Centre for Albanological Studies, the Institute of Geosciences, the Institute of Water, Energy and Environment, the Centre of Nuclear Physics and the Albanian Atomic Authority.

Table 2.2: Main S&T Stakeholders in Albania (Dall, 2006; Sulstarova, 2006)

Main ministry in Albania competent for S&T	- Ministry of Education and Science
Other ministries with importance to the S&T sector	- Ministry of Agriculture and Food and Consumer Protection - Ministry of Economy, Energy and Trade - Ministry of Culture, Tourism Youth and Sports - Ministry of Health - Ministry of Environment, Forest and Water Administration - Ministry of Public Works, Transport and Communication - Ministry of Interior
Other important stakeholders	- Council of Higher Education and Science - Rectors Conference - The Academy of Sciences
Universities, Centres and Institutes	- Interuniversitary Centre for Albanological Studies - Polytechnic University of Tirana - Agriculture University of Tirana - University of Tirana - Centre of Nuclear Physics and Albanian Atomic Authority - Institute of Water, Energy and Environment - Institute of Geosciences - Military University of Tirana - University of Shkodra - University of Elbasan “Aleksander Xhuvani” - Agricultural University of Korce - University of Gjirokaster - Technological University of Vlore - University of Durres - Academy of Arts - Academy of Sports and Physical Training, Tirana - Institute of Statistics

The private sector's investment level in S&T in Albania is extremely low. SMEs, or rather micro-enterprises (entities with fewer than five employees), make up the vast majority of private businesses. Their survival strategy focuses on labour intensive, low-cost production. Against this background, R&D falls almost entirely under public responsibility (Xhepa and Mancellari, 2003). Overall, there are very few private institutions, and these few operate mostly in the field of Human, Social and Political sciences but their personnel structures and their financial and cooperation procedures are not stable. However, in the field of information technology, the private sector became dominant by establishing market activities with some relevance to research and development (ICBSS, 2006).

The Centre for Research and Development in Tirana is a private research institute worth referencing. Since early 2002, it has produced and disseminated information about business development based on quarterly business tendency surveys for manufacturing and construction sectors. It is becoming well recognised by Albanian institutions, international organisations and is frequently referred by journalists and academics as a source of information regarding business development in Albania (Gajo, 2007).

2.2 International Cooperation

Albania has been experiencing continuous international cooperation and support, especially in the last five years. This cooperation has been substantially supported by many international organisations, as well as through the assistance of other countries in bilateral programmes (also providing significant benefits to the R&D sector). The largest part of the financial support in this respect came from the funds of the Stabilisation and Association Process, the CARDS programme, the Stability Pact for South Eastern Europe[3], the European Investment Bank, and the European Bank for Reconstruction and Development. The European Union's Tempus programme has been important in the area of higher education, while Albania's participation in the Framework Programmes for R&D and gradual integration into the European Research Area (ERA) has also been of particular importance. Inclusion into the European Investment Bank's Innovation 2010 Initiative ought to prove useful as well. Regarding multilateral cooperation in the area of science and research, Albania has closely cooperated with many specialised United Nations (UN) agencies, such as UNESCO, UNIDO, UNDP and UNECE[4]. Some other international organisations, such as the World Bank, have also been important donors and have helped in the area of R&D (Uvalic, 2006). In addition, many regional projects have been launched with the objective of promoting regional cooperation within South Eastern Europe. Regional scientific cooperation in Albania is currently being promoted by several regional organisations: for example, the Central European Initiative (CEI), the Adriatic-Ionian Initiative, the Stability Pact for South Eastern Europe, the Black-Sea Economic Co-operation (BSEC), and the International Atomic Energy Agency (IAEA).

Albania has participated in FP6 as a so-called third country. Albanian participants were involved in 17 projects within FP6 and mostly were active in "Specific measures and support of international cooperation" and "Information Society Technologies" (Ministry of Education and Science, 2006).

Albania's Minister of Education and Science Genc Pollo and EU Commissioner Janez

[3] On 8th May 2007 a summit on recent achievements in regional cooperation in South Eastern Europe was organised in Zagreb. The Stability Pact is transferring its responsibilities to locally managed bodies based in the region. The Zagreb Summit of the South-East Europe Cooperation Process (SEECP) and the Stability Pact Regional Table is an important step in this process. The European Commission fully supports this transfer of ownership to the local level and cooperates closely with the Stability Pact, the SEECP and other stakeholders to that end. A Regional Co-operational Council, which will become operational in 2008, will gradually assume the responsibilities of the Stability Pact for South Eastern Europe and the SEECP (Southeast European Times, 2007).
[4] Please see the List of Acronyms, chapter 8.

Potočnik signed the Memorandum of Understanding (MoU) with the European Commission allowing it full participation in the EU's Seventh Research Framework Programme (FP7) in Brussels on 17th December 2007. "Associated status" allows Albania to participate in all calls for proposals and compete on an equal footing with the EU Member States for research co-operation and support actions funded by FP7, as of 1st January 2008. As such, this agreement is an important part of the process of applying to join the EU, allowing scientists, universities and companies to create links with their counterparts across Europe and build up their scientific expertise, including in scientific fields crucial to implementing the body of EU legislation. Albania now joins the other countries in the Western Balkans regions that are associated to FP7.

Regional networks also include initiatives to aid the participation of Western Balkan countries in the EU Framework Programmes for R&D, as defined by the EU-Balkan Countries Action Plan on Science & Technology, adopted at the Ministerial Conference in Thessaloniki on 26th-27th June 2003. The Action Plan, along with the "Shared Vision", defined the priorities of research cooperation and provided a detailed examination of all possible sources of funding, thus contributing to the economic growth of Balkan countries and aiding their integration into the European Research and Innovation Area (CORDIS, 2003).

Although the Albanian Ministry of Foreign Affairs (MFA) has certain responsibilities in the field of international co-operation, it is the Ministry of Education and Science (MoES) which has full autonomy and responsibility for international R&D co-operation, especially concerning negotiations with partners in S&T institutions, contracting the framework for international bilateral and multilateral S&T cooperation and financing those activities which are selected and approved by the ministry. The MoES is a member of the SEE-ERA.NET project (South-East European ERA-NET) - a networking project funded in FP6 aimed at integrating the EU member states and the South Eastern European countries into the European Research Area by linking research activities within existing national, bilateral and regional RTD programmes as well as in the WBC-INCO.NET project funded in FP7 focussing on cooperation in science policy with the Western Balkan countries. ERA WESTBALKAN+ (FP6) is another project worth mentioning with participation from MoES. On the other hand, the Academy of Science (ASA) has full autonomy and responsibility regarding international R&D cooperation (in terms of negotiation with partners in international and national S&T institutions). It also has the right to negotiate with international organisations like the WMO (World Meteorological Organisation), the IAEA (International Atomic Energy Agency), the CTBTO (Comprehensive Nuclear-Test-Ban Treaty Organisation), the BSEC (Black Sea Economic Co-operation), UNESCO-ROSTE Venice etc., upon the permission of the Albanian Ministry of Foreign Affairs (ICBSS, 2006).

In the ICT field, there are Albanian institutes participating in various international scientific projects, such as TERENA (Trans-European Research and Education Network Association), SEEREN and SEEREN2 (South Eastern European Research & Education Network - INIMA with the Polytechnic University of Tirana and the Faculty of Economics of the University of Tirana), SEE-GRID and SEE-GRID2 (South Eastern European Grid-enabled e-Infrastructure Development), SEEFIRE (South-East Europe Fibre Infrastructure for Research and Education), ISOTEIA (Integrated System for the promotion of Territorial-Environmental Impact Assessment in the frame of spatial development) (INIMA, 2006).

Albania also participates in the IDEALIST7FP Network which supports participants in ICT Priority by network for IST under the transition to the 7th Framework Programme (funded in FP6). IS2WEB is a project co-ordinating the integration of scientists into the IST (Information Society Technologies) Programme of the FP6 and SEE-INNOVATION (focusing on the integration of SMEs in the field). The projects are funded by the European Commission

and assist innovative research organisations and SMEs in Western Balkan countries in getting informed about, and actively participating in, IST research funded by the European Commission. Furthermore, SCORE (Strengthening the Strategic Cooperation between the EU and Western Balkan Region in the field of ICT Research) is relevant in this field. Civet 2000, a private NGO is a partner of these projects in Albania[5].

Further projects with participation from Albanian institutions in FP6 are (European Commission, 2007):

- DAFNE-WBC (The use of household budget survey data as a tool for nutrition interventions in the post-conflict Western Balkan countries? the European Data Food Networking (DAFNE) approach)
- RECOVER (Renewable Energy COordinated DeVElopment in the Western Balkan Region)
- CSCAMHPPEI (Cultural Sensitivity and Competence in Adolescent Mental Health Promotion, Prevention and Early Intervention)
- ACCENT (Acceleration of the Cost-Competitive Biomass Use for Energy Purposes in the Western Balkan Countries)
- HECTOR (Eating Out: Habits, Determinants and Recommendations for Consumers and the European Catering Sector)
- SEADATANET (SEADATANET - A Pan-European Infrastructure for ocean and Marine Data Management)
- BAFN (Setting up of an agricultural and food research network in the Western Balkan Countries)
- EU-BALKAN-FABNET (EU-Western Balkans network for training and the promotion of cooperation in research activities within the Food, Agriculture and Biotechnology area of FP7)
- HUMSEC (Human Security in the Western Balkan region: the impact of transnational terrorist and criminal organisations on the peace-building process of the region)
- RETEXRESALB (Reinforcement of human and material capacities of the Textile Technology Research Centre in Albania)
- TRAINASA (Training Programme on International Research Project Development and Management for Young Scientists from the Academy of Sciences of Albania (ASA))
- SWEB (Secure, interoperable, cross border m-services contributing towards a trustful European cooperation with the non-EU member Western Balkan countries)
- WEB.DEP (Western Balkans Democratic Participation)
- RACWEB (Risk Assessment for Customs in Western Balkans)
- ELLECTRA-WEB (European Electronic Public Procurement Application Framework in the Western Balkan Region)
- BIOMERCURY (Worldwide remediation of mercury hazards through biotechnology)
- IMISCOE (International Migration, Integration and Social Cohesion in Europe)
- CALIMERA (Cultural Applications: Local Institutions Mediating Electronic Resource Access)
- TRABOREMA (Concepts for integrated transboundary water management and sustainable socio-economic development in the cross border region of Albania, Former Yugoslav Republic of Macedonia (FYROM) and Greece)
- RES INTEGRATION (Rural Sustainable Development through Integration of Renewable Energy Technologies in Poor European Regions)

[5] See such websites as: http://www.ideal-ist.net/, http://www.ist-world.org/ProjectDetails.aspx?ProjectId=e26b1aff3fe1432b8aa8e2c071c0d89e, http://www.score-project.eu/ and http://www.civet2000.com/ as accessed 26.03.2008.

- INTAILRISK (Assessment of Environmental Risk for Use of Radioactively Contaminated Industrial Tailings)
- WEB-ENV (Development of environmental guidelines for the region of Western Balkans)
- INDUWASTE (Management and remediation of hazardous industrial wastes in the Western Balkan Countries)
- WEB-MOB (Development of Researchers Mobility Policy Guidelines for the Region of Western Balkans)
- WYP2005 EUROPE (World Year of Physics 2005: Activities in Europe)

Albania also takes part in the Bologna Process. Albania signed the Bologna Declaration during the Berlin conference in 2003. From 2003 to 2005 several acts and orders were amended by the Parliament and the Ministry of Education and Science in order to implement the Bologna Declaration, including the study cycles, academic standards in higher education, teaching load, financial autonomy, and university admissions procedures. Tempus projects helped the higher education institutions to fit to the Bologna process requirements (European Commission, 2005).

Bilateral cooperation in Albania is based on competitive funding for joint research projects. The MoES supports these projects, the main goals of which are research, development and innovation based on the priorities of the national R&D programmes. Albania maintains bilateral inter-governmental cooperation in the area of R&D, mainly with Greece and Italy, FYR of Macedonia, and Slovenia. Over 80 projects were agreed with Greece in S&T cooperation between 2001 and 2006, and over 100 have been co-developed with Italy between 2002 and 2004. With the FYR of Macedonia and Slovenia, bilateral inter-governmental co-operation was running with six joint projects per country in 2006 (Agolli, 2007a). The operative priorities of such international agreements include: cultural heritage, environment, health sciences, seismology, transport networks, telecommunications, public health, economy, technological innovation, agronomy and biotechnology. Furthermore, the negotiations for bilateral cooperation with Austria and Turkey are ongoing (ICBSS, 2006). Albanian R&D institutions also participate in multilateral programmes - focusing especially on EU and UN programmes, but also in the national and regional (Balkan and Eastern Mediterranean region) programmes.

A group of Albanian academics and analysts with extensive experience on foreign policy and policy-making issues have established the Albanian Institute for International Studies (AIIS), a non-governmental, non-profit making research and policy institute, which has become the leading think-tank supporting Albanian policy makers and international partners in the fields of security studies, democracy, Euro-Atlantic integration and regional cooperation. Regarding Euro-Atlantic integration, the AIIS undertakes research, organises international conferences, conducts broad-based projects and publishes its findings and recommendations. The institute's dedication to Albania's integration into NATO and the European Union will continue to be pragmatic and focused on the realities of integration, including efforts in dismantling false perceptions surrounding the integration issue. In 2005, the AIIS established an independent research centre (AIIS - Centre for European Studies), focusing on contemporary issues of the EU policy debate. The centre's mission is to facilitate and contribute to Albania's EU integration process by providing the relevant expertise and assistance to the policy-making community. Furthermore, the institute also set up a European Programme in 2005. AIIS projects place emphasis on increasing public awareness and strengthening knowledge concerning the European integration process and the European Union; providing expertise and know-how to policy makers; and strengthening Albania's capacities to face the challenges of the Stabilisation and Association Process (SAP). The institute also publishes a monthly

review called *EUROPA* - a contribution towards the Europeanisation of Albanian society, emphasising the future challenges and opportunities presented by the SAP (AIIS, 2006).

3 The Input Side of the National Innovation Systems

Regarding the input indicators for the S&T system, some questions (e.g. the amounts spent in terms of the gross domestic product (GDP), volumes, growth rates etc.) need to be addressed. Here a distinction is made between private and public investment. R&D investment can be considered as an indirect measure of a country's innovation capacity (Fischer, 2006).

3.1 Development of Financial Resources Allocated to R&D

The National Statistical Office of Albania (INSTAT) has not yet released official statistics according to the standards of the OECD Frascati manual for R&D funding and performance. Government expenditures on R&D in Albania account for approximately 85% of the expenditure of research institutions (ICBSS, 2006).

The data in the table below regarding government expenditure on R&D shows that GDP during the 1996 to 2003 period was very low. After the deep financial and social crises that were a result of the collapse of the pyramid schemes in 1997, expenditure increased to 0.19% of GDP in 1998. During the Kosovo crisis in March 1999, the value of R&D expenditure/GDP was 0.11. Since 2000, the values have increased very slowly, a trend which will hopefully continue.

Table 3.1 R&D expenditure as a percentage share of GDP and as the annual rate from 1997-2003 (Agolli, 2007b)

Indicator	***1996***	***1997***	***1998***	***1999***	***2000***	***2001***	***2002***	***2003***	***2005***
As % of GDP	0.17	0.14	0.19	0.11	0.17	0.18	0.18	0.18	0.19
As annual rate by years		84.03	169.45	67.7	177.5	112.58	106.3	107.87	

The Ministry of Education and Science reported that total expenditure for research institutions in 2004 reached EUR 2.4 million. In 2005, R&D state funding still remained low at approximately 0.2% of GDP (INA - Great-IST, 2007).

The state budget finances R&D activities in Albania in two complementary ways: via funding institutions and via national R&D programmes. The institutional financing goes directly to central organisations in order to support the R&D activities of their dependent institutions. As for financing through R&D programmes, this is conducted using (ICBSS, 2006) the state budget, which is designated for national R&D programmes (see chapter 5.3). It is used to finance different projects in the priority areas in a competitive way through the MoES, following established and standard procedures, especially for international cooperation

There is hardly any current data available on the private sector (1997-2003). The level of investment in S&T was still too low to draw any substantive conclusions; despite its current difficulties and serious economical issues, some experts have been rather optimistic about Albania's future development, especially taking into consideration its proximity to European markets and innovative abilities of its people. Anyhow, step by step, the changing situation is optimistic for the R&D in Albania.

With the ongoing EU integration of Albania into the international community and donations provided by the World Bank and the European Commission for economic restructuring, a consolidation of R&D activities may be expected (ICBSS, 2006).

3.2 R&D Infrastructure

According to Uvalić, the overall state of R&D infrastructure in Albania is not very satisfactory. At the time of writing this report, there were still no research centres at the local or regional level, nor new technologies or innovation parks. The technology and technical research equipment has improved in recent years, but is still insufficient. In some institutions of ASA there are a lot of new scientific environments (for example, Institute of Nuclear Physics, Institute of Biological Researches, Institute of Hydrometeorology and Institute of Seismology). The communication and information infrastructure, the network access for higher education and research institutes, and the library information systems are highly inadequate and there is almost no access to electronic journals (except some incentives of ASA since 2004 to the CEEOL) and Science Citation Index databases (Thomson) (Uvalic, 2006). In the recent years the Government has become more sensitive to the need to ameliorate the situation.

There are also some private or non-profit making organisations offering and developing internet services (for example, Adanet, Albaniaonline, ICC, StarSat, Abissnet, SUN etc.). The MoES and the ASA have jointly set up a procedure to establish the Albanian Academic Network (AAN), which would be in charge of the national research and education network. At the time of writing this report, the network was still in a preliminary phase and did not cover all the research institutions and centres, higher education institutions, and other important stakeholders for S&T sector in Albania. Gradually, LAN networks for every institute/centre within the ASA system were created, and the internet services now work regularly (ICBSS, 2006).

The Albanian government built up the Information Society Agency. The mission and the objectives of this institution are:

- establishment and monitoring of ICT common standards on a national scale
- development of the modern platform of e-government for the public administration
- coordination of the major projects of ICT in central and local level, by avoiding duplications and increasing the efficiency of the funds' use
- development of common components of ICT in use by the government
- update and monitoring of strategies and national policies implementation by the Information Society in Albania
- highlighting of the recommendations serving for the implementation in the information society of strategies and policies. This included recommendations on rules of procedure and laws
- enhancement and facilitation of ICT spread in government's local services (E-Local Government) aiming to make easier citizens daily life
- reforming and modernisation of the public services, focusing the citizen (citizen-centred)
- organisation of the public private partnership (PPP) for the development and implementation of the strategies and plans of the information society
- evaluation and the suggestion of the budget needed for the implementation of the different stages of the national strategies
- offering maximum transparency in governing through ICT and E-Government in order to prevent corruption and increase public administration prestige
- infrastructure establishment offering information free access to the public

- integration of the Albanian society in the European and world structures of the Society of Information, and the coordination of the projects in European and local levels
- preparation of the necessary steps for the European integration through the adaptation of the electronic legislation and the set up of useful infrastructure.

Taking into consideration the main duties and objectives set out by the Civil Society Information Agency, a national project can be implemented by this Agency.

Albania has a very low internet penetration while the ICT facilities are concentrated in the state capital. The government should also follow through with the initiative of establishing a high-speed internet network between various governmental institutions, as well as a network of Public Access Centres (PACs) in rural areas of the country, to inform Albanians of information and communication technology benefits as well as provide access to modern services (SBRA-Great-IST, 2007). To allow the R&D infrastructure capacity of education and sciences in universities, the government invested EUR 1.6 million in 2007 (Agolli, 2007b).

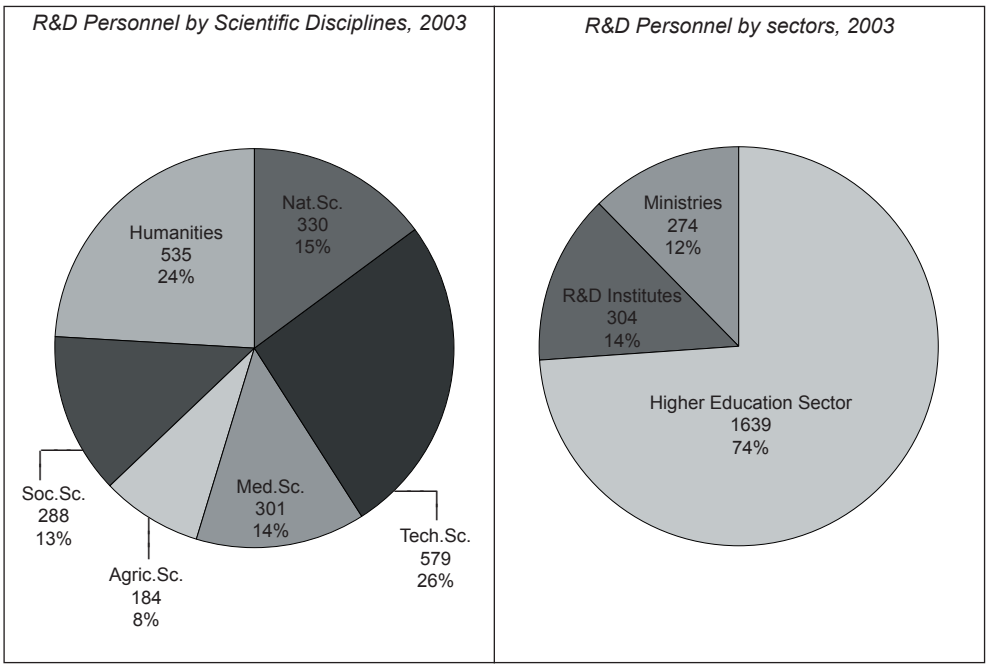
3.3 Human Resources in R&D

The human capital invested in a nation's S&T effort is as important as the financial resources devoted to the programme. The level of financial resources available for the national S&T programme usually sets the level of demand for human capital, but factors affecting the supply (such as university and technical school enrolments) are often unconnected to demand, leading to shortfalls or overabundance (UNESCO/UNDP, 1996). According to the most recent UNDP ranking for 2007/2008, Albania has a human development index value of 0.801, ranking 68th out of 177 countries. This ranking encompasses a life expectancy at birth of 76.2 years, an adult literacy rate of 98.7%, a combined primary, secondary and tertiary gross enrolment ratio of 68.6% and a GDP per capita of US$ 5,316 (UNDP, 2007). However, merely by not providing the number of researchers in R&D per million, the same report indicates the lack of these researchers in Albania.

Albania faces a distinct lack of human resources that would be able to undertake scientific research work, since the country has been severely affected by brain drain. The education system is poor and it ought to be a major priority to restructure and enrich it in order to build human capacity for the future (INA -Great-IST, 2007).

As stated already, most of the Albanian R&D performance is concentrated in ministerial institutes and centres, the Academy of Sciences, higher education institutions and the government sector, which together account for about 97% of R&D performance. Only a small percentage is developed by the private sector: companies, institutes/centres, non-profit organisations, which can be explained by an organisational allocation of the research institutes respectively to the ministries, the ASA, universities and private organisations. With regard to public R&D, the Academy of Sciences accounts for the highest share of scientific activity. Official human resource statistics in Albania for R&D employees and researchers do not equate to Full Time Equivalents (FTE) as defined in the OECD's Frascati manual. In the higher education sector in particular, researchers are only partly engaged in R&D activities and from 1990 onwards the level of human resources engaged in S&T decreased drastically (ICBSS, 2006).

Figure 3.1: R&D Personnel by Scientific Disciplines and Sectors of Employment (2003) (ICBSS, 2006)



The distribution of researchers by scientific discipline shows that almost 40% of researchers in Albania are found in Natural and Technical sciences, 14% in Medical sciences and around 8% in Agricultural sciences. Scientific personnel are numerous in higher education institutions, although they make little contribution to the R&D sector, highlighting the urgent need for changes in the research system. Research personnel from the Natural and Technical sciences, Medical sciences, Agricultural sciences, Social sciences and Humanities contributed to the shift of researchers from research institutes to the higher education sector, taking employment as the external staff of the public and private education sector (over 1,800 persons in the last decade). Around 120 scientists from the Academy of Sciences contribute to the country's higher education institutions. Generally, the quality of the science system is considered much higher than the level of the economy would suggest. One reason for this can be found in the sufficient supply of human capital, which exists despite the severe brain drain problems. Although the level of higher education has decreased and facilities have not yet been modernised, the education system seems to be capable of supplying a sufficiently large base of scientists to keep up the status of the science sector. However, there are severe difficulties in providing highly qualified graduates on a broad basis. Moreover, the ongoing process of emigration of the most highly educated people poses additional threats for the human capital basis (ICBSS, 2006).

Various surveys have shown that approximately 40% of professors and research scientists from the higher education institutions and science institutions in the country emigrated between 1990 and 1999. Furthermore, this exodus seems to be increasing, with even more highly educated people wanting to emigrate as shown by a 1998 survey. Another survey (1999) revealed that of 300 academics, who had obtained PhDs in the West during the 1980s and 1990s, 67% had emigrated. The emigration of the highly educated elite began with the

implementation of economic reforms, which resulted in hardship for the population and, above all, a reduction of real wages. Emigrants include highly educated and qualified people from all industrial sectors and scientific disciplines, mostly young males: 51% of emigrants are under 40 years old and 67% of them are male. However, many of the highly educated people who have gone abroad do not work in their area of specialisation, creating a considerable level of "brain-waste". For example, data from the 1998 survey reveal that about 74% of Albanians in Greece do not work in their previous area of activity. In Italy, this figure drops to 67%, in Austria to 58% and in the USA to 70% (ICBSS, 2006).

After the collapse of communism, thousands of young people left the country to study abroad - this contingent of Albanian society, which is exposed to Western methodology and practice, especially in the field of science, is in a position to revitalise Albanian institutions and provide fresh impetus into social, economical and political life. However, the continuous brain drain which is driven by the deteriorated economic living conditions, the lack of state-of-the-art infrastructure and funding (constituting serious obstacles for research) and restrictive visa regulations (hindering scientific exchange and temporary employment abroad) poses a severe threat to the Albanian social system (ICBSS, 2006).

The experience of other countries shows that about half of the students and scientists return to their home country after a period of time abroad, which means not only knowledge transfers but also a gain of human capital that may not have been developed had the students and scientists stayed in Albania. If it is assumed that only 20% of the Albanian students studied actually abroad will return during the next 10-15 years, the potential in terms of human capital for a small country like Albania is enormous. An influx of 4,000-5,000 professionals with university degrees from Western countries is expected to eventually contribute to a brain gain for Albania (Tafaj, 2003).

A joint UNESCO/Hewlett Packard (HP) project on piloting solutions for alleviating regional brain drain was implemented in 2003 in several Southeast European countries, including Albania. By providing resources, including technological and financial facilities, to various universities, the initiative has enabled young scientists from the region to work within the framework of joint research projects with their fellow-nationals living abroad. The project has provided grid technology to various universities from Albania, BiH, Croatia, the FYR of Macedonia, Serbia and Montenegro. The grid project was extended in April 2005 to include two new universities - the Polytechnic University of Tirana and the Ss. Cyril and Methodius University in Skopje. At the regional level, regular project meetings have also acted as a stimulus for transcending boundaries. Not only has the project strengthened scientific and educational capacities at the national level, it has re-established dialogue among young researchers from the region after years of broken communication. The networks created with UNSECO/HP support function autonomously, with the objective of sharing innovative experiences to help researchers from the region consolidate local capacities and undertake research beyond borders, without leaving their home countries permanently (Preda, 2007).

However, despite the aforementioned difficulties caused by brain drain throughout the 1990s, the number of R&D personnel gradually started to increase in 1996, and an upward trend has been present in practically all scientific disciplines ever since (see Table 3.2). Similarly, there was an increase in the number of doctors in R&D between 1996 and 2003, the increase being particularly marked in scientific fields such as Engineering, Medical science, and Social science (see Table 3.3).[6] The importance of young researchers in R&D has also increased in practically all scientific disciplines, but the most numerous, are young researchers in medical science (more than 50% of the total) (see Table 3.4). The number of professors and assistant

[6] The figures in these tables are not directly comparable, since some refer to part-time and others to full-time work.

professors has also increased, again in all disciplines (see Table 3.5).

Table 3.2: R&D Personnel (data is valid for the Higher Education sector) (Uvalic, 2006)

	1996	1997	1998	1999	2000	2001	2002	2003
Natural sciences, mathematics	20	25	27	30	32	34	35	37
Technical sciences	23	24	27	30	34	34	36	38
Medical sciences	45	48	48	50	53	55	57	60
Social sciences	31	34	36	38	39	39	40	42
Humanistic sciences	45	46	47	50	53	57	60	62
Total	**164**	**177**	**185**	**195**	**211**	**219**	**228**	**239**

Table 3.3: Number of Doctors in R&D by Scientific Field (data is valid for the Higher Education sector) (Uvalic, 2006)

	1996	1997	1998	1999	2000	2001	2002	2003
Natural science	72	77	76	86	91	96	100	105
Engineering	26	31	33	37	39	42	46	50
Medical science	27	30	34	38	41	45	49	51
Social science	16	19	22	25	28	31	33	36
Humanities	21	23	25	28	30	32	34	35
Total	**162**	**180**	**190**	**214**	**229**	**246**	**262**	**277**

Table 3.4: Number of Young Researchers in R&D by Scientific Fields (data is valid for the Higher Education sector) (Uvalic, 2006)

	1996	1997	1998	1999	2000	2001	2002	2003
Natural science	15	18	21	24	26	29	31	33
Engineering	12	13	13	14	14	15	15	17
Medical science	100	107	109	111	114	116	118	119
Social science	14	15	15	15	16	16	18	19
Humanities	13	14	14	16	17	17	18	18
Total	**154**	**167**	**172**	**180**	**187**	**193**	**200**	**206**

Table 3.5: Number of Professors and Assistant Professors, by Scientific Field (data is valid for the Higher Education sector) (Uvalic, 2006)

	1996	1997	1998	1999	2000	2001	2002	2003
Natural science	54	62	66	70	73	79	86	92
Engineering	26	29	31	33	36	38	39	41
Medical science	52	56	59	65	69	75	80	88
Social science	13	15	17	19	23	28	31	36
Humanities	52	59	65	69	77	79	85	91
Total	**197**	**221**	**230**	**256**	**278**	**299**	**321**	**348**

In accordance with the prioritisation of the development strategy for the education and sciences, the Albanian government is taking a lot of measures to ameliorate the R&D human resources situation.

The Government of Albania has placed high priority on the issue of human capital. Directly related to this priority is the process of reversing the phenomenon of brain drain. The return of qualified migrants has been identified as a key policy in the government's Strategy for Migration to achieve an effective engagement of the Albanian diaspora in development processes. Following a request of the Government, UNDP facilitated the preparation of a programme for greater engagement of the diaspora in Albania's socio-economic development based partly on the lessons learned and experience of various organisations (UNDP Albania, 2006).

The objective of the project is to support the creation of the necessary incentives and national policy mechanisms to effectively engage the Albanian Diaspora in the scientific, administrative and economic development of the country. Over its two-year duration the project will seek to reverse Albania's brain drain. The project will support the Government in the preparation of a policy framework for the above processes. It will also establish an online database to match the demand of Albania's academic institutions, public administration, and private sector with the expertise offered by the Albanian diaspora (UNDP, 2006).

Table 3.6: Estimated Project Budget (in USD) (UNDP Albania, 2006)

Budget Items	Amount
Project set up and public awareness	50,000
Expatriate Knowledge Transfer Initiative	700,000
Internship Scheme	100,000
Academic Scheme	100,000
Support to Diaspora Institute	50,000
Project Total	**1,000,000**
UNDP Contribution	300,000
Donor Funding Sought	**700,000**

The main result of the project will be to establish an enabling environment for highly skilled Albanian expatriates to contribute to Albania's progress and development. Albania's future success and competitiveness are closely linked with the establishment of an enabling environment within the country for skilled individuals to give their contribution. It is equally important to acknowledge the fact that the process of bringing back qualified Albanians cannot be achieved through short or medium term interventions. The involvement of the diaspora requires a great vision and continuous effort that go beyond the scope of a single programme. Thus, this project represents the initial, yet crucial steps of a longer process. To stimulate the involvement of the young researchers, the Government opened a new special "Fund of Excellence" amounting to over 100 million Albanian lek (Ministry of Education and Science of Republic of Albania, 2007).

4 The Output Side of the National Innovation Systems

The output of an innovation system is manifested through the new knowledge, new products and processes which are produced. Whereas indicators such as the Gross Expenditure on Research and Development (GERD) and number of researchers provide a measure of the resources potentially allocated to innovation, this chapter focuses on the results of the innovation processes and their output indicators such as patents and scientific publications.

4.1 Patenting Activities in Albania

Among other approaches, innovative output can be measured by patent data, the most important advantage of which is the wealth of the information supplied. A patent file granted by the European Patent Office (EPO) provides data on the invention, which is protected by the patent through the title, abstract and technological classification. Furthermore, patent data provide the only output measure available for almost all countries in the world, including Albania (Hörlesberger, 2006).

European inventors today have a choice between two alternatives when seeking patent protection for their inventions: the European Patent Office (EPO) and national patent offices. The EPO was set up to provide patent protection through a single procedure, defining the granting of patents in some or all of the contracting states of the European Patent Convention (EPC). The procedure for obtaining a patent at the EPO consists of two phases and sometimes a third phase dealing with the possible objections. In contrast to national patents that are valid in only one country, a European patent gives its proprietor equivalent rights to a national patent in each member state. Moreover, European patents may also be effective in some countries, including Albania, that have not yet acceded to the EPC (EPO, 2006).

A second barrier to patenting is the cost associated with a patent application. Studies estimate that the cost of an application and the 10-year maintenance of a patent at the EPO is approximately EUR 32,000 (Roland Berger Market Research, 2004). In contrast, applications to national patent offices may be less expensive (applications to local patent offices in the Western Balkans in particular are expected to incur a considerably lower cost than an application to the EPO) (Hörlesberger, 2006).

Albania has its own Patent and Trademark Office. From 1957 the protection of foreign trademarks in Albania was carried out by Chamber of Commerce. On 22nd March 1993, the function of the Chamber of Commerce for registration of trademarks and industrial design passed to the Patents Office (Decision: D.C.M. No 135), which was under the dependency of the Committee for Science and Technology. On 27th April 1994, the law on Industrial Property was approved; providing grants and protection for the following industrial rights, such as patents for inventions and utility models, trademarks and service marks, industrial design and appellation of origin. The activity of the Albanian Patent and Trademark Office (ALPTO) as a Central and Public Institution financed by the state budget under the dependency of the Council of Ministers began with the resolution of the Council of Ministers no. 313, “For functioning of the Directorate of Patents and Trademarks”, dated 13th June 2000. ALPTO is a government institution, which provides grant and protection for: patents for inventions and utility models, industrial designs, trademarks and service marks, geographical indications and topography of integrated circuits. The tasks of ALPTO are determined and regulated by law no. 7819 dated on 27th April 1994 on “Industrial Property” and amendments in power. Today ALPTO is a public institution under the Ministry of Economy, Trade and Energy (METE) (Albanian Patent and Trademark Office, 2005c).

Its main activities are: to administer all the procedures for grant and protect the industrial property rights; to provide reliable examination and registration related to patents, trademarks, industrial design and geographical indications; to compose laws and regulations related with IP system; to act as a representative in the Courts for issues relating to the Industrial Property; to represent Albania and Albanian obligations, connected by bilateral agreement with a homologue office (the Directorate of Patents and Trademarks and Industrial Property State Office of Republic of Macedonia) and other international organisations for issues of Industrial Property (Albanian Patent and Trademark Office, 2005a).

ALPTO services are based on laws and regulation in force, offering new information to the public, free of charge, relating to the object of industrial property rights. This information can be found in the publications and bulletins of the office. The office also provides assistance by answering general questions in the field of industrial property rights; by helping to interpret the laws and regulations relating to forms of protection; by responding to questions concerning application procedures; by offering services to users all over the country; by increasing awareness of the industrial property systems through organisation seminars; by publishing specialised information in a tri-monthly journal; and by issuing regular leaflets and materials related to industrial property items (Albanian Patent and Trademark Office, 2005a).

ALPTO organises activities, trainings and seminars to increase the public awareness related to the Industrial Property Rights. It gives consultancy for universities, private companies, attorney offices, etc. ALPTO also organises seminars and training in the occasion of the Regional Cards Programme for South and Eastern Europe. This project is financed by the European Patent Office and the European Community (Albanian Patent and Trademark Office, 2005b).

Concerning industrial property rights, the Directorate General for patents and trademarks (GDPT) was restructured and given additional staff. Registration and administration of patents, trademarks and industrial designs has been computerised. This has improved the processing of applications and the supply of information. However, further strengthening of the capacity of both the copyright office and the GDPT is still required. The provision of training to judges, prosecutors and customs administration is not enough to solve the problem. The current industrial property law from 1994 needs substantial improvements (European Commission, 2007).

The drafting of the Law on Intellectual Property (in coordination with the legislation of the EU Member States and the framework of the SAA) was completed in October 2007. The draft law is completed in cooperation with the European Patent Office and Max Planck Institute (Bushati, 2007).

Amendments to this draft law are in full compliance with the *acquis communautaire* of the European Commission in the field of Industrial Property and specifically with:

- European Patent Convention (EPC 2000),
- Directive 98/44/EC on the legal protection of biotechnological inventions,
- Directive 98/71/EC on the legal protection of designs,
- Directive 89/104/EEC of the Member States relating to trade marks,
- Directive 2004/48/EC on the enforcement of intellectual property rights,
- Regulation (EEC) No. 1768/92 concerning the creation of a supplementary protection certificate for medicinal products,
- Regulation (EC) No. 1610/96 concerning the creation of a supplementary protection certificate for plant protection products,

- Regulation No. 6/2002 on Community designs,
- Regulation No 40/94 on the Community trade mark,
- Regulation No 2081/92 on the protection of geographical indications.

Among the main changes specified in this draft law in comparison with the legislation in force are:

1. The draft law provides for the protection of biotechnological inventions in line with the requirements of Directive 98/44/EC on the legal protection of biotechnological inventions
2. The draft law provides for the issuance of certificates of supplementary protection for medicinal products and plant protection products in line with the provisions of the Regulation (EEC) No 1768/92 concerning the creation of a supplementary protection certificate for medicinal products and Regulation (EC) No. 1610/96 concerning the creation of a supplementary protection certificate for plant protection products, and also reflects in detail the calculation of the additional time frame for Patents,
3. The draft law provides for the "objection" of the third party as regards the granting of ownership over an object of intellectual property within three months from the date of publication of application, thus avoiding future judicial disputes arising from the infringement of previous rights. The draft law foresees as well the restoration of rights, when the owner of the PI object has not been able to meet the deadline established by ALPTO,
4. The draft law specifically provides for temporary and safeguard measures to be taken by the court and other institutions engaged in the protection of intellectual property rights in case of infringement of IP rights, in line with the provisions of Directive 2004/48/EC "on the enforcement of intellectual property rights" and provisions of the Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement.

The draft law also gives to the judicial system and other institutions involved in the protection of Industrial Property, the opportunity to increase their role in the protection of other rights. The broad consultation of the draft law with the public and non-public partners is carried out by ALPTO during 2007. The procedure for the approval of the draft law has already started (December 2007) and it is expected that METE undertakes the respective legal initiative (Bushati, 2007).

On 19th February 2007, the Republic of Albania ratified both the Hague Act (1960) and the Stockholm (Complementary) Act (1967). On the same day, the Geneva Act of the Hague Agreement Concerning the International Registration of Industrial Designs was signed by the Republic of Albania. The notifications of these agreements by the Secretariat of the World Intellectual Property Organisation (WIPO) were made on 19th March 2007 for both The Hague Agreement and the Geneva Act (WIPO, 2008).

In the framework of strengthening institutional capacity of ALPTO, in 2007 some improvements have been made to the integrated information system in accordance with WIPO standards. These improvements include the completion of the database for all the Industrial Property objects (patents, trademarks and industrial designs) and correction of data imported and processing of applications carried over from previous years. These are processes observed and assessed by WIPO (Bushati, 2007).

In 2007, four Intellectual Property Bulletins were published on-line, thus informing on the IP

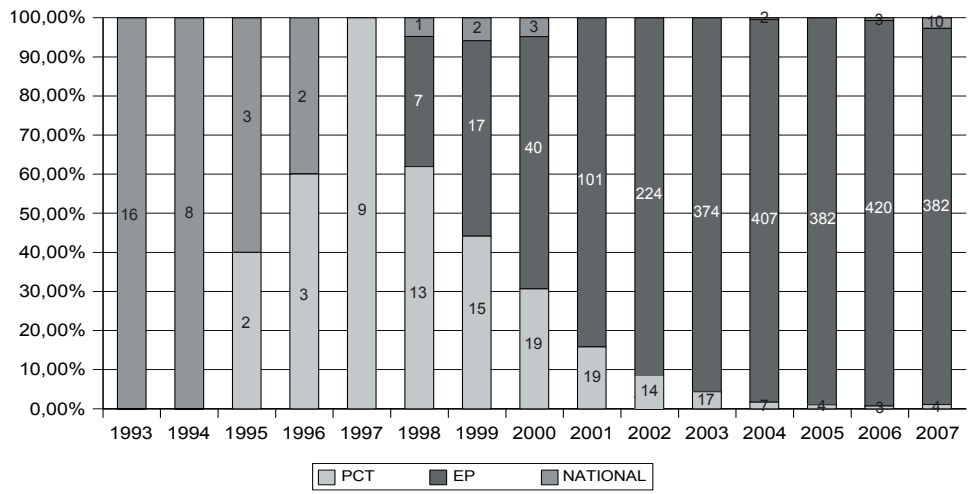
objects deposited or registered with the ALPTO, and giving the opportunity for opposition in case of violation of rights.[7] In continuation of the improvement of the services provided by ALPTO, for the first time it was made possible the printing of the new models of registration certificates and renewal of the Invention Patent, Trade Marks and Industrial Designs service. This model approximated ALPTO with the standards of the counterpart offices of the region and even more and it is implemented for the first time in Albania.

As regards the system of Industrial Property protection, ALPTO has cooperated with USAID and the Magistrates School to organise training courses in the field of intellectual property. In addition, a close cooperation with the Sector of Patents and Marks Protections at the Directorate General of Customs has been established.

Finally, in order to assist practitioners of this field, a Commentary for the Law on Intellectual Property containing a number of cases regarding the infringement of Intellectual property Rights has been compiled.

Another achievement is that patents are presented in a new format which constitutes an approximation with the standards of the European counterpart offices. The Patent Register (in electronic and also hard copy format) is created. 1,000 patents out of a total of 2,510 are recorded in the register. In 2007 the number of applications for the invention patents was 352 from EPO, 10 national patents and 4 Patent Cooperation Treaty (PCT) patents. For the first time since 1997, there is an increase in the number of national patent applications, from 3 in 2006 to 10 in 2007.

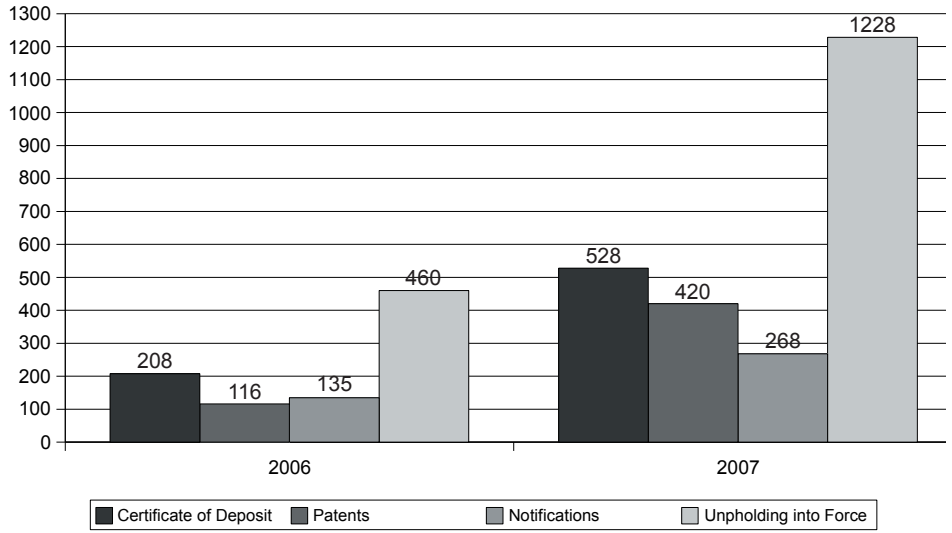
Figure 4.1: Division of Albanian patent applications (1993-2007) (Bushati, 2007)



366 applications for patents were submitted in 2007 and 420 patents have been registered. 528 certificates of deposit were issued in 2007, compared with 208 of the previous year, out of which 298 are pending the expiry of the opposition/objection deadline following their publication in the Intellectual Property Bulletin No 17 and No 18. 268 notifications for completion of formalities were issued, compared with 135 of the previous year, 1,228 applications for upholding into force, compared with 460 of the previous year and 30 applications for change of ownership/address/name.

[7] See http://www.alpto.gov.al/rubrika.asp?id=22&idv=9 as accessed 26.03.2008. In Albanian only.

Figure 4.2: Demonstration of increase in volume of work. Comparison between 2006 and 2007 (Bushati, 2007)



In 2007 74 patents were refused for their failure to meet the formalities within the legal deadline, 5 withdrawals were accepted, 29 patents were abandoned and 9 applications had abandoned out of a total of 366 applications for patents during this year (deposited after 15th December 2007).

Figure 4.3: Status of applications for patents in 2007 (Bushati, 2007)

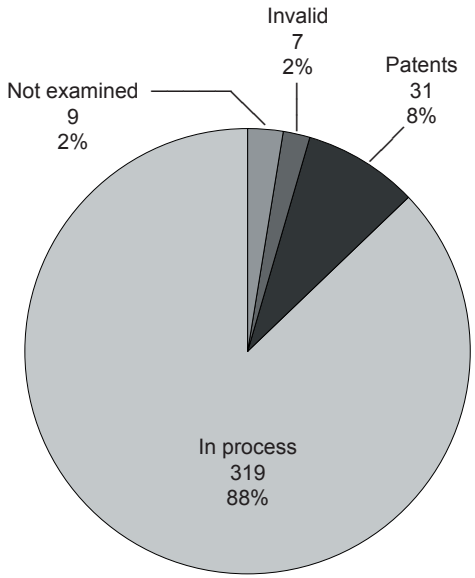


Figure 4.4: Total applications for patents (Bushati, 2007)

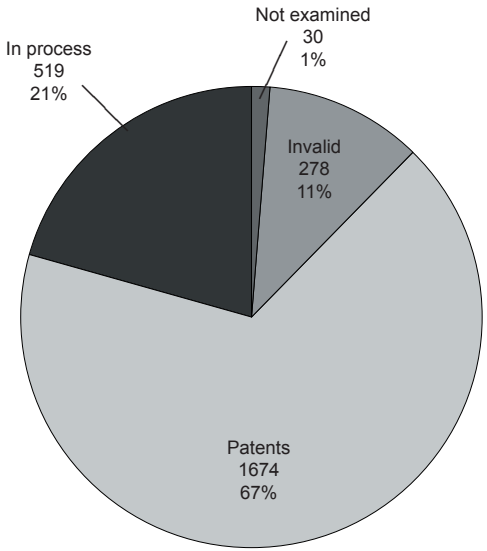


Figure 4.5: Number of issued patents from 2000 to 2007 (Bushati, 2007)

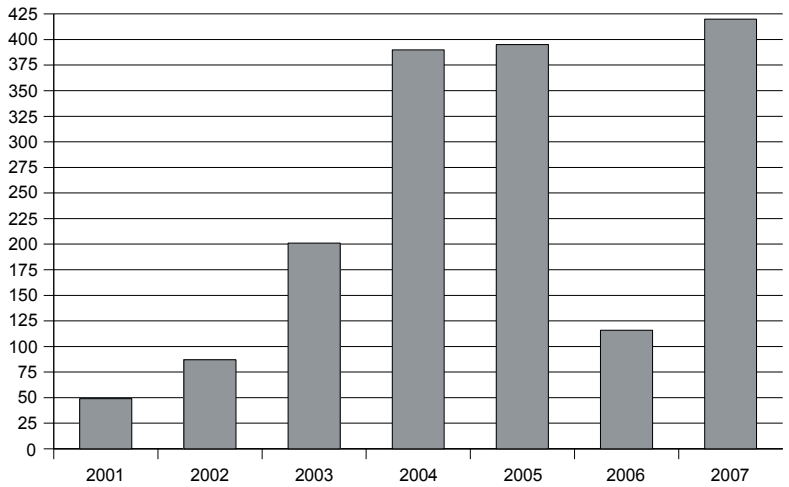


Table 4.1: Comparison of patents issued from 2000-2007 (Bushati, 2007)

Year	Patent issued each year
2000	6
2001	49
2002	87
2003	201
2004	390
2005	395
2006	116
2007	420
Total	**1,664**

The graph and table below show the status of applications for patents during the years.

Figure 4.6: Status of applications 2000-2007 (Bushati, 2007)

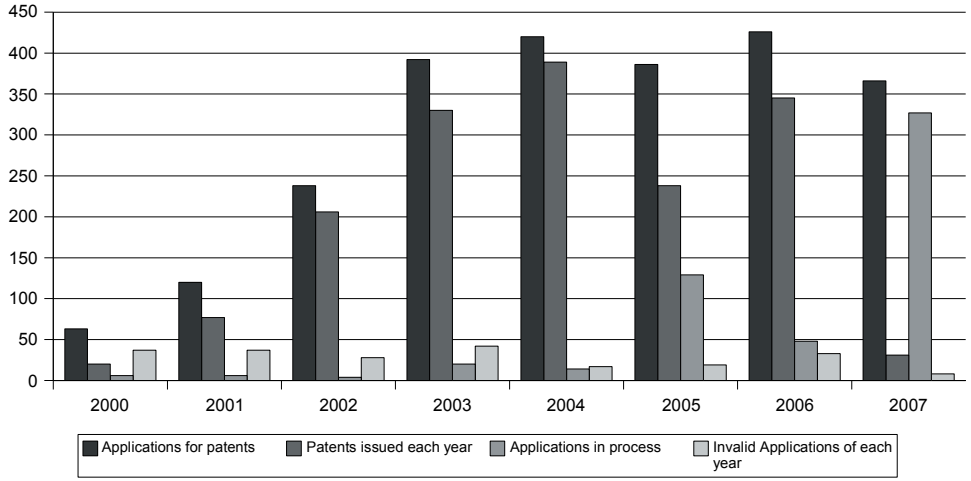


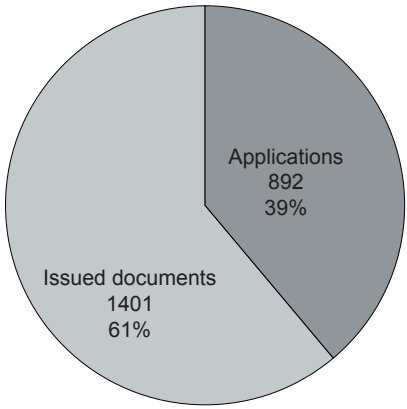
Table 4.2: Status of applications 2000-2007 (Bushati, 2007)

YEAR	Applications for patents	Patents issued each year	Applications in process	Invalid Applications of each year
2000	63	20	6	37
2001	120	77	6	37
2002	238	206	4	28
2003	392	330	20	42
2004	420	389	14	17
2005	386	238	129	19
2006	426	345	48	33
2007	366	31	327	8
Total	2411	1636	554	221

As regards trade marks and service, the number of applications in 2007 reached 892 applications (including the number of applications of 391 marks for renewal) and 947 registrations.

Of these applications, 454 applications for trade marks are examined and are under process, 528 registration certificates and 419 renewal certificates for marks are issued. The number of total applications during 2007 is lower than the number of issued documents. This shows that a greater work has been done, thus facing in the beginning of 2007 the work accumulated during previous years.

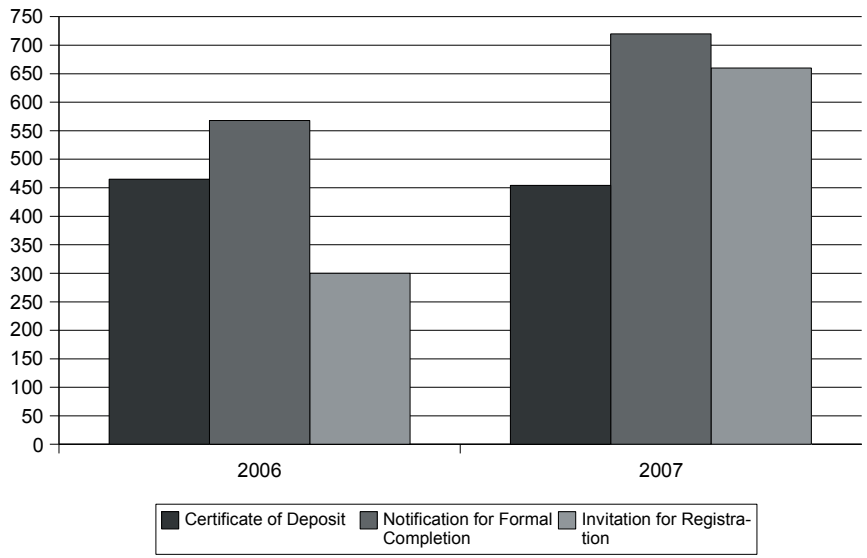
Figure 4.7: Number of issued documents versus number of applications in 2007 (Bushati, 2007)



In 2005, 283 registration and renewal certificates were issued, compared with 369 registration and renewal certificates issued in 2006 (that is an increase of 30.4% from 2005 to 2006). In 2007, 947 registration and renewal certificates were issued, a further increase of 156.6% on the number of certificates issued in 2006.

During 2007, 454 certificates of deposit for trademarks are issued and published compared with 465 in 2006; notifications for completion of flaws and formalities are issued for 720 applications compared with 568 in 2006; 660 invitations for registration compared with 300 in 2006.

Figure 4.8: Comparison of documents issued for examination in 2006 and 2007 (Bushati, 2007)

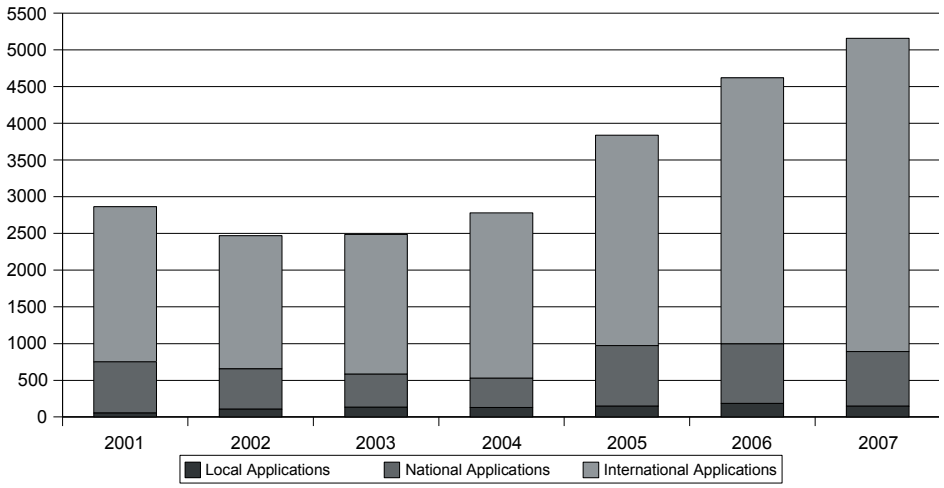


The greatest increase in the number of applications for marks has been mainly in the number of applications made internationally from the Madrid Agreement. In 2007, the number of these applications reached 4,264 trademarks. If a comparison is made of the number of application made nationally, locally and internationally in 2005 compared with applications in 2007, it is identified a slight increase in the number of local applications, even though the number of persons who apply and who have approached ALPTO has been greater compared with the previous years. Applications made from the Madrid Agreement have increased by 48.7%. At the same time, the great increase of the number of international applications has brought about the reduction, at a certain extent, of the number of national applications. But in total, the number of applications in 2007, compared with 2005 is increased by 34.4%.

Table 4.3: Comparison of national, local and international applications (2001-2007) (Bushati, 2007)

Years	2001	2002	2003	2004	2005	2006	2007	2005/07
Albanian applications	54	106	132	128	147	186	148	6.7%
Applications through national procedures of foreign applicants	696	550	451	399	825	809	744	-9.8%
Applications from Madrid Agreement	2115	1814	1903	2252	2866	3624	4264	48.7%
Total	2865	2470	2486	2779	3838	4619	5156	34.4%

Figure 4.9: Comparison of national, local and international applications (2001-2007) (Bushati, 2007)

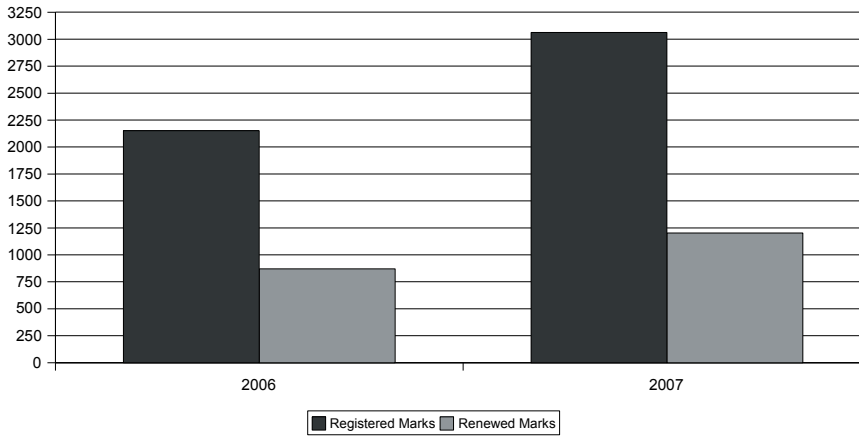


The table and graph below show the ratio of international registered and renewed marks in 2007/2006. It shows registrations in 2007 increasing by 42.2% on 2006 and the number of renewed marks increasing by 38%.

Table 4.4: Ratio of international registered and renewed trademarks in 2006 and 2007 (Bushati, 2007)

YEAR	2006	2007	2007 / 2006
Registered marks	2152	3062	42.2%
Renewed marks	871	1202	38 %
Total	3023	4264	41%

Figure 4.10: Ratio of international registered and renewed trademarks in 2006 and 2007 (Bushati, 2007)



The Legal and External Relations Sector was established in September 2007 following the approval of the new ALPTO structure. This sector will cover the activity of the institution, first of all the following of the judicial cases involving the protection of industrial property rights which have increased considerably in 2007, and also the relations and administering of external relations of ALPTO.

A priority of the ALPTO activity has been focused on information technology: administering, maintenance, storage and processing of information concerning the Industrial property objects and IT administering, maintenance and infrastructure as a key element for the functioning of ALPTO, in line with international standards (for example, administering of the Industrial Property Automation System IPAS database).

4.2 Publication Activity in Albania

Most of the scientific work is carried out by the Albanian Academy of Science, universities and other research institutes. In the words of Peter Ballantyne in the 2006 UNESCO report “Accessing and Disseminating Scientific Information in South Eastern Europe”, the Academy is certainly a local leader in this sector, since the publication is an integral part of its research process (Ballantyne, 2006).

Various scientific studies are published by the Academy’s Publishing House *Shkenca* in the form of books, monographs, periodic volumes, bulletins and other types of literature; offering the output of scientific research to the academic community and wider public on a continuous basis. Albanians abroad (especially in Kosovo/UNMIK, the FYR of Macedonia and Italy) also play a role in the providing of these publications.

The principal aim of PH Shkenca is to publish studies in the field of Albanology - Linguistic, Historical, Ethnological, Folkloric, Archaeological and other fields of scientific research. The most important journals and periodicals of the Academy of Sciences of Albania are Philological studies, Historical studies, ILIRIA, AJNTS, Folk culture, the magazine Our language, Matters of the Albanian folklore, Candavia, published in Albanian and with a summary in English or French are listed in the CEEOL (Central and Eastern European Online Library) - an on-line archive, which provides access to summary text articles (access to the full text is restricted to subscribers) from 255 humanities and social science journals, electronic books and re-digitised documents pertaining to Central, Eastern and South-Eastern European topics. The CEEOL. is the result of 10 years of work by the Frankfurt Eastern/Western European Cultural Centre, Palais Jalta and intends to provide an on-line library and a document shop. Its content is provided by numerous publishers and editors, mainly from Central and Western European countries, which deal with Eastern Europe in terms of its history, languages and literature, along with its cultural, social and political realities (C.E.E.O.L., 2007).

One of the journals, the Albanian Journal Natural and Technical Sciences (AJNTS) (two publications per year in the English language) has an important role in the scientific community in Albania. A lot of papers are a contribution of scientists living in and out of the borders of Albania. These papers strengthen the cooperation and transfer of technologies in Albania. Many bulletins are prepared by the institutions of the Academy of Sciences of Albania (ASA) about the national emergency (for example, seismological, hydrological, meteorological, radiological dose rate) (Academy of Sciences of Albania, 2001).

Extensive exchange activities are conducted between Albania's National Library, its University libraries, the Scientific Library of ASA and a variety of external institutions. This has numerous positive effects for Albania: the libraries are not only enriched with scientific literature but the most important scientific publications, especially those of the Academy of Sciences, are not only sent to European libraries but also to the Library of Congress in the USA. It is thought that the situation described by the above-mentioned report to UNESCO, stating that Albanian researchers seem "to need additional training and support to help them publish in regional and international journals" is now in the past (Ballantyne, 2006).

Another important source for the scientific publications are the private publishing houses with the original publications of well-known Albanians, but also with the publication of important internationally-renowned scientific works, that have become part of the scientific community since their translation to Albanian. However, the crucial problem today regarding scientific publications in Albania is the total lack of online access to these publications that are today a reality in many countries (Bushati, 2007).

5 National R&D Strategy and Legal Framework

The societies of the South Eastern European region have all been going through radical changes and transitions since 1990, although from significantly different starting points. Most S&T policies in the Western Balkans region are characterised by their encouragement of sustainable support for basic research at higher education institutions and research institutes, for the development of human resources and for cooperation inside the framework of the European Union's programmes for RTD and joint research programmes with the European Science Foundation or bilateral agreements (Dall, 2006).

In technology policy, emphasis is placed on linking research institutions as sources of knowledge with industry and SMEs, as well as encouraging the establishment and functioning of intermediary institutions (Kobal, 2005).

5.1 Legal Framework for National R&D System

A legal framework is indispensable in the organisation of R&D institutes, the innovation infrastructure and programmes that provide grants to research organisations and innovative companies. Most commonly, laws are prepared separately for the areas of S&T and higher education. The Albanian system of higher education is still affected by the new Law on Higher Education, which enhanced the scope for autonomy of higher education institutions, institutionalised the Rectors Conference as a major consulting body, set up a new accreditation system, changed admission criteria and promoted the adoption of the European Credit Transfer System (ECTS). Legislative priorities are determined by the requirements of the Bologna Declaration (signed by the Albanian government in September 2003) and not by the needs of scientific research (Dall, 2006).

In compliance with the above-mentioned Law of Higher Education (which was amended in 2007) in the Republic of Albania the Albanian Government has emitted several normative acts, decisions, directives and decrees, which have qualitatively influenced the process of the Bologna Chart implementation (Theodhori, 2006). But the new Law of Higher Education opens the new opportunities on the progress of both higher education and scientific research.

On 22nd May 2007, the Albanian Parliament approved the new law "On Higher Education", which is meant to replace the previous law on Higher Education, dating from 1999 (Ministry of Education and Science of the Republic of Albania, 2007b). This law introduces a number of new issues:

- It establishes the legal framework for the three university cycles after the European model (for example, the ECTS system and the Diploma Supplement).
- It provides for the interdisciplinary study programmes, the joint programmes and the continued learning
- Quality Assurance is conducted through the internal and external evaluation and the accreditation, essential to the Bologna Process.
- The financial provisions are among the most advanced, enabling the Higher Education Institutions to manage their budget on their own, as unconditional transfer.
- It has provisions for the efficiency and management of the research at universities, following the reform of the Research Institutes.
- It offers a comprehensive framework for private higher education, previously based on an Act of the Council of Ministers in 2002.
- For the management, the new provisions also enable new governing bodies, enhancing the responsibility, management, reporting, and transparency within the university.
- The Council of Professors at faculty level will be responsible for the third cycle studies, which until now were in the exclusive hands of the Dean.
- The Council of Ethics will have considerable responsibility and role in the context of a healthy atmosphere, in the circumstances when cases of abuse have become more numerous.
- The provision of the matriculation system will help to make administration more efficient and instantaneous (Gjinko, 2007)

The Law on Science and Technological Development sets the objectives of S&T policy, which include stimulating the global integration of Albania's national R&D activity and encouraging privatisation of S&T activities. It also defines the procedures for S&T policy development (Dall, 2006).

The IP legislation is fully in compliance with the TRIPS Agreement and also with the EU Directives on intellectual property matters (European Commission, 2006a).

5.2 Main Documents Reflecting National Innovation Strategies

Poverty reduction and economic development are considered to be the highest priorities on the Albanian policy agenda. However, the main strategy and key planning documents used by the Albanian government are of a rather general nature. The integration of the Stabilisation and Association Agreement with the European Union, the "UN Millennium Development Goals" (which do not focus on science) and the "National Strategy for Socio-Economic Development" are relevant strategies to be put into practice. The "National Government Action Plan" is the steering instrument which aggregates sectoral government action plans and consolidates the main policies. It aims to provide an overview, although the harmonisation of strategies is insufficient and the prioritisation of goals still remains unclear (UNDP Albania, 2005). To date, neither science nor research have been mentioned as a top national priority (prioritisation has mainly focused on health and education).

Nevertheless, the new Albanian government has established this area as a priority for the first time and far-reaching reforms are expected. A master plan for political development has been set up, including institutional and legal reforms. First and foremost, the aim is to improve the integration of higher education into the science framework. The master plan, which is designed to define the strategic direction and process of change for the future of higher education in Albania between 2006 and 2016 has been drafted and was in the consultation process during the last update of this report. Once agreed, it will form the basis of an action plan. The draft master plan also talks about the implementation of an intermediary body, a "Research Strategy Group" which will develop a national research strategy and rationalise research capacity (Gjinko, 2007).

The forthcoming national research strategy will select the areas in which research efforts are to be concentrated and provide a basis for rationalising the integration of the research institutions. The draft also states that academic research will be funded selectively on a project basis and through competition. This is foreseen mainly for the universities in Tirana. On the other hand, some small 'base line' funding for all universities will be provided to allow the development of one or two research specialists (Draft Master Plan for Higher Education, 2006; Agolli, 2007a). The encouragement of young researchers, excellence, mobility and the research infrastructure are key aspects of research development. Furthermore, numerous bilateral agreements have been signed and Albania's integration into the SEE-ERA.NET project and joint calls in 2006 promoted further internationalisation of Albanian research.

The "National Strategy for Socio-Economic Development" (2001) has suggested, among many other measures, the harmonisation of the activities of research institutions with the requirements of industry and agriculture, the establishment of a national centre for agricultural scientific research and the promotion of applied research in accordance with the needs of farmers (Council of Ministers of Republic of Albania, 2001). The Progress Report on the implementation of the National Strategy for Socio-Economic Development during 2003, "Objectives and Long Term Vision" and Priority Action Plan 2004-2007 of April 2004, point out that the process of creating a National R&D Programme has already begun for some of the main areas (Republic of Albania, 2004).

Furthermore, the definition of standards for scientific research is included in the mid-term plan of the Ministry of Education and Science. The National Education Strategy 2004-2015

provides a roadmap intended to help strengthen the sector's performance and to improve the learning outcomes and efficiency of the system. In addition, the Strategy on Employment and Vocational Training (Ministry of Labour and Social Affairs of the Republic of Albania, 2003) deals with instruments that contribute to the enhancement of innovation. The job creation target is focused on small and medium sized enterprises and on encouraging direct foreign investment. Although the term *innovation* has not been used, the *"development and strengthening of competition in the market through production of more competitive goods, transfer of new technologies and know-how"* (Ministry of Labour and Social Affairs of the Republic of Albania, 2003) is one of the principal aims in supporting SMEs. The Rural Development Strategy (World Bank, 2002) and the Mid-Term Programme for Integrated Rural Development (2004-2007) also deal with the strengthening of R&D as a major area of importance. The Action Plan for the Implementation of European Partnership Priorities (Council of Ministers of Republic of Albania, 2004) discusses legislative and institutional measures focusing on agricultural research, such as setting up a single Agency for Agricultural Research and Extension. Another important document is the National Information and Communication Technologies Strategy (Republic of Albania, 2003), approved in April 2003, which highlights research in ICT as a part of one goal, as well as the implementation of ICT education in Albanian higher education institutions and academic networks (Dall, 2006).

5.3 Main Fields of Intervention and Research Priorities

Innovation policy as such has only recently re-emerged in the Western Balkan countries, after having been reduced to a secondary role during the transition process. According to Radošević, innovation policies in the region of the Western Balkans should recognise the structural weaknesses of their individual innovation systems and apply country-specific solutions, as opposed to the rather imitative mode that has so far prevailed. Investment in R&D and high-tech orientation are regarded as the dominant paradigm in innovation policy (Radosevic, 2005).

Serious long-term structural problems that affect the S&T sector need to be discussed in order to assure further development. Amongst these structural problems are budgetary constraints and public debt, a generally low level of development, widespread unemployment, poverty and massive migrations, pointing to the need for industrial restructuring in largely agricultural, de-industrialised economies (Uvalic, 2005). Due to the overall lack of resources, prioritisation is of utmost importance, research orientation needs to be steered towards the economic and social needs of the present in order to make provision for the future. International programmes need to support foresight studies and the process prioritisation, as simply focusing on the RTD Framework Programme or imitating the strategies of other countries will not bring the desired results (Uvalic, 2006). The draft master plan for higher education also raises several current concerns, such as the inhomogeneity of the system on the institutional level, the insufficient level of university autonomy which shall be increased, as well as ensuring external and internal accountability and better management (Agolli, 2006).

Priority setting in the S&T sector is intended to facilitate efficient performance of certain identified S&T fields by providing a predictable allocation of critical-size funds. The need to define thematic S&T disciplines and fields has been recognised by all countries. Generally, the research priorities in the region are Information and Communication Technologies, Life sciences, research on Agribusiness and Biotechnology, Genomic research, Environmental and Materials research, and research on renewable energies and sustainable development as well as water management, transport, Aerospace research, Humanities and Social Sciences, and research in SMEs, although the level of specification varies from country to country. A great deal has been achieved in terms of institution and strategy development. In

general, however, some papers remain superficial and many statements have more to do with paying lip service than real policy implementation and related operations. The level of aggregation seems too broad and thus, goal-oriented interventions will be difficult to identify and are unlikely to generate the expected benefit. Much remains to be done, including the implementation of national foresight studies in order to support the prioritisation process. It would also be worth considering a complementary comparative regional foresight exercise to assist the diverse national attempts (Uvalic, 2006).

Table 5.1: National R&D Programmes in Albania (Agolli, 2007a; Gjinko, 2007)

Period	Selected National R&D Programmes
2003 - 2005	• Albanological and Humanity Studies • Agriculture and Food • IST • Public Health • Natural Resources • Biotechnology and Biodiversity
2007-2009	• Social and Albanological Sciences • IST • Biodiversity and Environment • Agriculture, Food and Biotechnologies • Health • Water and Energy • Materials

Albania still needs to focus on institutional development. Long-term objectives include both transforming the education and research network into an innovation system, and developing structures, competences and capacities in order to properly evaluate and monitor scientific projects, including transparent recruitment policies and payment systems. Further actions for change include reorganising research institutes and creating national research centres, improving the infrastructure and introducing statistical standards. The focus is also on international and regional cooperation in bilateral agreements, regional actions, and European and international RTD programmes (Ministry of Education and Science of the Republic of Albania, 2004). In general, tasks that will positively influence the national innovation system include improving and completing the legal framework and working conditions for public administration, fighting corruption, and implementing and enforcing laws. Priority tasks according to the government include improving the scientific output, protecting and developing national interests, combining research and higher education, observing intellectual property rights and participating in international S&T co-operation (Ministry of Education and Science of the Republic of Albania, 2005). Nevertheless, these elements are hardly quantified with measurable indicators, and to date have not been properly programmed, monitored or evaluated (UNDP, 2005), but the new Government step by step working to ameliorate the situation through projects for this topic: it's working to build up the S&T statistics in Albania.

Higher education and research receive little support from the donor community, although some attention is being paid to improving ICT networks and technical infrastructure. Shortcomings in the institutions themselves and the organisation of R&D can be identified as following (ICBSS, 2006):

- an absence of any institutional organisation with programmes and projects of wide interest;

- a lack of ongoing scientific activities (e.g. conferences, journal production etc.) in many sub-structures of institutions;
- modest implementation and usage of the national R&D programmes;
- a considerable part of the qualified staff co-operates outside the institutional structures.

S&T policy is mainly focused on applied research. Until 1999, there were fifteen priorities on the agenda; a policy which is now being criticised by the ministry, which says "*everything is a priority = nothing is a priority*" (Ministry of Education and Science of the Republic of Albania, 2004).

A series of positive elements have been registered in the last years regarding the R&D strategy activities. However, these elements alone cannot compensate the need for a comprehensive intervention, studied, accepted and realised on the basis of new principles. In summary, the main positive developments are listed below:

- A systematic change in science funding was adopted through the introduction of national programmes with three-year cycles and a considerable reduction in the number of priority fields, meanwhile until 1995, priority fields changed each year, and thus, the meaning of 'priority' was lost, because each field was financed in such a modest way (the annual fund is EUR 410,000).
- The internal integration effort was increased: the MoES adopted the concept of working in the mixed scientific research groups within the applications for national programmes and international projects, thus eliminating the risk of parallel development and duplicated efforts, while at the same time stimulating cooperation between different institutions and groups.
- A more active participation in international programmes through the projects of the scientific community in the country took place.
- There was a shift to standardise practices in R&D policy delivery - the whole procedure for national programmes was adopted according to the European standards.
- Since 1999, balanced bilateral agreements were reached, even financial ones, based on the international criteria of evaluation. In the realisation of the "Protocols of Co-operation", under the responsibility of the MoES, the same procedure is applied, with the same basic documents and in a synchronous way in both countries, according to the bottom-up principle.
- In the last few years, a slight increase in financial support, especially institutional funding, was achieved.
- Successful interventions occurred in the improvement of infrastructure. The MoES supported the establishment of modern computer networks in five universities, new modern laboratories, etc.
- An increase in cooperative initiatives concerning applications of scientific-technological products in the private sector was manifested.
- The MoES is also becoming active in a series of regional initiatives and, bilateral scientific relations were extended to the FYR of Macedonia and Slovenia (from two to four joint bilateral inter-governmental cooperation projects within each country were running in 2006); two others are under finalised with Turkey and Austria.
- In 2005, financial support was provided at a percentage of 50% to research institutes and 50% to universities. In 2006, it was 35% for research institutes and 65% for universities (Agolli, 2007a).
- National R&D Programmes (NRDP) receives financial sources from the state budget's R&D 'bottom-up' initiatives. The compilation of each NRDP programme

describes the main development objectives of the priority fields. The NRDPs are prepared by a group of experts and approved according to the standard rules used by the Council of Higher Education and Science. The MoES is responsible for the implementation and complete financing of the project (programmes are implemented through projects, with duration of three years). Six national R&D programmes were implemented during 2003-2005 and six others to be implemented (during period 2007-2009) started only this year (NRDP projects since November 2007) on the priority fields. A competitive system is used to allocate financial support. (ICBSS, 2006; Agolli, 2007a).

- Association to the Framework Programme (FP7) as of 1st January 2008 will boost international cooperation.

Further problems and shortcomings need to be addressed in near future in order to improve the existing institutional capacity in Albania (ICBSS, 2006):

- the legislative base and administrative links leave much to be desired;
- the actual supporting infrastructure is insufficient and has limited competence;
- the system of research institutions is dispersed, with many small and unnecessary units;
- in many cases the development policy for research institutions continues to demonstrate a lack of adaptation to the new economic situation;
- the level of research in higher education institutions is not at the proper level;
- there are no quality and quantity standards for evaluating the institutions and scientific work;
- the cooperation between the different units inside the country continues to be limited;
- the basic infrastructure is of a low level;
- the information for respective scientific communities outside the country is missing;
- international integration is still low;
- studies conducted in the past have a low practical impact.

Some other weaknesses and threats, for instance those identified in the Great-IST project, can be to a large extent generalised (SBRA-Great-IST, 2007): low access to facilities, low priority for R&D, illustrated by very low GERD, low level of participation in EU RTD; politicised, as opposed to professional administration capable of creating partnerships and managing complex relations between stakeholders in multiple innovation related sectors; limited qualified information technology personnel; lack of RTD statistics; unfavourable general business climate; weak network of SME associations and inadequate SME representation at national level; high unemployment; poor broadband infrastructure and access; large gap between declared ICT strategies and actual policy implementation; absence of motivation to harmonise with EU ICT policies due to unclear prospects of European integration; large grey economy (estimated up to 50% of GDP); lack of stability in the region and; inaction of broadband development and uptake.

The SBRA-Great-IST project also stated some indicators showing the positive trend, especially in the IST domain (SBRA-Great-IST, 2007): rather good performance in FP6 projects; strong diasporas, potentially capable of supporting ICT-based development and emergence of knowledge economy; dynamic economic growth; pilot and experimental projects (and technologies) based on best practices in neighbouring countries; network of Public Access Centres (PACs), to be established in rural areas of Albania to inform Albanians on ICT benefits as well as to provide access to modern services; an initiative to establish a high-speed internet network between various governmental institutions; introduction of a variety of national and

international IST projects, for example, IS2WEB, INTERREG IIIB CADSES ELISA, TRISTAN-EAST, SEEREN, TERENA, SEE-GRID.

6 Summary and Draft Conclusion

South Eastern Europe cannot be viewed as a homogenous area, although most of the countries in the region are challenged by similar issues, albeit of very different degree. The underdevelopment of S&T governance in Albania is among important structural problems requiring urgent attention. Although a variety of formal and informal institutions, mechanisms and procedures for managing S&T infrastructure are in place, there is a clear inconsistency between the functions described in the legislative framework and their actual implementation. Albania clearly needs to continue its efforts in developing a sustainable strategy, also taking regional and European dimensions into account. Foresight and the identification of innovation capacities will help to develop policies and a long-term strategy in a regional context. A high level of awareness among the public and politicians about the relevance of RTD and the need for a dialogue between the economy, academia and administration will provide the basis for developing a science policy that is in line with economic policies and priorities (Dall, 2006).

R&D was one of the system elements most negatively affected during the transition and crisis period of the last 15 years. The research budget of Albania is still bellow the threshold level, while modernisation of the institutional and structural set-up of the national innovation system is long overdue. Links to other subsystems, such as education, the regional economy, and the financial and banking system, are generally still underdeveloped. Systemic problems which negatively affect the research and innovation systems in the country are mostly a result of overdue reforms of the S&T policy and RTD structures. The legislative system is characterised by a disruptive S&T policy formulation process, an overall low status of S&T in governmental policy priorities, a weak policy delivery system in terms of institutional structures and capacities, a lack of sufficient public and private funding for RTD, the generation renewal and the brain drain problem etc. Other problems include the need to revitalise RTD activities (in terms of increasing the demand for RTD results in industry, addressing the imbalance between basic, interdisciplinary and applied research, improving the knowledge base in technical disciplines and redeveloping the physical RTD infrastructure) and internationalise RTD activities. However, in comparison with other developing regions, South Eastern Europe still has a fairly sound human capital basis. Its absorptive capacity is central for learning, assimilating and using the knowledge developed elsewhere. At the same time, the relative losses in quality at all levels of the education system are worrying (Schuch, 2006).

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8 List of Acronyms

AAN	Albanian Academic Network
AIIS	Albanian Institute for International Studies
AJNTS	Albanian Journal Natural and Technical Sciences
ALPTO	Albanian Patent and Trademark Office
ASA	Albanian Academy of Sciences
BERD	Business Expenditure on R&D
BSEC	Black-Sea Economic Co-operation
CADSES	Central, Adriatic, Danubian and South-Eastern European Space
CARDS	Community Assistance for Reconstruction, Development and Stabilisation
CEEOL	Central and Eastern European Online Library
CEI	Central European Initiative
CORDIS	Community Research & Development Information Service
CTBTO	Comprehensive Nuclear-Test-Ban Treaty Organisation
EC	European Commission
ECTS	European Credit Transfer System
EPC	European Patent Convention
EPO	European Patent Office
ERA	European Research Area
ERA-NET	European Research Area Network
EU	European Union
EUR	Euro (currency)
FP5, FP6, FP7	European Community Framework Programmes for Research and Technological Development
FTE	Full Time Equivalent
FYROM	Former Yugoslav Republic of Macedonia
GERD	General Expenditure on R&D
GOVERD	Government Expenditure on R&D
GDP	Gross domestic product
HERD	Higher Education Expenditure on R&D
HP	Hewlett Packard
IAEA	International Atomic Energy Agency
ICBSS	International Centre for Black Sea Studies
ICT	Information and Communication Technologies (also: one of the priorities in the Cooperation Programme of FP7)
INIMA	Albanian Institute of Informatics and Applied Mathematics
INSTAT	National Statistical Office of Albania
INTERREG IIIB	EU-funded programme that helps Europe's regions form partnerships to work together on common projects
IP	Intellectual Property
IPA	Instrument for Pre-Accession Assistance
IS2WEB	FP6 project "Extending Information Society Networks to the Western Balkan Region"
ISOTEIA	Integrated System for the Promotion of the Territorial-Environmental Impact Assessment in the Frame of Spatial Development
IST	Information Society Technologies (also: one of the priorities in FP6)
Lek	Albanian currency
MFA	Ministry of Foreign Affairs

MoES	Ministry of Education and Science of Albania
MoU	Memorandum of Understanding
METE	Ministry of Economy, Trade and Energy
NATO	North Atlantic Treaty Organisation
NGO	Non Governmental Organisation
NRDP	National R&D Programmes
NSSED	National Strategy for Socio-economic Development
OECD	Organisation for Economic Co-operation and Development
PAC	Public Access Centre
PCT	Patent Cooperation Treaty
PIU	Programme Implementation Unit
PPP	Public Private Partnership
p.p.p.	purchasing power parity
R&D	Research and Development
RTD	Research and Technological Development
SAA	Stabilisation and Association Agreement
SAP	Stabilisation and Association Process
SBRA	Slovenian Business and Research Association
SEECP	South Eastern Europe Cooperation Process
SEE-ERA.NET	FP6 Project " Southeast European Era-Net"
SEEFIRE	South-East Europe Fibre Infrastructure for Research and Education
SEE-GRID	South Eastern European Grid-enabled e-Infrastructure Development
SEEREN	South Eastern European Research & Education Network
SFRY	Socialist Federative Republic of Yugoslavia
SMEs	Small and medium size enterprises
S&R	Science and Research
S&T	Science and Technology
TERENA	Trans European Research and Education Network Association
TRIPS	Trade-Related Aspects of Intellectual Property Rights
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNIDO	United Nations Industrial Development Organisation
USA	United States of America
USD	US Dollar (currency)
USPTO	United States Patent and Trademark Office
WIPO	World Intellectual Property Organisation
WMO	World Meteorological Organisation
ZSI	Zentrum für Soziale Innovation (Centre for Social Innovation, Austria)

Annex

Important laws in the legal S&T framework of Albania (Dall, 2006; Agolli, 2007a)

Law on Science and Technological Development (1994), amended in 1998	Sets out the objectives of S&T policy, which include stimulating the global integration of national R&D and encouraging privatisation; expounds the procedures of S&T policy development. The main functions of the Committee for Science and Technology are currently performed by the Ministry of Education and Science, with a very limited number of people now working on it, i.e. formulating S&T policy and national R&D programmes in order to implement this policy (Agolli, 2007a).
Law on Higher Education (amended in 2007)	It regulates the activities of universities and faculties, the establishment and work of managing bodies, way of choosing teaching staff, etc. The role of university, its scope of work and basic work conditions and objectives are regulated by laws, while the overall organisation and activities are more closely elaborated by their statute.
Law and Statute of the Academy of Sciences, Nr.9182, 2nd May 2004	It regulates the activity of Academy of Sciences of Albania and their scientific research of institutes and centres.
Law No. 7819 on Industrial Property (1994), amended by Law No. 8477 (1999)	Regulates industrial property, trade marks and industrial designs (these fields are also partly regulated by the Penal Code, Civil Code, Penal Procedure Code, Civil Procedure Code and Customs Code Law No. 8449 (1999).
Law on Copyright No. 7564 (1992), amended by Law No. 7923 (1995), Law No. 8594 (April 2000) and Law No. 8630 (July 2000).	Regulate copyright and related rights (those fields are also partially regulated by the Council of Ministers' decision Act No. 309 (2000) on "User's Tariffs", as well as in parts of the Penal Code, Civil Code, Penal Procedure Code and Civil Procedure Code.
Law No.9741, 21st May 2007	For the Higher Education in Republic of Albania
Law No. 7819 27th April 1994	On Industrial Property
Law No. 8477 22nd April 1999	Amendments on Law,No.7819
Law No. 9525 25th April 2006	Amendments on Law 7819, Date April 27, 1994, Law On Industrial Property
Law on No. 8488 13th May 1999	Protection of Topographies of Integrated Circuits
Council of Ministers Decision Act, No.313, 13th June 2000	Functioning of Albanian Patent and Trademark Office
Council of Ministers Decision Act, No. 568, 23rd October 1995	Fees of Albanian Patent Office for Industrial Property Objects

Prime Minister order, 22nd October 2001,	For approval of administrative structure of Albanian Patents and Trademarks Office
Law No. 8449, 27th January 1999	Penal Code, Civil Code, Penal Procedure Code, Civil Procedure Code, Customs Code
Decision Act, No. 248, 27th April 2007	National Agency of Information
Law No. 9647, 27th November 2006	On the adherence of the Republic of Albania to Geneva Act of the Hague Agreement concerning the international registrations of industrial designs, Regulations Under the Geneva Act 1999".Industrial designs Creation of new and original industrial designs
Law No. 9648, 27th November 2006	On the accession of the Republic of Albania to Hague Act of the Hague Agreement concerning the international registrations of industrial designs

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BOSNIA AND HERZEGOVINA

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1 Introduction

This country report is produced by the Information Office of the Steering Platform on Research for Western Balkan Countries and reviews the situation of Science and Technology (S&T) in Bosnia and Herzegovina (BiH).

The report summarises main papers published by the United Nations Educational, Scientific and Cultural Organization (UNESCO), the South-East European ERA-NET (SEE-ERA.NET), the Austrian "Gesellschaft zur Förderung der Forschung", and several independent scholars on the issue of S&T in Montenegro. For the complete list of references please see References in chapter 7, starting on page 85 of this report.

The objective of this study is to enhance our understanding of the national innovation system in Bosnia and Herzegovina. An overview of the situation in S&T regarding the main stakeholders, input and output indicators, the national strategies and priorities, and the main documents and laws in the field is given below.

The 'system of innovation' approach was taken into account when compiling this report, and it covers important factors influencing the development, diffusion and use of innovations, as well as the relations between these factors. It does not place emphasis on individual firms or research organisations, but rather on innovation as an interactive and interdependent process.

Relevant organisations in this respect are firms, higher education institutions, government agencies, etc. interacting to create knowledge and innovation. The macro-level of the system is analysed using indicators such as R&D personnel ratios, R&D expenditure, patent application intensity rates, etc.

The report was compiled in autumn 2006 by the Information Office, by Ms. Elke Dall and Ms. Maruška Bračić, Centre for Social Innovation, Vienna, Austria and reviewed by Mr. Florian Gruber, Centre for Social Innovation, and Mr. Ammar Miraščija, National Information Point for the Framework Programmes in Bosnia and Herzegovina. A brief update was carried out in summer 2007 by Mr. Jure Zrilič, Centre for Social Innovation. A final review was carried out in December 2007/January 2008 by Ms. Biljana Camur, Ministry of Civil Affairs Bosnia and Herzegovina. Finally, the availability of the internet sources used was checked again.

1.1 Bosnia and Herzegovina - A Brief Profile

Bosnia and Herzegovina is a small country within the Western Balkan region, with a population of about 4 million people (43% urban and 57% rural). Following its declaration of independence from the former Socialist Federal Republic of Yugoslavia (SFRY) in April 1992, Bosnia and Herzegovina was plunged into a three-year long war, which led to major displacements of population and extensive physical and economic destruction[1]. The Dayton Peace Agreement retained Bosnia and Herzegovina's international boundaries and created two entities within the Bosnia and Herzegovina state: Federation of Bosnia and Herzegovina and Republic of Srpska. There is also the self-governing district of Brčko, which remains under the sovereignty of the central-state government, the Council of Ministers of Bosnia and Herzegovina. In accordance with the Dayton Peace Agreement, a Peace Implementation Council was established and a UN-mandated High Representative appointed, in order to

[1] According to the statistics, Bosnia and Herzegovina had 4.4 million inhabitants in 1991 and 3.6 million in 1996. In 2002, the population increased to 3.8 million inhabitants, still a dramatically lower number compared to pre-war figures.

support the peace implementation process. Currently, the High Representative - who has been granted strong executive powers - also acts as the EU's Special Representative. The Office of the High Representative (OHR) oversees the implementation of the civilian aspects of the Dayton Peace Agreement. Bosnia and Herzegovina is a parliamentary democracy and the constitution in force is defined by the Dayton Peace Agreement (European Commission, 2006c).

Bosnia and Herzegovina was among the poorest republics of the former SFRY. For the most part, agriculture was in private hands and farms were small and inefficient. Industry is still greatly overstaffed, reflecting the legacy of the centrally-planned economy (U.S. Department of State, 2005). Nevertheless, BiH's economy has made significant progress since the end of war in 1995, when the GDP had dropped to only 20% of its pre-war levels. High donor inflows in the initial post-war years resulted in annual growth rates of about 10% from the year 2000. As donor aid declined, the real GDP growth slowed to only 3.5% in 2003 due to a severe drought (USAID, 2005). Growth in 2004 rose to 6%, while in 2005 the growth rate of real GDP was only 5.5%. The increase rate of the real GDP (according to the production method) in BIH in 2006 was 6.2% and by that rate BiH is among the most dynamic transition economies in Europe (Central Bank of BiH, 2007).

The service sector accounts for the largest part of the economy, 62% of GDP, while industry accounts for 21% and agriculture for 12% of GDP. The ratio of exports to imports of goods and services to GDP in 2003 was equal to 85%. However, this ratio is driven mainly by the high level of imports. The EU is Bosnia and Herzegovina's main trading partner, accounting for around 40% of exports and 45% of imports (European Commission, 2006c).

Due to the strict currency board strategy which links "konvertibilna marka" (Convertible Mark, BAM) to the euro, inflation remains mostly low and was on average 0.4% in 2005. However, in January 2006 the inflation rate reached 7.6%, mainly due to the increase in prices related to the introduction of Value Added Tax (VAT) on 1st January 2006. Inflation rates in the two entities have been converging over the last five years, but inflation remains higher in the Republic of Srpska. Clearly, such a currency regime gives little possibility for active monetary policy (European Commission, 2006a). After the inflation pressures in 2006, the inflation rate was lower than 2% in the first quarter of 2007, which is in line with the inflation from previous years. Price increases in 2007 were much slower, while the trends of retail prices between the two entities are quite similar (Central Bank of BiH, 2007).

According to official data, unemployment rose from 43% in 2004 to 44.6% in 2005. Using ILO definitions, unemployment was estimated at 31% in April 2006, but having accounted for the informal sector, unemployment is estimated to be closer to around 20% of the working-age population, although no recent official estimate is available (European Commission, 2006a). In 2007 the overall unemployment rate was estimated to be 29% (United Nations Development Programme, 2008).

As regards the economic situation, Bosnia and Herzegovina has begun the negotiation process to join the World Trade Organisation (WTO) and has signed all the Free Trade Agreements (FTAs) proposed by the Stability Pact's Memorandum of Understanding on Trade. A unified customs tariff has been applied since 1999. However, the country has generally been lagging behind in its implementation of FTAs, especially compared to its neighbouring countries. Bosnia and Herzegovina benefits from the autonomous trade measures introduced by the EU in September 2000, which allow more than 95% of all imports (including agricultural produce) to enter the EU duty-and-quota free (European Commission, 2006c).

After seven months of intensive negotiations BiH (with other countries of South Eastern Europe) signed a "new" and improved Central European Free Trade Agreement (CEFTA) on 19th December 2006, creating a free trade area in South Eastern Europe. The new CEFTA is a tremendous economic and political achievement for South Eastern Europe (Efendic and Medjedovic, 2006).

In the first seven years following the signing of the Dayton Peace Agreement, BiH received nearly USD 5 billion[2] in humanitarian and reconstruction assistance, about 75% of which was in the form of grants. However, total assistance levels have been declining in recent years. In 2005, official grants fell below USD 300 million[3] and are expected to decrease further. Official loans during the period 2003 to 2007 are estimated to be at a level of USD 100-150 million per year. The largest official grant donor is the EU, and the principal lenders are the World Bank and EBRD (USAID, 2005).

USAID has allocated over USD 1 billion to Bosnia and Herzegovina since 1996. In 2005, the Agency adopted a "Strategy Plan" for Bosnia and Herzegovina (2006 to 2010), with the objectives of deepening economic reforms in the country, strengthening institutions to foster democracy and good governance, and building a viable state (USAID, 2005).

A stand-by arrangement (worth around USD 100 million[4]) with the International Monetary Fund (IMF) was adopted in August 2002 and concluded in February 2004. The programme focussed on policies to achieve post-reconstruction growth and further significant fiscal consolidation. In 2003, the IMF and BiH authorities started negotiating a new stand-by agreement (European Commission, 2006c).

After an initial post-war strategy based on reconstruction needs, the emphasis of World Bank operations shifted towards helping Bosnia and Herzegovina achieve sustainable growth. In May 2004, negotiations on granting a USD 34 million[5] Economic Management Structural Adjustment Credit (EMSAC) were concluded; the credit aims at supporting a set of reforms and Bosnia and Herzegovina's transition from aid-dependent to self-sustained growth. In September 2004, the World Bank adopted its Country Assistance Strategy for the period between 2005 and 2007, which focused on reforms in the areas of public finance and administration, private sector development and key social and economic infrastructure (European Commission, 2006c).

In 2003, the European Bank for Reconstruction and Development (EBRD) signed two new projects in Bosnia and Herzegovina, granting EUR 39 million (European Commission, 2006c).

Economic revitalisation clearly remains BiH's most immediate task. Successful accomplishment of such growth requires an environment conducive to private sector development and supportive of a market-led economy. At present, privatisation has been slow, unemployment remains high, and some restructuring of BiH's domestic debt is also necessary before economic growth is achievable (U.S. Department of State, 2005).

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[2] EUR 3.7 billion (05.12.2006); www.oanda.com/convert/classic
[3] EUR 253 million (31.12.2005); www.oanda.com/convert/classic
[4] EUR 102.3 million (01.08.2002); www.oanda.com/convert/classic
[5] EUR 28.4 million (01.05.2004); www.oanda.com/convert/classic

1.2 Relations between Bosnia and Herzegovina and the EU

Integration into the EU is one of the main political objectives of Bosnia and Herzegovina. An EU / Bosnia and Herzegovina Consultative Task Force (CTF) was established in 1998 as a joint vehicle to provide technical and expert advice. Meetings of the CTF have constituted a central forum for technical and political dialogue. Discussions at the CTF meeting held in May 2005 focussed on the priorities identified by the Commission in its 2003 Feasibility Study for the negotiation of a Stabilisation and Association Agreement (SAA). For the time being, the Stabilisation and Association Process (SAP) remains as the EU's policy framework for BiH. Countries participating in the SAP have been given the opportunity to become EU member states, thus Bosnia and Herzegovina is a potential candidate country for EU accession. Formal contractual relations between the EU and Bosnia and Herzegovina will be established through the signing of the Stabilisation and Association Agreement. The SAA negotiations were officially opened in November 2005 and have progressed well from a technical point of view, with a substantial part of the text of the future SAA having been agreed (European Commission, 2006a). In December 2006 the European Commission and Bosnia and Herzegovina concluded the final technical round of Stabilisation and Association Agreement negotiations. On 4th December 2007, BiH made the first step towards EU accession, by initialling the Stabilisation and Association Agreement (SAA) with the European Union (Delegation of EC to BiH, 2007).

Enlargement of the EU to encompass new applicant countries will be achieved primarily through the continuing process of peaceful integration across Europe, and by extending this area of stability and prosperity towards new members. As recent conflicts in the Balkans have shown, economic, civil and political progress remains essential for to guarantee peace, democracy and human rights in the Western Balkans. The EU has contributed to this process by creating a common internal market, thereby ending the long period of division in Europe. Among Western Balkan countries, Croatia and the FYR of Macedonia are on their way to joining the EU, and while Serbia, Montenegro, Bosnia and Herzegovina and Albania are also striving for EU membership, they still have a long way to go. Although the international presence in Bosnia and Herzegovina (namely, the governing authority of the High Representative) has driven reforms, it has also slowed the process of political maturation and impeded local ownership of the reform process. The Dayton Peace Agreement created a fragmented, multi-layered government that has diffused responsibilities is ultimately unsustainable and impedes economic growth. It left the Council of Ministers of Bosnia and Herzegovina small and with only limited competences. Thus, a consistent and coordinated vision of the country's future as a modern state is highly necessary (USAID, 2005).

The overall objective of all the assistance provided by the EU is to support BiH in the framework of the Stabilisation and Association Process. In particular it aims to help consolidate the peace process and foster inter-entity co-operation; to help ethnic reconciliation and the return of refugees and displaced persons to their homes of origin; to establish functioning institutions and a viable democracy, based on the rule of law and respect for human rights; to lay the foundations for sustainable economic development and growth; and to bring Bosnia and Herzegovina closer to EU standards and principles (Delegation of EC to BiH, 2007).

Since 1991, the European Commission has set aside more than EUR 2.5 billion to deal with the conflict and post-conflict effects in Bosnia and Herzegovina (European Commission, 2006c):

- Over EUR 2 billion of EC assistance betwee 1991 and 2000 (mainly through the ECHO, PHARE and OBNOVA programmes)[6] focussed on refugee programmes and reconstruction.

- EUR 312 million was allocated through the Community Assistance for Reconstruction, Development and Stabilisation programme (CARDS) (the EC's main financial instrument for the Western Balkans) between 2001 and 2004. This allows focus to shift from post-war reconstruction to institutional capacity-building and economic development, i.e. putting BiH in a better position to fulfil its own responsibilities as a state, especially for its own reform and European integration processes. Key areas are the development of state-level public administration and institutions, economic reform, customs and taxation, policing, justice, border management and refugee return.

- An additional EUR 100 million have been allocated through CARDS for 2005 and 2006. Assistance priorities reflect those earlier established in the European Partnership for Bosnia and Herzegovina, with an ever-stronger focus on institutional capacity building and economic development. Key areas remain as follows: public administrative reforms (including customs and taxation), justice and home affairs-related issues (including police reform, integrated border management and judicial reform) and improvement of the investment climate (including trade, education, environment and infrastructure).

The Instrument for Pre-Accession (IPA) replaced CARDS in 2007. IPA remains focused on institution building and socio-economic development. The Multi-annual Indicative Planning Document (MIPD) 2007 - 2009 for BiH provides for an overall financial envelope of EUR 226 million. The MIPD takes account of the country's Mid-Term Development Strategy and the EU Integration Strategy, as well as the priorities identified by the BiH annual progress report and the European Partnership. IPA is an accession-driven instrument, fulfilling all the requirements stemming from the accession process, notably in terms of priorities, monitoring and evaluation (European Commission, 2007a). The IPA aims to provide targeted assistance to EU candidate countries and potential candidate countries, and has entirely replaced CARDS and other pre-accession financial instruments (PHARE, ISPA, SAPARD). The programming has five components – Transition Assistance and Institution Building; Regional and Cross-Border Cooperation; Regional Development; Human Resource Development and Rural Development - only the first two of which apply to potential candidate countries (including BiH). The IPA allocates over EUR 11 billion during the 2007-2013 period (see-science.eu, 2006).

Gaining support is mostly in the hands of Western Balkan countries which need to demonstrate certain efforts in formulating and submitting requests to the relevant authorities. In the field of research, the SEE-ERA.NET project, as well as the Steering Platform launched in June 2006, provide support behind this process, acting as a forum for the exchange of experiences and best practices among the Western Balkan countries, as well as through focused and co-ordinated interventions targeted at European Commission services and the EU Member States (Bonas, 2006).

[6] Please see List of Acronyms

The European Union has also been providing Bosnia and Herzegovina with macro-financial assistance. In 1999, the EU allocated about EUR 60 million in funds (EUR 20 million of which were loans and EUR 40 million were grants). This assistance was followed by a similar allocation in 2002, which is dependent on both political conditions and the IMF's economic standards (European Commission, 2006c).

The European Union remains also the main trading partner of Bosnia and Herzegovina. The vast majority of Bosnia and Herzegovina's products can enter the EU zone duty free, due to the autonomous preferential regime adopted by the EU in 2000. Exported goods are essentially base metals, wood and wood products, mineral products and chemicals, while imports mainly include machinery, mineral products, foodstuffs and chemicals (European Commission, 2006c).

On 18th September 2007 the European Union (EU) and five West Balkan nations (among them BiH) signed nine agreements on visa facilitation and readmission, which will bring the two sides closer in cooperation in migration and movement of persons. The signature of the agreements is an important political decision toward closer cooperation between the EU and the Western Balkan countries in the sensitive areas of migration and movement of persons (see-science.eu, 2007a).

2 Contemporary Institutional Landscape

The BiH state-level government, the Council of Ministers, was granted limited powers under the Dayton Peace Agreement, although it is progressively taking on more responsibilities. Bosnia and Herzegovina has a bi-cameral parliament comprising the House of Representatives (BiH HoR) and the House of Peoples, of which two-thirds of members are elected from the Federation of Bosnia and Herzegovina and one-third from the Republic of Srpska. Bosnia and Herzegovina has a rotating, collective, three-member presidency. There are ten ministers in the Council of Ministers, one of whom is appointed chairman (prime minister) for a four-year term. The entities have their own governments, and the cantons within the Federation also have powerful local governments with a strong influence on the S&T sector (European Commission, 2006c).

2.1 Main Stakeholders Involved in Policy Making in Bosnia and Herzegovina

The dissolution of the former Yugoslavia and the application of the Dayton Peace Agreement (1995) have contributed to the complexity of the governing system in BiH, which is also reflected in the distribution of competence regarding science and technology. At present there are three levels of political and administrative competences in BiH: the State, the BiH Federation (including the ten cantons of the BiH Federation) and the Republic of Srpska. The State of BiH has some limited competences to regulate S&T through the Ministry of Civil Affairs but no funds to support the R&D activities. Basically, the role of the Ministry is to co-ordinate activities between the two entities responsible for the field of higher education, science, culture and sports, and to take responsibility for international obligations, although this must be done without the means or mandate to implement these obligations (Dall, 2006). In addition, the Ministry of Communication and Transport is responsible for preparation and development of strategic and planning documents that fall within international and inter-entity communications, transport, infrastructure and information technologies.

Unlike the State of BiH, both the BiH Federation and the Republic of Srpska have ministries in charge of science (the Ministry of Education and Science in the Federation, and Ministry of Science and Technology in the Republic of Srpska) and possess financial resources (Dall, 2006). The jurisdiction over education, science, culture and sport is conducted by the entity of BiH Federation and its ten cantons, and the Republic of Srpska. The Ministry of Education and Science of the BiH Federation is responsible for education and research at the level of the Federation but each of the ten cantons within the Federation has jurisdiction over educational, scientific and technological policy. Furthermore, the cantons enjoy substantial legislative, judicial and executive powers, and have their own constitution, government and legislative body (Papon and Pejovnik, 2006).

At the BiH Ministry of Foreign Affairs, the Office for International Cooperation in the Fields of Science, Technology, Education, Culture and Sports was established in order to begin work on bilateral agreements concerning scientific, technological and educational cooperation with many countries including those within South Eastern Europe (SEE) (Tanovic, 2005). This Office is responsible for international cooperation in such projects as SEE-ERA.NET, because at the time that these projects started, the Ministry of Civil Affairs did not have its current mandate allowing it to take over international obligations (Dall, 2006).

Table 2.1: Main S&T Stakeholders in the Federation of BiH (adapted from Dall, 2006)

Main ministry in the Federation of BiH responsible for S&T	- Ministry of Education and Science - Ministries of the 10 cantons inside the Federation of BiH
Other ministries with importance to the S&T sector	- Ministry of Trade - Ministry of Agriculture, Water and Forestry - Ministry of Energy, Mining and Industry - Ministry of Health - Ministry of Finance - Ministry of Communication and Transport
Public universities in the Federation of BiH	- University of Sarajevo - University of Mostar - University of Mostar - Džemal Bijedić - University of Zenica - University of Tuzla - University of Bihać

Most of Bosnia and Herzegovina's R&D potential was destroyed during the war or is now out-dated. Efforts were made to improve the conditions in higher education, through the adoption of a state-level law, the Law on Higher Education, on 30th July 2007, the harmonisation of entity and cantonal laws in line with this state-level law, as well as the elaboration of a state law for science and technology activities. The aim is to recover the pre-war level of R&D investment (1.5% of GDP). The ministry established a fund worth BAM 1.9 million[7] to support research projects but it lacks relevant statistics and data on R&D activities (scientific manpower, finance, infrastructure, scientific publications, patents) in the Federation (Papon and Pejovnik, 2006).

To date, the Sarajevo Canton is the only canton within the BiH Federation which has adopted a science law for the organisation of research activities within its territory. It has established a research fund worth BAM 1.5 million[8] to support research projects based on expert evaluation

[7] Around EUR 900,000, www.oanda.com/convert/classic
[8] Around EUR 800,000, www.oanda.com/convert/classic

under the responsibility of the Academy of Sciences and Arts of BiH (ANUBiH) (Papon and Pejovnik, 2006). The ANUBiH is entrusted with the responsibility for the overall development of science and the arts, with organizing scientific research and arts-related events, with publishing papers written by its members and associates, and with the state of science and the arts and their development in BiH (Camur, 2008).

Table 2.2: Main S&T Stakeholders in the Republic of Srpska (RS) (adapted from Dall, 2006)

Main ministry in the Republic of Srpska responsible for S&T	- Ministry of Science and Technology
Other ministries with importance to the S&T sector	- Ministry of Education and Culture - Ministry of Economic Affairs and Coordination - Ministry of Economy, Energy and Development - Ministry of Agriculture and Forestry - Ministry of Health and Social welfare - Ministry of Trade and Tourism - Ministry of Transport and Communications
Public universities of the Republic of Srpska	- University of East Sarajevo - University of Banja Luka

Within the Republic of Srpska (RS), issues of S&T are dealt with by the Ministry of Science and Technology, which dedicated 80% of its budget (approximately BAM 3 million[9] in 2005) to R&D activities through its support of projects. A law defining the main guidelines in research activities has been adopted as well as a basic document for the research strategy of RS, which defines the main areas to be supported and developed within the higher education institutions, research institutions and industry (Papon and Pejovnik, 2006). In 2007 the Ministry of Science and Technology RS dedicated approximately BAM 3.7 million to R&D activities (including 90 R&D projects, 25 science conferences, 18 projects for science infrastructure and the training of a new generation of young scientists - 161 postgraduate students, 176 masters of science and 93 doctors of science) and BAM 1.2 million for implementing the academic and research computer network in Republic of Srpska (SARNET) (Camur, 2008).

When the BiH state-level law on science is finally adopted, the existing laws in the different entities and cantons should be harmonised. Furthermore, it should take into account the present situation of BiH's research potential, on which information is still incomplete. The definition of priorities before adopting such a law could prove necessary (Papon and Pejovnik, 2006).

[9] Around EUR 1.4 million; www.oanda.com/convert/classic

Table 2.3: Other Important Stakeholders in S&T in BiH (adapted from Dall, 2006; Camur, 2008)

- Institute for Standardisation
- Institute for Metrology
- Institute for Intellectual Property
- Institute for Genetic Engineering and Biotechnology
- Agriculture Institute of the Republic of Srpska
- Federal Agriculture Institute, Sarajevo
- Federal Agro-Mediterranean Institute, Mostar
- Federal Institute for Geology, Sarajevo
- Federal Institute for Agro-pedology
- Institute of Metallurgy „Kemal Kapetanović“, Zenica
- Rectors Conference
- Working Group for Higher Education, Quality and Modernisation (OSCE. co-chaired by the Council of Europe and the Ministry of Civil Affairs of BiH)
- Academy of Sciences and Arts of Bosnia and Herzegovina (ANUBiH)
- Academy of Sciences and Arts of the Republic of Srpska (ANURS)
- Agency for Statistics of Bosnia and Herzegovina (BHAS)
- Statistical Office of the Federation of Bosnia and Herzegovina
- Republic of Srpska Institute of Statistics
- World University Service of BiH (SUS B&H) / Foundation for Higher Education
- State Commission for Cooperation with UNESCO
- Unit for Economic Planning and Implementation of the Medium-term Development Strategy of BiH
- National Information Point for FP6/FP7 in BiH
- „Circle 99“, Association of BiH intellectuals
- Office of the High Representative (OHR)
- World Bank Country Office in BiH
- OSCE Mission in BiH
- United States Aid (USAID)

The complexity of the fragmented, multi-layered political and administrative organisation in Bosnia and Herzegovina, with many different national and international institutions and bodies involved in the creation and implementation of R&D legislation, poses many difficulties in establishing a unified state-level science policy. In 2005, there was no single political entity at the state level with a clear mandate over higher education, research, or even industry. As stated above, the Ministry of Civil Affairs of Bosnia and Herzegovina has some general responsibility in these domains, but lacks the legal framework allowing action to be taken, as well as the necessary budget to support such activities (Papon and Pejovnik, 2006).

As a result of the Dayton Agreement, educational authority (including the management of higher education) was shifted to the Republic of Srpska and to the ten Federation cantons. The Federation’s system is financed by canton-level tax revenues and because of this, the cantons also claim rights and privileges over decision making. In the Brčko District, the government comprises departments on education and also on economic development, but no initiatives have been taken to promote the research technology transfer. In the Republic of Srpska, the Ministry of Science and Technology is responsible for activities related to science and research, technological development and innovation, including the provision of information and supervision. Furthermore, this ministry incorporates the Academy of Sciences and Arts of the Republic of Srpska into its jurisdiction, whereas education comes under the remit of the Ministry of Education and Culture (Dall, 2006; Camur, 2008).

Bosnia and Herzegovina's S&T system extends to eight public universities (Sarajevo, Bihać, Tuzla, Zenica and two universities in Mostar for the BiH Federation; East Sarajevo, Banja Luka for the Republic of Srpska), several private universities, public-mission oriented research institutions (e.g. in metallurgy and agriculture) of various legal (and often undefined) status, as well as a limited number of industrial laboratories (performing mainly development tasks).

The Higher Education Co-ordination Board (HECB) of Bosnia and Herzegovina was formed as part of the Education Development Project, which was funded by the World Bank in 2000 to co-ordinate the reform of higher education. This body became the Rectors Conference in 2005 and no longer exists in its original form.

Rectors of the universities and representatives of academic communities have been active in the Working Group for Higher Education Quality and Modernisation in Bosnia and Herzegovina. The Working Group, in coordination with various international actors (e.g. the Council of Europe, the OHR etc.), prepared the education reform strategy (Federal Ministry of Education and Science of Federation of Bosnia and Herzegovina, 2003; Ministry of Education and Culture of the Republic of Srpska, 2003). In general, higher education and science rank very low on the list of priorities for restructuring. As local governments fail to prioritise research and technological development, further assistance from the international community is needed (Dall, 2006).

2.2 International Cooperation

Countries of the Western Balkans have seen a constant renewal of international cooperation and support in the last years. This cooperation has been substantially supported by many international organisations and individual countries through bilateral programmes (also providing significant benefits to the R&D sector). The largest part of the financial support in this respect came from Stabilisation and Association Process funds, the CARDS programme, the Stability Pact for South Eastern Europe, the European Investment Bank, and the European Bank for Reconstruction and Development. The European Union's Tempus programme has been important in the area of higher education, while the inclusion of the Western Balkan countries into the 6th Framework Programme (FP6) for R&D (Bosnia and Herzegovina participated in the FP6 as a partner in the project consortia), and their gradual integration into the European Research Area (ERA), has also been of particular importance. Currently BiH participates in FP7 as an International Cooperation Partner Country, but intentions have been expressed to associate to the Framework Programme.

Regional networks also include initiatives to aid the participation of Western Balkan countries in the EU Framework Programmes for R&D, as defined by the EU-Balkan countries Action Plan on Science & Technology adopted at the Ministerial Conference in Thessaloniki on 26th/ 27th June 2003. The "Action Plan", along with the "Shared Vision", defined the priorities of research cooperation and provided a detailed examination of all possible sources of funding, thus contributing to the economic growth of the Balkan countries and aiding their integration into the European Research and Innovation Area (CORDIS, 2003).

From 1st January 2007, the Commission uses a new financial tool, the Instrument of Pre-Accession (IPA), for promoting modernisation, reform and alignment with the *acquis*. IPA has entirely replaced CARDS and other pre-accession financial instruments (PHARE, ISPA, SAPARD). The programming has five components (BiH as potential candidate country is eligible for the first two): Transition Assistance and Institution Building; Regional and Cross-Border Cooperation; Regional Development; Human Resource Development and Rural Development. As a region, the Western Balkan countries and Turkey will benefit from

almost EUR 11.5 billion of pre-accession financial instrument money between 2007 and 2013 (European Commission, 2006b).

Inclusion of these countries into the European Investment Bank's Innovation 2000 Initiative ought to prove useful as well. Regarding multilateral cooperation in the area of science and research, the Western Balkans have cooperated closely with many specialised United Nations (UN) agencies, such as UNESCO, UNIDO, UNDP and UNECE[10]. Some other international organisations, such as the World Bank and USAID, have also been important donors and have helped especially in the area of higher education (Uvalic, 2006). EU Commissioner Janez Potočnik visited BiH in the beginning of October 2007 and discussed future association with FP7. It is to be hoped that BiH will become associated to FP7, which gives greater opportunities not only for BiH but for the entire region (see-science.eu, 2007b).

Many regional projects have been launched with the objective of promoting regional cooperation in South Eastern Europe. Regional scientific cooperation is also being promoted within several regional organisations. BiH is participating in the following ones: the Central European Initiative (CEI), the Adriatic-Ionian Initiative (UNIADRION) with four BiH universities participating (both Universities in Mostar, the University of Sarajevo and the University of Banja Luka), the Stability Pact for South Eastern Europe, the International Centre for Genetic Engineering and Biotechnology (ICGEB) and the International Atomic Energy Agency (IAEA). Universiti Dzemal Bijedic of Mostar, University of East Sarajevo, University of Mostar, University of Sarajevo and University of Tuzla are individual full members and the University of Bihać is an individual associate member of the European University Association (European University Association, 2008).

The World University Service of BiH (SUS B&H) is a part of the World University Service of Austria (WUS Austria), an association committed to promoting education as a human right on the basis of academic freedom and university autonomy. WUS Austria was established as a non-profit organisation in Graz in 1983. Since 1994, it has developed a regional focus on South Eastern Europe and set up local offices in Belgrade, Podgorica, Prishtina and Sarajevo. It plays a consultative role with the United Nations and UNESCO (WUS Austria, 2006). The SUS B&H was established in 1999 as a humanitarian organisation. The main goal of the SUS B&H is to secure active and continuous support for the higher education sector, scientific research activities and civil society in BiH, as well as improving the general conditions in science and education, in order to prevent further brain-drain from the country. Its activities are based on the objectives of the Bologna Process and the European Union's Framework Programmes for research funding. The beneficiaries are governmental institutions, academic society, national and international non-governmental organisations, scientific and research institutions, private companies, and small and medium size enterprises (SUS BiH, 2006).

WUS Austria has been successful in putting into operation various projects in the Western Balkans, some of which include Centre of Excellence projects, Networking Infrastructure projects, Training Courses on Project Management and International Cooperation, Internet and Computer Training Programmes and so on. Bosnia and Herzegovina also benefits from ongoing WUS Austria projects, namely CDP+ (Course Development Programme Plus), BGP (Brain Gain Programme), BCC (Balkan Case Challenge), e-Learning, CIC (Counselling and Information Centres) and others (WUS Austria, 2006).

BiH is a part of the Bologna Process and over the past two years, some significant shifts have been recorded in its implementation. The biggest credit for this goes primarily to the public universities in BiH and the international community (in particular, the Council of

[10] Please see List of Acronyms

Europe, the European Commission in BiH and the Austrian Development Agency). A number of international projects have been started aiming at assisting BiH in accomplishing the objectives stated in the Bergen Communiqué (Sabanac, 2006):

- Quality assurance (TEMPUS project and the Joint Council of Europe and the European Commission in the BiH project "Strengthening Higher Education in BiH");
- Recognition of qualifications and study periods (Austrian Development Agency and the Joint CoE/EC Project);
- National Qualification Framework (Joint CoE/EC project).

Also a new Law on Higher Education has been adopted. The Law integrates the core principles in the area of higher education as established or being established in the European higher education area. Beginning with the universal principles of non-discrimination and right to education, the law governs the principles of autonomy of universities, integrated universities, the mobility of students and academic staff, the formation of state bodies in charge of higher education, and other such educational legalities (Sabanac, 2006).

At the international level, BiH's scientific community maintains links with partners abroad, sometimes making contact through former colleagues who have emigrated, thus preventing national isolation. Further links are created through European Union programmes such as Tempus, which has aided cooperation with other European universities. A few laboratories sought to participate in either the Integrated Projects (IPs) or Networks of Excellence (NoEs) of FP6[11] (Papon and Pejovnik, 2006), although it was not easy to fulfil this intention. The UNESCO report still asserts that there were no such projects funded with participation from BiH institutions, however, it can be stated that BiH institutions participate in three IPs funded by FP6. The National Information Point (NIP-BiH) reports 32 participations in different project categories, mainly in activities under specific INCO-calls. The NIP-BiH has since been transformed into a National Contact Point (NCP) in the 7th Framework Programme.

An agreement was signed between the Austrian Development Agency and the Foundation for Higher Education/SUS BiH which allowed for the establishment of the NCP system for EU Framework Programmes in Bosnia and Herzegovina. This project was supported by the Austrian government, the Open Society Fund and the Ministry of Civil Affairs BiH. NCP FP BiH activities are conducted to promote participation of BiH researchers and research organisations into the Seventh Framework Programme for Research and Technological Development. Activities targeted at the BiH scientific and research community (for example, academic institutions or industries) include consultations, FP7 information dissemination, organisation of information days and workshops for participants and project proposers, information on current FP calls for proposals and delivery of all other relevant information (NCP FP BiH, 2007a).

In 2007 the Ministry of Science and Technology of Republic of Srpska, together with the Universities of Sarajevo East and Banja Luka started the project 'Development of Capacities of Scientific and Research Higher Education Institutions in the Republic of Srpska for Participation in International Programmes (Centre for Project Management)' that has as its aim the strengthening of higher education institutions and research, but also the involvement

[11] FP6 was running up to the end of 2006. FP7 is fully operational as of 1st January 2007, and will expire in 2013. It is designed to build on the achievements of its predecessor, working towards the creation of a European Research Area, and carrying it further towards the development of a European knowledge economy and society.

of other institutions in the Republic of Srpska in European programmes for science and higher education (FP7, TEMPUS etc.) and to improve international co-operation of these institutions (Center for Project Management, 2008).

Although it is obvious that Bosnia and Herzegovina could benefit a great deal from research projects funded by the present European Framework Programme, a realistic appraisal of the present situation in research laboratories throughout the country leads us to conclude that the great majority would not be able to compete in getting their projects approved and funded, since their equipment is often obsolete (Papon and Pejovnik, 2006). As regards FP6 (which ran between 2002 and 2006), research organisations from BiH could participate with the possibility of funding within the activity area of INCO (International Cooperation). Furthermore, they could participate in the activities of the seven Thematic Priorities, provided they operated using the budget reserved for cooperation with third countries. Also, as a third country, BiH participated in the Human Resources and Mobility Programme (Marie Curie Activities) within the specific programme 'Structuring the European Research Area'. For the time being, the activities of BiH's scientific-research organisations in EU framework programmes are reflected in their participation as partners in project consortia. Partners from Bosnia and Herzegovina acted as part of the consortia in some successful projects in the Fifth Framework Programme - FP5. Under FP6, BiH has had a significant percentage of success compared to FP5 (NIP FP6, 2006). Ten projects have already been successfully completed, and further 30 are in the process of implementation (NCP FP BiH, 2007b).

In 2007 eight scientific institutions from BiH participated successfully in the SEE-ERA.NET Pilot Joint Call. SEE-ERA.NET is a co-ordination project running under the 6th Framework Programme of the European Union. It aims at structuring and expanding the European Research Area (ERA) to the Southeast European (SEE) countries by co-ordinating and supporting Research and Technological Development (RTD) activities conducted at bilateral level between 15 consortium members. The partners are from "old" and "new" member states, candidate countries and Western Balkan countries (WBC). The Austrian Centre for Social Innovation (ZSI) is the co-ordinator of the project. The Coordinator for Bosnia and Herzegovina in SEE-ERA.NET project is the Ministry of Foreign Affairs BiH (Camur, 2008).

Experts highly recommend participation of BiH in the COST and Eureka Programmes, both of which would entitle both SMEs and academic laboratories to be involved in a wider range of RTD activities. Participation of BiH in these two programmes, coordination and funding, could come from the Ministry of Civil Affairs (Camur, 2008).

3 The Input Side of the National Innovation Systems

The current economic situation in Western Balkan countries still poses significant constraints on national policies in R&D. Most countries in the region are still at less than 30% of the EU-25 GDP per capita average, hardly reaching 60-80% of their 1989 GDP. Restrictive fiscal and monetary policies, necessary for attaining macroeconomic stabilisation, allow limited public expenditure and have generally contributed to the low investment rates, experienced also in the R&D sector. Although financial assistance received from abroad is significant, it is not always provided on a continuous basis (Uvalic, 2006).

3.1 Expenditure on R&D

In the European Union and among its national economies, research and development are considered to be the key resources for increasing competitiveness and long-term growth. As part of the transition to a knowledge-based economy, one of the actions called for by

the Lisbon European Council in March 2000 was to stimulate the creation, absorption, diffusion and exploitation of knowledge (through the European Research Area), to develop education and training to improve the knowledge of society, and to encourage the start-up and development of innovative businesses. At the Barcelona Council meeting in March 2002, one of the strategic objectives agreed upon was to increase the R&D expenditure to 3% of GDP by 2010, two-thirds of which should originate from the private sector. [12]

It is difficult to come up with an exact evaluation of public investment in R&D activities in BiH, mainly due to the absence of national aggregated statistics. The Agency for Statistics of Bosnia and Herzegovina (BHAS) only began collecting and monitoring data on R&D in 2005, and the general statistical system of BiH is still not compliant with the relevant European standards. The signature of the 'Agreement on the implementation of harmonised methodologies and standards in preparing the statistical data of Bosnia and Herzegovina' between the country's statistical institutions has been a positive step. This agreement sets out clear guidelines on the roles and responsibilities of the state-level Agency for Statistics of Bosnia and Herzegovina and the entities' statistical institutions. As a result of this agreement, the entity institutions will be obliged to use standard statistical methodologies, classifications and nomenclatures as regulated by the BHAS, pursuant to EU and international standards. However, difficulties have been encountered in the implementation of the agreement (European Commission, 2006a).

According to official figures as reported by Papon and Pejovnik, the present funding of R&D activities in BiH fluctuates at around 0.05% of GDP (Papon and Pejovnik, 2006). Other estimates made by the country's stakeholders range between 0.05 and 0.15%. In 2006 Gross Expenditure on R&D (GERD) was only 0.05% of the GDP (INA - Great-IST, 2007), while in 2007 GERD was 0.075% of the GDP (on base public funding) of the Republic of Srpska (Camur, 2008).

In BiH, most of the research infrastructure is obsolete, many laboratories lack operating funds, libraries are unable to pay subscription costs to international science journals and internet connections suffer from low bandwidth and the fact that BIHARNET (the Academic and Research Network) has been out of use since 2000 (as described in chapter 1.6: R&D Infrastructure). The younger generation currently attending higher education institutions has no means of being trained in research activities and the majority of industrial research has been dismantled (Papon and Pejovnik, 2006). As already mentioned, no funds are available for science at the state level - expenditures are periodical and minor, mainly realised through the two entities and on the cantonal level. The government's main priority remains to bring the level of expenditures on R&D back to the pre-war (1992) level of 1.5% of GDP. Bearing in mind that Bosnia and Herzegovina's GDP has barely reached 70% of its pre-war level, it is clear that the amount spent on R&D is extremely low. Funding of R&D activities is far below the level attained by almost all other European countries – the average share of R&D national expenditure of GDP for the EU-25 being 1.9% - in some larger Member States it is even equal to or above 2% of GDP, and aims to reach 3% of GDP by 2010, in line with the Lisbon objectives.

It is quite understandable that under such conditions of fragmented S&T structures and severe budgetary restraints, no research policy at the state level can be developed. Currently, there are no tools to help assess the situation and needs (manpower and infrastructure), or to define the priorities, organise the co-ordination of activities within the country, mobilise funding for research activities and stimulate international cooperation. However, there are a few research institutions that operate at state level, co-operating with partners in several regions

[12] In the EU-27 in 2006, average general expenditure for R&D was 1.84 % of GDP (CORDIS and Community Research and Development Information Service, 2007)

and abroad. This clearly shows that the possibility of undertaking joint tasks at the state-level remains, in spite of the current difficulties. The absence of state institutions which would define and implement RTD policy is a major obstacle in reconstructing research activities in BiH (Papon and Pejovnik, 2006).

3.2 R&D Infrastructure

In her survey on the national systems of research and development in the Western Balkan Countries[13], Milica Uvalic concluded that the general situation regarding the R&D infrastructure in Bosnia and Herzegovina is highly unsatisfactory. Before 1992, R&D activities were primarily undertaken within large industrial faculties and their research divisions (for example, Energoinvest Company), and to a much lesser extent, in higher education institutions (only at some technical faculties). During the war, much of the industry was destroyed and the R&D infrastructure completely disintegrated. Today, research equipment is usually provided without an overall strategy, so problems of incompatibility and non-uniformity of equipment frequently arise (Uvalic, 2006).

The new legislation on public procurement has rendered the purchase of equipment very complicated, leading to instances where sometimes the cheapest options are selected, while more important aspects, such as the compatibility and the quality, are often neglected. Obtaining approval from the relevant ministries to purchase new equipment for research or education purposes with custom and tax deductions is a burdensome process, and thus highly discouraging. An upward trend has been registered regarding the use of ICT in research institutions, although the pace of this improvement is also not very satisfactory (Uvalic, 2006).

Internet connections in BiH were established relatively late (mostly due to the effects of the war), and no significant improvement has been made either in the quality of internet connections, or in the development of research and education networks. Although all research and education institutions have PCs, their exact number is unknown. In higher education institutions only around 60% of computers are connected to the internet, thereby failing to take advantage of computer technology. Internet penetration in BiH in 2006 fluctuated at around 17.7% (over 800,000 people were using the internet). This share is somewhat similar to the global average in 2007 (approximately 20% or 1,3 billion internet users around the world, according to the latest statistics), although it does not compare to the EU average (51.3% or about 253 million Internet users in 2007, according to the Internet World Stats website[14] (Internet World Stats, 2007).

The Academic and Research Network of BiH (BIHARNET) was established in 1998, with the aim of connecting education and research institutions to the internet, and developing a national research and education network. Even though the state did not participate in founding or financing the network, BIHARNET was the only actor of higher education, science and culture, organised at the state level. The foundation of BIHARNET and its central administrative and technical unit, the BIHARNET Centre, was made possible through a donor-funded project led by the government of the Republic of Slovenia, which provided all financial resources for the development of the network, technical equipment, staff and telecommunication fees. The donors' project was terminated at the end of 1999, but Slovenia continued providing internet access to BIHARNET throughout the year 2000. Unfortunately, after the state government of BiH failed to pay for these services, the Slovenian Telecom disconnected BIHARNET entirely,

[13] For the purposes of SEE-ERA.NET Consortium - Integrating and Strengthening the European Research Area in Southeast Europe.
[14] http://www.internetworldstats.com/stats4.htm

leaving the academic community of BiH without international connectivity. Due to the lack of any significant funding, BIHARNET has been out of use since the end of 2000 (TERENA, 2003). Since January 2007, a new cross-border dark fibre cable has provided high speed internet connection to the research community in Bosnia and Herzegovina. This initiative is part of the South-Eastern European Research and Education Network (SEEREN2) and is a result of monthly efforts of all the BiH partners and the National Research and Education Networks of Greece (GRNET) and Serbia (AMRES) (SEEREN2 Project, 2007).

The Republic of Srpska's academic research network, SARNET, was officially connected to the European academic and research network, GEANT, in December 2006. The event also took place within the framework of the EU-financed initiative SEEREN2, which aims to make innovative technologies and services available to researchers, educators and scientists across the Western Balkan region (SEEREN2 Project, 2007).

IS2WEB, a project to integrate scientists into the IST programme of the FP6 and SEE-INNOVATION (focussing on the integration of SMEs in the field) also operates in Bosnia and Herzegovina, collaborating with the World University Service of BiH (SUS BiH, 2006).

The National and University Library (NUL) of BiH offers various services to its users, including the library website and an on-line catalogue. NUL is the national agency for ISSN, ISBN and Cataloguing in Publications (CIP), and is also the depositary library for the publications of several UN organisations. Today, NUL has a collection of about 500,000 books, periodicals and other documents (in comparison to 3 million before the war). The destruction of Vijećnica, the historical building of the NUL, in mid-1992 represents one of the most tragic consequences of the war, in terms of education and research. NUL publishes the National Bibliography in three series: monographs, periodicals, and articles in serial publications. Thanks to the implementation of the co-operative cataloguing system, some records are accessible automatically and there are a number of other libraries throughout BiH which also use this system[15] (Uvalic, 2006).

A contemporary bibliographic information system and an information system on research activities, supporting knowledge-based development, are among the absolute prerequisites for any modern information society. BiH has been a member of COBISS (Cooperative on-line bibliographic system and services) since 1998. COBISS was established by the Slovenian Institute of Information Sciences (IZUM) in 1991. The cooperation between the COBISS Centre and COBISS in BiH was temporarily disrupted in September 2004, due to some difficulties in gaining the necessary funding from the ministries. In January 2006, 380 libraries were using COBISS software for automatisation of their activities (293 Slovenian, 44 Serbian, 21 Macedonian, 13 BiH and 9 Montenegrin libraries). IZUM has been pursuing the development of the third generation of applicative software (COBISS3) since 1997, using a new technological platform (COBISS.SR, 2006). Furthermore, the National and University Library of Bosnia and Herzegovina has a 'basic participant' status under The European Library project, a project which is being realised through the authorities of the Conference of the European National Librarians and the European Commission. It involves 32 European National Libraries participating as full members, along with 15 basic participants, including BiH (The European Library, 2006). The Commission aims to achieve not just a single database, but rather integrated access to the digitalised material of Europe's cultural institutions through a single multilingual entry point. From 2007 collaboration has expanded to archives and

[15] Public and University Library in Banja Luka, Sarajevo City Library, Faculty of Philosophy Library in Sarajevo, Public and University Library "Derviš Sušić" Tuzla, Public Library Zenica, Public and University Library BiH, City Library Mostar, Faculty of Law Library Mostar, Mechanical Faculty Library Zenica, Library for the Blind Sarajevo, Library of Academy of Sciences and Arts BiH Sarajevo, Medical Faculty Library in Foča (Uvalic, 2006)

museums. 2,000,000 books, films, photographs, manuscripts, and other cultural works are accessible within The European Library (Cousins, 2007).

A report by the INASP (International Network for the Availability of Scientific Publications) entitled 'Accessing and Disseminating Scientific Information in South Eastern Europe', was undertaken in 2006 for the purposes of UNESCO-ROSTE. It analysed the existing infrastructure of the Western Balkan countries in detail, particularly the situation regarding connectivity, e-journals, libraries, and e-publishing. The report confirmed great variety among individual countries in the Western Balkans in each of these areas of scientific information dissemination. According to the INASP findings, researchers in Bosnia and Herzegovina still lack good connectivity and wide access to international journals and databases. Indeed, some pockets of access and connectivity do exist, but problems with mobilising both funds and commitment for these purposes still occur. INASP has suggested various areas for activity (for example, providing access to international journals, online journal services, open access publishing and archiving, regional cooperation) (INASP, 2006).

3.3 Human Resources in R&D

Dramatic consequences for human resources in the Western Balkan countries are just a part of the aftermath of the break-up of the SFR Yugoslavia, which led to military conflicts, recurrent economic crises, severe budgetary restrictions, industrial restructuring and other reforms accompanying the transition to a market economy. Over the last years, there have been two processes directly affecting the R&D sector: the massive and continuous brain-drain, frequently of top experts who emigrated to seek employment opportunities abroad; and the so-called 'brain-waste', where specialists leave their professions for better paid jobs in the private and/or informal sector of the economy. Both phenomena have had profound implications for the human capital of the Western Balkan countries, especially in Bosnia and Herzegovina, Serbia and Montenegro (Uvalic, 2006).

A joint UNESCO/Hewlett Packard (HP) project on piloting solutions for alleviating the regional brain drain was implemented in 2003 in several Southeast European countries. By providing resources, including technological and financial facilities, to various universities, the initiative has enabled young scientists from the region to work within the framework of joint research projects with their fellow-nationals living abroad. The project has provided grid technology to various universities from Albania, BiH, Croatia, FYR of Macedonia, Serbia and Montenegro. Moreover, at the regional level, regular project meetings have also acted as a stimulus for transcending boundaries. Not only has the project strengthened scientific and educational capacities at the national level, it has re-established dialogue among young researchers from the region after years of broken communication. The networks created with UNSECO/HP support function autonomously, with the objective of sharing innovative experiences to help researchers from the region consolidate local capacities and undertake research beyond borders, without leaving their home countries permanently (Preda, 2007).

Before 1989, the number of researchers and research institutions in former Yugoslavia was considered too large, so a general decline in the R&D personnel in its successor states was logically expected. Today, the attractiveness of R&D professions in all Western Balkan countries has become a major problem. The higher education sector still remains the main employer of researchers, while the academic community is getting smaller and older because a research career is not appealing enough to young researchers (the main reasons being low payment, no social standing and other incentives are limited). Rising inequality and social differentiation have also led to the disruption of traditional values, so in contrary to the situation before 1989, a university degree is no longer a guarantee for getting a job (Uvalic, 2006).

In 2006/2007 there have been 65,630 enrolled students in institutions of higher education in the Federation of BiH, 6,967 students have graduated, 252 people have gained a Masters of Science and 108 have become doctors of science (Federal Office of Statistics, 2007).

In Bosnia and Herzegovina there are no statistics on the total R&D personnel, only on the number of professors and assistant professors at various higher education institutions. The total number of professors and assistant professors at eight universities in BiH in 2006 stood at around 3,000[16]. The largest human potential in higher education is registered at the University of Sarajevo, followed by the University of Banja Luka, the University of East Sarajevo, the University of Tuzla and the University of Mostar. However, the research activity at higher education institutions is reported to be almost non-existent, since professors are mainly oriented towards teaching (Uvalic, 2006).

There is an absolute urgency to re-invest in scientific and technological research in BiH. Launching an ambitious programme to train Ph.D. students, thus educating a young generation of scientists and building-up the country's research infrastructures are priority tasks for which state-level funding (complemented by international funds) is necessary. It would also be desirable to gradually increase salaries of scientists in higher education institutions and research institutions and to invest more time in research activities (Papon and Pejovnik, 2006).

4 The Output Side of the National Innovation Systems

The output of an innovation system is manifested through the new knowledge, new products and processes which are produced. Whereas indicators such as the 'Gross Expenditure on Research and Development' and the 'Number of Researchers' provide a measure of the resources potentially allocated to innovation, this chapter focuses on the scientific output such as patents and publications.

4.1 Patenting Activities in Bosnia and Herzegovina

Among other approaches, innovative output can also be measured by patent data, the most important advantage of which is the wealth of the information supplied. A patent file granted by the European Patent Office (EPO) provides data on the invention, which is protected by the patent through the title, abstract and technological classification. Furthermore, patent data represent the only output measure available for almost all countries in the world, including the Western Balkan countries (Hörlesberger, 2006).

European inventors today have a choice between two alternatives when seeking patent protection for their inventions: the European Patent Office (EPO) and national patent offices. The EPO was set up to provide patent protection through a single procedure, defining the granting of patents in some, or all, of the contracting states of the European Patent Convention (EPC). The procedure for obtaining a patent at the EPO consists of two phases and sometimes a third phase to deal with possible objections. In contrast to national patents that are valid in only one country, a European patent gives its proprietor equivalent rights to a national patent in each member state. Moreover, European patents may also be effective in some countries, including BiH, that have not acceded to the EPC. BiH holds a so-called "Extension state" status within the EPO - this means it recognises European patents, although it is formally not a member of the organisation (European Patent Office, 2006).

[16] Official statistics for the Federation of BiH (Statistical data on economic and other trends, January 2005) show, that there were over 2,000 teachers and advisers in the six universities of the Federation and 58,000 students.

A second barrier to patenting is the cost associated with a patent application. Studies estimate that the cost of an application and the 10-year maintenance of a patent at the EPO are approximately EUR 32,000 (Roland Berger Market Research, 2004). In contrast, applications to national patent offices may be less expensive (applications to local patent offices in the Western Balkans in particular can be expected to incur a considerably lower cost than an application to the EPO) (Hörlesberger, 2006).

On 1st December 2003, the president of the EPO and the Minister of Foreign Trade and Economic Relations of BiH signed an agreement on cooperation regarding patents (Co-operation and Extension Agreement). This agreement entered into force on 1st December 2004, which means that since then, it has been possible to extend the protection conferred by European patent applications and patents to Bosnia and Herzegovina. Extended European patent applications and patents will essentially enjoy the same protection in Bosnia and Herzegovina as the patents granted by the EPO for its current 30 member states. According to the EPO, extension to BiH can be requested for any European and international patent application filed on or after 1st December 2004, but neither is available for applicants filed prior to this date, nor for any European patent issued from such applications (EPO, 2006).

The CARDS Intellectual Property Rights (IPR) project launched by the European Commission helps all BiH institutions in charge of intellectual property protection and enforcement to harmonise IP laws with WTO requirements and EU directives, and to offer effective protection to intellectual property rights holders at the national level. Completion of the CARDS IPR project will contribute to the archived specific objectives, such as ensuring adequately educated staff for implementing administrative procedures before the Institute for Standards, Metrology and Intellectual Property of Bosnia and Herzegovina (CARDS, 2006).

The Institute for Standards, Metrology and Intellectual Property of Bosnia and Herzegovina is the legal successor of the Institute for Standardisation, Metrology and Patents, established in 1992. The new institute was set up in December 2000, and its responsibilities have been extended to include not only Industrial Property Rights Protection (covered by the previous Institute), but also Protection of Copyrights and Related Rights (CARDS, 2006). The Book of Rules for the internal organisation of the Intellectual Property Institute was approved by the Council of Ministers in May 2006 and five units were established. The institute is considerably under-resourced, which undermines its capacity to perform its tasks efficiently (European Commission, 2006a).

The Hörlesberger survey states that over 2,000 patents have been granted since this state agency was founded in 1992. As the number of patents granted is greatly influenced by the limited resources at the institute, the author only discusses the number of patent applications (in total from 1992 to 2005). The record shows that two technologies accounted for more than 70% of all patents applied for: Pharmaceutical Industry and Cosmetics, with 38% of all patents applied for, and Organic Fine Chemistry, with another 35%. Together with biotechnology and medical engineering, each with shares of 2%, these related industries account for more than three quarters of all patent applications. The other important technological fields were civil engineering, building and mining with 3% of applications, and consumer goods and equipment accounting for a further 2% (Hörlesberger, 2006).

5 National R&D Strategy and Legal Framework

Most S&T policies in the Western Balkan region are characterised by their encouragement of sustainable support for basic research at higher education institutions and research institutions, for the development of human resources, and for cooperation within the European

Union's framework programmes for RTD and joint research programmes with the European Science Foundation or bilateral agreements (Dall, 2006). In technology policy, emphasis is placed on linking research institutions, as sources of knowledge, with industry and SMEs, and encouraging the establishment and functioning of intermediary institutions – although the success of such a policy in practice is still being questioned (Kobal, 2005).

This chapter discusses the legal framework for national R&D strategies, presents the main documents reflecting these strategies, and highlights the main fields for intervention and research priorities in Bosnia and Herzegovina.

5.1 Legal Framework for the National R&D Strategy

The legal framework and the legislative pace and intensity in BiH have suffered a great deal from the fragmented and decentralised political-administrative system following the Dayton Peace Agreement. Some of the legislation on R&D activities has been taken over from the former Yugoslavia, and as such, does not correspond to new needs, while other parts of the legislation are based on entity laws or BiH state regulations. Although a number of important laws have been adopted between 2001 and 2002 (including the Law on the Establishment of the Institute for Standards, Metrology and Intellectual Property, the Law on Industrial Property, the Law on Copyright and Related Rights and the Law on Standardisation), it was not until 2005 when a framework for a Law on Science at the state-level was drafted (Uvalic, 2006).

Table 5.1: Important Laws in the Legal S&T Framework of BiH

- The Law on Freedom of Access to Information (Official Gazette of BiH 28/00)
- The Law on the Central Database and Exchange of Information (Official Gazette of BiH 32/01)
- The Law on Establishment of the Institute for Standards, Metrology and Intellectual Property (Official Gazette of BiH 19/01)
- The Law on Industrial Property (Official Gazette of BiH 3/02)
- The Law on Copyrights and Related Rights (Official Gazette of BiH 7/02)
- The Law on Telecommunication (Official Gazette of BiH 2/01)
- The Law on Standardisation (Official Gazette of BiH 19/01)
- The Law on Scientific and Research Activity (Official Gazette of RS 4/02 and 68/07)
- The Framework Law on Higher Education (Official Gazette of BiH 59/07, 2007)

Papon and Pejovnik strongly recommended that the drafting of the Law on Science (currently in a preliminary phase) involves the main stakeholders of the present research system in BiH (the ministries and administrations in charge of science and innovation in the political-administrative entities of the country, the academies, higher education institutions and research institutions and representatives of the economic sectors). These actors should assess the present situation of BiH's research potential and the complementary roles played by various institutions in charge of S&T policy in the country (Papon and Pejovnik, 2006).

The new Law on Science should define (Papon and Pejovnik, 2006):

- the responsibility of the BiH state in the definition of a S&T policy;
- the role and means of a state-level institution to be created for the implementation

- the legal framework needed to implement this policy: statutes of state institutions to be created whenever necessary, statutes of researchers not employed by higher education institutions, specific regulations regarding cooperation between research institutions (e.g. public and private);
- the means to evaluate projects, programmes and institutions;
- the rules for intellectual property protection.

In principal, the Law on Science will define the general objectives of BiH's S&T policy and provide the legal framework in which the research system will operate. The law should also encompass the guidelines and institutional means for defining priorities and funding research activities at state level (Papon and Pejovnik, 2006).

Bosnia and Herzegovina's Parliament adopted a Law on Higher Education on 30th July 2007, enabling diplomas issued in the country to be recognised internationally. Adoption of the law means BiH diplomas will now be recognised within the European Higher Education Area and potentially worldwide. The Law is a subject of hot debate, particularly since it would put higher education funding in the hands of the entities - the government of the Republic of Srpska, and the Federation of BiH's cantons - instead of those of the state. This could be interpreted as meaning higher education is not consistent across BiH, since the funding is not a standard issue (Southeast European Times, 2007). BiH Commission for Cooperation with UNESCO reported on 1st June 2007 that the latest Draft Law on Higher Education is significantly removed from the spirit and the principles of the Bologna Declaration and is not a good ally for Bosnia and Herzegovina and its EU integration ambitions. Its public statement emphasizes the concerns caused by the system of financing that keeps the existing differences on entity and cantonal levels, which provides the political elites with dominant influence on the development of universities, enrolment policies and election of management (OneWorld Southeast Europe, 2007).

5.2 Main Documents Reflecting National Strategies for Research, Development and Innovation

International assistance helped in formulating many of the Research, Technological Development and Innovation (RDTI) strategies relevant to Bosnia and Herzegovina. However, as the government still has not devised a national RTD strategy, the major document remains the Medium Term Development Strategy PRSP (Poverty Reduction Strategy Paper) for the period between 2004 and 2007. Its implementation will contribute to the preparation of the country's integration into the European Union, with the focus on signing and implementing the Stabilisation and Association Agreement, which has been published along with the corresponding multi-annual indicative programmes and other documents relating to the CARDS assistance and Council Decisions. The Economic Policy and Planning Unit - which is now the Directorate for Economic Planning - was formally established by a law adopted in September 2006. This body has overseen the monitoring of the Medium-Term Development Strategy, updated in March 2006 (European Commission, 2006a).

The Medium Term Development Strategy PRSP sets several sector priorities, each with a few research components. In the priority sphere of education, one of the six goals is to develop scientific research as a prerequisite for quality education (Council of Ministers of Bosnia and Herzegovina, Ministry of Foreign Trade and Economic Relations et al., 2004b). The document states that science and research have been entirely neglected in the education system. The PRSP identified support measures for the key sectors of industry, including the creation of entity funds in order to support scientific research. It also encourages companies to adopt

international standards and introduces incentives for the investment in new technologies. In the sections on agriculture, forestry, energy, and health, the application of scientific achievements and modernisation of education and research were mentioned, but not in any great detail. In the ICT sector, the focus is on the academic ICT network BIHARNET. Although there is currently no systematic mechanism at national level to develop a national research and education network, the vision is to re-establish BIHARNET, which does not function in practice although it still formally exists (see chapter 1.6) (Council of Ministers of Bosnia and Herzegovina, Ministry of Foreign Trade and Economic Relations et al., 2004a).

The Policy, Strategy and Action Plan of the Information Society of Bosnia and Herzegovina for the period 2004-2010 has also been adopted. These documents outline a clear commitment to stimulating research in the field of ICT, critically stating that in BiH, research is often considered to be expensive, thus a privilege only afforded by rich countries. The assessment of the industrial sector in these documents is very bleak, but ICT is seen as the key factor for development. Support measures, such as the establishment of state science and technology funds and the development of technology parks and incubation centres, are mentioned. Nevertheless, one should bear in mind that research funds are practically non-existent, even on the sub-state level (Council of Ministers of Bosnia and Herzegovina and United Nations Development Programme-UNDP, 2004).

In November 2002, the education authorities published five pledges in a document called 'Message to the People of Bosnia and Herzegovina: Education Reform'. Priority areas for S&T reform were identified as the following: raising the quality of higher education and research in BiH; significantly increasing the number of people with access to higher education and ensuring full participation of BiH's higher education institutions in the European Higher Education Area by giving them autonomy in decision-making; promoting research that will improve the academic system; and supporting overall social and economic development. In this respect, the government demonstrated its determination to continue strengthening scientific and research activities by increasing the budgetary resources dedicated to research, developing new legislation for scientific research and ensuring tax benefits for scientific institutions and individuals conducting scientific research. Furthermore, the government promised to improve the quality of learning and teaching in higher education institutions and increase their contribution to cultural, economic and social development. This will be achieved by providing competitive access to the aforementioned funding, and by allocating competitive grants specifically for research projects within the new funding system for higher education, in order to support and strengthen the research carried out by students and academic staff (Republic of Bosnia and Herzegovina, 2002).

Pledge 4 of this Education Reform Strategy specifically deals with the S&T sector: in line with the Bologna Declaration and the Lisbon Strategy, it aims to raise the quality of higher education and research in order to improve the academic system and to support overall social and economic development. However, the reform paper also clarifies that successful implementation of all the strategic goals is contingent upon early adoption and implementation of the new legislation, regulations and funding mechanisms for higher education at all levels (Republic of Bosnia and Herzegovina, 2002).

The European Commission's 2006 Progress Report for Bosnia and Herzegovina shows that little progress has been made in the field of education, mainly due to the country's complex institutional set-up - as described above, fourteen ministries in BiH are responsible for education: one at the state level, one per entity, one for the Brčko District and one for each of the ten cantons. Improvements regarding the legal framework have been slow, with key legislation still pending, and weak implementation of existing legislation. As a result, BiH is

still not fulfilling the requirements set out in the Bologna Process (European Commission, 2006a).

Other important strategic documents include the National Environmental Action Plan of BiH, which includes objectives to provide support for scientific research and continuous education in the field, to stimulate the development of new technologies and to upgrade existing ones and/or replace them with environmentally acceptable alternatives (Federation of Bosnia and Herzegovina, 2003), the Strategic directions of science and technology development in the Republic of Srpska (2004) and the Strategy of science and technology development of Bosnia and Herzegovina (ANUBiH - UNESCO funding, 2006).

The Multi-Annual Indicative Planning Document 2007 - 2009 for the Instrument for Pre-accession Assistance (IPA), the so-called MIPD, also touches upon the issue of RTDI. It states that a sound and comprehensive research policy is necessary as well as an industrial policy. These policies shall be adopted and implemented and capacity building to this end shall be supported within the framework of the IPA (European Commission, 2007b).

Table 5.2: Main Documents Reflecting National Strategies for Research, Technological Development and Innovation (Dall, 2006)

BiH Medium Term Development Strategy 2004-2007 / PRSP - Poverty Reduction Strategy Paper	It sets out several sector priorities which have a research component, mainly education and industry.
Public Investment Programme (PIP)	It is in line with the Mid-term Development Strategy and determines concrete projects for implementation.
Policy, Strategy and Action Plan of the Information Society of Bosnia and Herzegovina for the period 2004 -2010	The documents were adopted in November 2004 and contain a clear commitment to the stimulation of research in the field of ICT.
MIPD (Multi-Annual Indicative Planning Document 2007 - 2009 for IPA)	This document states that BiH will have to develop a sound and comprehensive industrial policy and an integrated research policy. An industrial, as well as a, research/innovation policy will be adopted and implemented. The MIPD also pledges to support capacity building for the development of a Research and Innovation Policy.
Mid-term expenditure framework (MTEF)	It has so far been adopted at entity level but from 2005 onwards will be adopted at the state level.
Education Reform Strategy 'A Message to the People of Bosnia and Herzegovina, Education Reform'	It contains one pledge regarding the improvement of science and research in the higher education sector.
National Environmental Action Plan BiH (NEAP)	Scientific research shall stimulate the development and implementation of environmentally friendly technologies.
- Export Strategy of BiH - Strategy of Small and Medium Size Enterprises - Strategy of Foreign Investments - Strategy of Corporate Restructuring - Strategy of Public Administration Reform - Strategy of Agriculture - Strategy of Food Safety - Preparation of corporate restructuring plan is underway.	The preparation of these further documents has started.

5.3 Main Fields of Intervention and Research Priorities in Bosnia and Herzegovina

According to Dall, the connection between basic and applied research, as well as between academic and industrial activities needs to be developed more thoroughly. In the industrial sector, the PRSP acknowledged the following branches of industry as being of strategic importance and considered their development to be worthy of stimulation: wood processing, food processing, textiles, leather goods and footwear, metalworking, tourism, energy and ICT. A series of measures for restructuring and modernising industries, strengthening their competitive ability and export capacities, and improving the entrepreneurial environment and market transparency have been selected. To date, neither S&T policy nor RTD as a strategic intervention have been consciously interlinked with the economic reform process. S&T policy and R&D strategy need to be created and implemented as soon as possible, to include clear structures for decision making, as well as general policy objectives and major legal provisions at the state level. The adoption of the Law on Science is of the utmost importance. Furthermore, policy development and policy delivery need to be supported by statistical data, which is currently of very limited availability. S&T institutions, as well as the human resources available, need to be registered, mapped, evaluated and connected (Dall, 2006).

Cooperation across inner-Bosnian and Herzegovina borders, within the region as well as with international partners, should be fostered. The establishment of academic and research networks relating to institutional cooperation and ICT connection (BIHARNET) is an important step in this direction[17]. Efforts to reinforce bilateral and multilateral scientific and technical cooperation and to join international research projects supported by the European Union must continue.

Another area for intervention is to emphasise applied research as the main orientation in the RTD sector. Since there are no research funds at state level, there has been no operational setting of the thematic priorities, but in the upcoming period applied research in the following areas will be prioritised: electric power industry, information and communication industry, food industry, woodworking and wood-pulp industry, mining and ferrous metallurgy, machine-building and metal working and chemical and petrochemical industry.

The national and regional authorities should give first priority to stabilising, if not normalising, relations within the country. This would bring much needed stability to the region and help attract investment from abroad. Not to mention that it should heal the deep fragmentation of the national market due to the 'cantonisation' of the country. According to the SBRA-Great-IST Report, the government should give a greater priority to ICT, beyond the strategies which are rather generic and disorganised, often the result of wishful thinking of authorities to follow the priorities and recommendations of the EU community - rather than actual possibilities of the country and its parts. Thus the new strategy proposed by the Academy of Arts and Sciences of Bosnia and Herzegovina which will be presented soon under the title Strategy for the S&T Development of BiH, will hopefully contain realistic goals - harmonisation of the priorities in the field of science and research through various programs, projects and actions on university capacity-building and participating in the FP7 (SBRA- Great-IST, 2007).

The SBRA–Great-IST Report has stated some of the weaknesses and threats for BiH ICT domain (SBRA- Great-IST, 2007) such as big discrepancies between the normative regime and the actual state of affairs in the ICT domain; poor broadband infrastructure and access; deep fragmentation of the national market due to cantonisation of the country; inaction of

[17] BIHARNET is currently not functioning due to the lack of funding. See Chapter 1.6.

broadband development and uptake.

On the other side there are several strengths and opportunities (SBRA- Great-IST, 2007): strong growth of IT sector; Council of Ministers established a dedicated government agency, allowing more effective coordination of ICT sector; previous experience (prior to 1991, Bosnia and Herzegovina had a vibrant technology heritage, boasting sophisticated applications of mainframe and server-class computer technologies); development of private sector ICT-focused education opportunities; positive regional ICT trends and a potential for a 'spillover' of innovation and experimentation, through peer networks and open communities of knowledge.

5.4 Guidelines for the Future S&T Framework

In order to support the development of the R&D sector in Bosnia and Herzegovina, a series of recommendations have been issued through various international organisations, such as UNESCO. French professor and scientist Pierre Papon, Professor of Thermal Physics at the Ecole Supérieure de Physique et Chimie Industrielles in Paris, is one of the authors who have dealt with this issue in recent times, contributing substantial scientific input in attempts to ameliorate the existing situation in the sectors of science, technology, research and development in Bosnia and Herzegovina. With the help of Professor Stane Pejovnik, he has written the Guidelines for a Science and Technology Policy in Bosnia and Herzegovina, commissioned by the UNESCO Office in Venice, in which they discuss the scientific potential of BiH with a focus on research infrastructure. In this report, the authors introduce a series of guidelines and recommendations for science and research policy in Bosnia and Herzegovina, based on a thorough analysis of the present situation and problem issues in the country. They then suggest changes to be made in the near future, in terms of R&D funding and the creation of state-level institutions, which would be able to define and implement the policy introduced by the newly drafted Law on Science. The authors also offer some explanations as to why research is of vital importance for the future of Bosnia and Herzegovina, specifying priorities for action, S&T policy tools, the role of regional and international cooperation and of international organisations.

The authors suggest that funding of R&D should be divided into three stages, involving the BiH state, the political-administrative entities (the Republic of Srpska and the BiH Federation), some cantons (in particular those which support higher education institutions) and the private sector (industry and services). In the short term (2006-2009), it is recommended that integration of R&D as a transversal priority for the development of BiH should be taken into account during the revision of the Medium-term Development Strategy. The objective of this stage would be to double current investments in research activities in BiH. In the medium-term (2010-2012), the authors suggest the adoption of a financial plan with a global yearly expenditure by the public entities (state or other entities) and the private sector representing at least 0.5% of the country's GDP. This funding should be complemented by additional investments and loans (for example from the European Investment Bank and the World Bank). During the same period, industry should increase its own R&D investment, which might represent one third of total R&D expenditure of the country by 2012. The authors agree that BiH should invest 2% of its GDP in R&D as a long-term goal (Papon and Pejovnik, 2006).

Rebuilding the scientific and technological potential of BiH requires the adoption of a 'road-map', with three general medium-term objectives (2006-2015) (Papon and Pejovnik, 2006):

- training a new generation of scientists in BiH's higher education institutions or abroad;
- developing research infrastructures (experimental equipment, computers, information networks and libraries) to international standards;
- reinvesting in industrial research in a limited number of sectors.

Furthermore, the authors stressed the necessity of defining the S&T policy at state-level in BiH in order to rebuild a recognised and effective competence in science and technology in the country and to develop research activities which may also address BiH's socioeconomic development needs (Papon and Pejovnik, 2006).

In order to define and implement a functioning state-level R&D policy, the authors recommended the establishment of several institutions, primarily, a state-level ministry responsible for science and research policy (either an existing ministry, for example, the present Ministry of Civil Affairs, or a purpose-created ministry), a State Agency for Science and Research as an advisory body under the responsibility of the State Ministry, an Advisory S&T Committee chaired by the Prime Minister with the mandate of defining the main guidelines and priorities for state-level research policy, and finally, a State Fund for R&D in BiH with the objective of supporting scientific projects (Papon and Pejovnik, 2006).

An important issue that must be dealt with is the lack of cooperation between researchers and industry, and also between public research actors (academics and researchers of various institutions). A factor which clearly inhibits cooperation is the almost non-existence of competitive academic infrastructures between public laboratories, and between industry and research institutions. However, the situation is not completely grim, some cooperation between higher education institutions, research laboratories, and occasionally between local firms and research institutions, even at the national level, does exist. This implies that there is an awareness of the importance of cooperation. Most of the actors in the economic sectors (particularly in the BiH Chamber of Commerce) are also pleading for the development of cooperation between the academic community and its industrial partners (Papon and Pejovnik, 2006).

In the first phase, scientific cooperation in Bosnia and Herzegovina should probably be established or re-established on a regional basis (with neighbouring countries from the former Yugoslavia, as well as with Albania, Bulgaria, Romania, etc.). An obvious advantage of such cooperation lies in the fact that neighbouring institutions within the region might eventually share important research infrastructures through cooperation (Papon and Pejovnik, 2006).

Further cooperation of BiH's policymakers with SEE-ERA.NET should also be an important factor in the further improvement and development of international cooperation with the EU.

The general objectives to be achieved in the second phase are (Papon and Pejovnik, 2006):

- training a new generation of scientists and re-training existing scientists in new experimental techniques;
- building-up the country's research infrastructure (technical equipment, computers, information networks, libraries) which should provide the scientific community with the capacity to undertake competitive research activities;
- reinvesting in industrial research in a limited number of sectors (prioritising those which export a large percentage of their production);

- creating a general framework for the development of an industry-university partnership.

According to the authors, a minimum level of basic research should be developed in disciplines such as Physical Sciences, Mathematics, Biological Sciences and Medicine, Social Sciences and Humanities, laying the groundwork for future technological development (in SMEs, for example) and constituting a means of interaction within the international scientific community.

Within this framework, the authors define a limited number of research priorities:

- health (including activities in biology and genetics, clinics, as well as chosen topics in pharmacology, management of the public health system, and the relationship between the environment and health conditions);
- metallurgy (steel, aluminium, alloys, mechanical properties, basic processes and surface treatment, and the reduction of pollution);
- energy (hydropower, coal, renewable energy and transmission);
- agriculture, forestry and food industry (in particular Mediterranean agriculture, medicinal plants, processing of wood and soil protection).

6. Summary and Draft Conclusions

Since World War II, almost all developed countries have promoted research activities as an important dimension of public policy and a basis for industrial development. The former SFR Yugoslavia was among the countries which substantially supported R&D. This support was conducted at a federal level, thus BiH succeeded in gaining and developing a well recognised competence in science and technology in its higher education institutions, national institutions and its large, technology-exporting, industrial companies (Papon and Stane Pejovnik, 2006).

The war and its economic consequences devastated the country and resulted, among other things, in low levels of innovation and research activities. Previous research infrastructure has now either been destroyed or is outdated, a considerable brain drain continues to take place, and the private sector is hardly active in R&D in Bosnia and Herzegovina. R&D centres in large companies have either stopped operating or have become service centres. Weak governance is also manifested at the university level, as universities are mostly loose associations of autonomous faculties and other institutions, just like in the former Yugoslavia, and science and research are not systematically integrated into university life. Currently, the main focus lies in the reorganisation of teaching as stipulated by the Bologna Process. The Academy of Sciences and Arts of Bosnia and Herzegovina, founded in 1951, is a very important scientific and artistic institution in the country. Additionally, the Academy of Sciences was also established in the Republic of Srpska during the war years. The fragmentation of the present structures represents one of the main constraints in attaining Western European standards (Dall, 2006).

The importance of scientific research, which consequently leads to a knowledge-based economy, is being recognised all over Europe. In order to achieve such ambitious goals, the EU Member States adopted the Lisbon Strategy in March 2000. Bearing that in mind, Papon and Pejovnik say that it is quite reasonable to conclude that BiH will not have a future unless it is capable of rebuilding its scientific and technical network through research activities at various levels. Other experts also believe that it is of vital importance for Bosnia and Herzegovina to overcome its difficulties and prevent an increase in the technological gap vis-à-vis the EU, through the implementation of more appropriate policies. Furthermore,

it is absolutely necessary to raise public awareness of the knowledge-based economy, and the key role played by innovation and technological progress in the economic growth and development of each of the Western Balkan countries.

Although substantial potential in research systems in the Western Balkan countries certainly exists, they are generally characterised by an unfavourable structure, weak interaction with the business sector and insufficient linkages with the education and research systems of other countries. Furthermore, since science, scientists and scientific research in these countries have been marginalised for years, R&D has not been amongst the key priorities, and a clear long-term strategy in this area is still absent. Generally speaking, Uvalic acknowledges the existence of some limited links between business enterprises, higher education institutions and research institutions, and any government measure to encourage the development of further such networks in this respect would be highly welcomed (Uvalic, 2006).

According to Uvalic, if the governments in the region wish to achieve such high standards, they need to be able to find the right balance between restrictive economic policies, which are clearly necessary for macroeconomic stabilisation purposes, and other types of policies with long-term effects, which can help to raise economic competitiveness (e.g. increased investment in human capital, R&D and education). There is also a need to attract more Foreign Direct Investment (FDI) by further improving the business environment and decreasing the investment risks, which would further facilitate the transfer of modern technologies and know-how. Continued foreign assistance in supporting R&D will clearly remain important in the medium term. Excellent experiences with EC-funded, institutional and capacity-building projects, as gained in recent years, should continue. As most of the researchers and scientists in the Western Balkan countries are employed at higher education institutions, the reform of higher education system was, and still remains crucial to further development, and cannot be regarded as independent from the R&D sector (Uvalic, 2006).

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8 List of Acronyms

AMRES	Serbian Academic Network
ANUBIH	Academy of Sciences and Arts of Bosnia and Herzegovina
ANURS	Academy of Sciences and Arts of the Republic of Srpska
BAM	Bosnian Konvertibilna Marka (currency)
BASMP	Institute for Standardisation, Metrology and Intellectual Property of BiH
BERD	Business Sector Expenditure on R&D
BHAS	Agency for Statistics of Bosnia and Herzegovina
BiH	Bosnia and Herzegovina
BIHARNET	Academic and Research Network of BiH
CARDS	Community Assistance for Reconstruction, Development and Stabilisation
CEFTA	Central European Free Trade Agreement
CEI	Central European Initiative
CIP	Cataloguing in Publications
COBISS	Cooperative on-line bibliographic system and services
CoE	The Council of Europe
CORDIS	Community Research & Development Information Service
COST	Co-operation in Science and Technology
CTF	Consultative Task Force
EBRD	European Bank for Reconstruction and Development
EC	European Commission
ECHO	European Community Humanitarian Aid Department
EMSAC	Economic Management Structural Adjustment Credit
EPC	European Patent Convention
EPO	European Patent Office
ERA	European Research Area
ERA-NET	European Research Area Network
EU	European Union

FDI	Foreign Direct Investment
FP6	Sixth EU Framework Programme for R&D
FP7	Seventh EU Framework Programme for R&D
FTA	Free Trade Agreement
GDP	Gross Domestic Product
GÉANT	A multi-gigabit pan-European data communications network
GERD	Gross Domestic Expenditure on Research and Development
GOVERD	Government Sector Expenditure on R&D
GRNET	Greek Research and Technology Network
HE	Higher Education
HECB	Higher Education Co-ordination Board of BiH
HERD	Higher Education Sector Expenditure on R&D
HoR	House of Representatives (BiH Parliament)
IAEA	International Atomic Energy Agency
ICT	Information and Communication Technology (also acronym for the related FP7 'Cooperation Programme' theme)
ILO	International Labour Organisation
IMF	International Monetary Fund
INASP	International Network for the Availability of Scientific Publications
INCO	International Cooperation (also a sub-programme in FP7 'Capacities')
IP	Integrated Projects (an activity type in FP6) also used as Intellectual Property
IPR	Intellectual Property Rights
IPA	Instrument for Pre-Accession Assistance
IS2WEB	FP6 project "Extending Information Society Networks to the Western Balkan Region"
ISBN	International Standard Book Numbering
ISPA	Instrument for Structural Policies for Pre-Accession
ISSN	International Standard Serial Number
IST	Information Society Technologies (Programme line in FP6 - in FP7 it changed to ICT)
IZUM	Slovenian Institute of Information Sciences
MIPD	Multi-Annual Indicative Planning Document
MTEF	Mid-term expenditure framework
NATO	North Atlantic Treaty Organisation
NCP	National Contact Point
NEAP	National Environmental Action Plan BiH
NGOs	Non-governmental organisations
NIP BiH	National Information Point for EU Framework Programmes in BiH
NoE	Network of Excellence (an activity type in FP6 and FP7)
NUL	National and University Library
OBNOVA	EU assistance programme for Bosnia and Herzegovina
OSCE	Organisation for Security and Co-operation in Europe
OHR	Office of the High Representative
PHARE	Pologne, Hongrie Assistance à la Reconstruction Economique
PIP	Public Investment Program
PRSP	Poverty Reduction Strategy Paper
R&D	Research and Development
RDI	Research and Development Institutions
RS	Republic of Srpska
RTD	Research and Technological Development
RTDI	Research, Technological Development and Innovation

SAA	Stabilisation and Association Agreement
SAP	Stabilisation and Association Process
SAPARD	Special accession programme for agriculture and rural development
SEE	South East Europe
SEE-ERA.NET	FP6 project South Eastern European Era-Net
SEE INNOVATION	FP6 project “Facilitating innovation for ICT SMEs in South Eastern Europe”
SEEREN	FP6 project “South Eastern European Research and Education Network”
SEE-SCIENCE.EU	FP6 project “Information Office of the Steering Platform on Research for Western Balkan Countries”
SFRY	Socialist Federation Republic of Yugoslavia
SME	Small and Medium Size Enterprise
S&T	Science and Technology
STI	Science, Technology and Innovation
SUS B&H	Svjetski Univerzitetski Servis BiH
TEMPUS	Trans-European Mobility Scheme for University Studies
TERENA	Trans European Research and Education Networking Association
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNIADRION	Adriatic-Ionian Initiative
UNIDO	United Nations Industrial Development Organisation
USAID	United States Aid
VAT	Value-Added Tax
WB	Western Balkans
WBC	Western Balkan countries
WTO	World Trade Organisation
WUS	World University Service
ZSI	Zentrum für soziale Innovation (Centre for Social Innovation)

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Science and Technology Country Report

CROATIA

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1 Introduction

This country report is produced by the "Information Office of the Steering Platform on Research for Western Balkan Countries" and reviews the situation of Science and Technology (S&T) in Croatia.

The report summarises the main papers published by the United Nations Educational, Scientific and Cultural Organisation (UNESCO), the South-East European ERA-NET (SEE-ERA.NET), the Austrian "Gesellschaft zur Förderung der Forschung", and several independent scholars on the issue of S&T in Croatia. For the complete table of references please see References in chapter 7, starting on page 134 of this report.

The objective of this study is to enhance our understanding of the national innovation system in Croatia. An overview of the situation in S&T regarding the main stakeholders, input and output indicators, the national strategies and priorities and the main documents and laws in the field is given below.

The 'system of innovation' approach was taken into account when compiling this report, and covers important factors influencing the development, diffusion and the use of innovations, as well as the relations between these factors. It does not place emphasis on individual firms or research organisations, but rather on innovation as an interactive and interdependent process.

Relevant organisations in this respect are firms, higher education institutions, government agencies, etc. interacting to create knowledge and innovation. The macro-level of the system is analysed using indicators such as R&D personnel ratios, R&D expenditure, patent application intensity rates, etc.

The report was compiled in autumn 2006 by the Information Office, by Ms. Elke Dall and Ms. Maruška Bračić, Centre for Social Innovation, Vienna, Austria and reviewed by Mr. Miroslav Polzer, Centre for Social Innovation / Austrian Science and Research Liaison Office Ljubljana, Ms. Emira Bečić, Ministry of Science, Education and Sports, Croatia and Ms. Jadranka Švarc, Institute of Social Sciences Ivo Pilar Zagreb. A brief update was carried out in summer 2007 by Mr. Jure Zrilič, Centre for Social Innovation. A final review was carried out in December 2007/January 2008.

1.1 Croatia - A Brief Profile

Before the dissolution of the SFRY (Socialist Federal Republic of Yugoslavia), Croatia was (after Slovenia) the most prosperous and industrialised region in the country. The economy emerged from a mild recession in 2000 with tourism, banking and public investments leading the way. Although the macroeconomic situation has largely been stabilised, structural reforms have not been as successful.

Today, Croatia is a presidential, multi-party parliamentary democracy with a population of 4.4 million and a GDP of EUR 34,220 billion in 2006 or EUR 7,706 per capita (Becic and Svarc, 2007). In 2006, the annual average real growth was 4.8 %. In the first quarter of 2007, real GDP growth accelerated markedly to 7 % year on year, up from 6% in the same quarter of the previous year. Unemployment rates in Croatia have been in decline (12.7% in 2005 and 11.2% in 2006), but a small increase in unemployment is predicted for 2007 and 2008 (European Commission, 2007).

Administratively, the country is divided into 20 counties (županije), in addition to the city district of the capital, Zagreb. The Croatian population represents about 0.96 % of that of the European Union (EU), while its economy in 2005 was about 0.28 % of the EU's economy, in terms of gross domestic product (GDP). The European Union's official stance is that the country is a functioning and stable democracy. Following the launch of accession negotiations, Croatia needs to focus on the substantial tasks ahead in terms of adopting EU legislation and building the administrative structures and capacity necessary for its correct enforcement (European Commission, 2006; Becic and Svarc, 2007).

Croatia has undergone a difficult de-industrialisation process since gaining its independence. The importance of industry, including the energy sector, declined to some 20.5% of total GDP in 2006, while the service sector represented about 67.4% of total GDP. The share of agriculture, hunting and fishing has slowly declined during the last few years and now represents 6.2% of total GDP in 2006. Overall, Croatia is an open economy and its main trading partners are from the EU (accounting for over 50% of all imports and exports) – its most prominent partners being Italy, Germany and Austria, while Croatia itself also represents the EU's main trading partner in the Western Balkans region. Moreover, since the opening of the EU market under the Autonomous Trade Measures in 2000 and the trade provisions of the Stabilisation and Association Agreement in 2002, trade between the European Union and Croatia doubled between 2000 and 2004. In 2005, the European Commission concluded that Croatia is a functioning market economy able to cope with competitive pressure and market forces within the EU, provided that it continues to implement its reform programme to improve the remaining weaknesses. There is, however, a potential risk to Croatia's macroeconomic stability due to certain external and fiscal imbalances. Furthermore, administrative and judicial barriers need to be removed in order to allow the development of a more prominent private sector and to encourage foreign direct investment. In addition, state interventions in the economy remain significant and little progress has been made with regards to large state-owned enterprises, thus the strengthening of financial discipline within state-owned enterprises remains a particular economic policy challenge. It is clear that Croatia will need to address the identified weakness with much will and determination (European Commission, 2006; Becic and Svarc, 2007).

1.2 Relations between Croatia and the EU

Croatia was the second country to sign a Stabilisation and Association Agreement (SAA) with the EU in October 2001, an agreement which entered into force in February 2005. The SAA is an essential instrument for the EU's Stabilisation and Association Process with the Western Balkans, providing a contractual framework for relations between the EU and Croatia, until Croatia's final accession to the EU. Full implementation of the SAA will aid Croatia in its preparation for EU membership, while the progress and dynamics of the integration process will depend upon Croatia's fulfilment of its SAA commitments. The European Commission will help Croatia in the implementation of the agreement by providing technical advice and financial assistance (European Commission, 2006).

Croatia presented its application for EU membership in February 2003. The Commission published its response to the application in April 2004, maintaining that Croatia is both a functioning democracy and a functioning market economy, which should not face major difficulties in complying with the objectives of the *acquis,* providing it continues in its efforts to make the necessary adjustments. Following the positive assessment by the Commission, the European Council of 17th-18th June 2004 decided that Croatia should receive candidate country status. However, there was still one important pending issue between the EU and Croatia that needed to be resolved before the country could actually start the negotiation

process - full cooperation with the ICTY (UN International Criminal Tribunal for the former Yugoslavia). A positive review of such cooperation arrived on 3rd October 2005, allowing the Council to open negotiations with Croatia that same day. The first stage of negotiations - the so called "screening" - enables the EU to decide when to open individual chapters for negotiations. The first field to face scrutiny after the negotiations were officially opened was cooperation in Science and Research (Chapter 25), which opened and (temporarily) closed on 13th June 2006. The draft screening reports have been transmitted to the Council for discussion within the Member States. The degree of convergence between the national policy of Croatia and the European Research Area was satisfying and no major difficulties in accepting the EU *acquis* on research are expected. Overall assessment of the current situation in the field of science and research was very good: Croatia has expressed determination to further increase the level of financing of the sector and to fulfil all remaining prerequisites for cooperation with the European Framework Programmes for S&R. A milestone in this respect was Croatia's accession as a fully associated country to the Sixth Framework Programme (FP6) for the remainder of 2006. In 2007 Croatia gained the "associated status" in FP7 as well. The next chapter scheduled in the negotiation process for Croatia was Education and Culture (Government of the Republic of Croatia, 2006b). Negotiations on this Chapter 26 (Education and Culture) were completed on 11th December 2006. The European Commission concluded that Croatian policy on science, research and education is developing in the same direction as that of the European Union and that Croatia has enough scientific and research capacity to participate in EU programmes (Petrovecki, Paar et al., 2006).

As a candidate country, Croatia benefited from all three pre-accession financial instruments - PHARE (Poland and Hungary: Assistance for Restructuring their Economies - the funding programme which has expended to cover ten countries), ISPA (Instrument for Structural Policies for Pre-Accession) and SAPARD (Special Accession Programme for Agriculture and Rural Development). Croatia was also eligible for the CARDS Regional Programme in 2005 and 2006. Pre-accession financing was estimated at EUR 105 million in 2005 and EUR 140 million in 2006, which represents a substantial increase in overall EC assistance compared to the amounts pledged by CARDS (EUR 60 million and EUR 62 million in 2005 and 2006 respectively). An overall total of EUR 262 million was allocated to Croatia from the CARDS programme between 2001 and 2004 (European Commission, 2006). From 1st January 2007, the Commission uses a new financial tool, the Instrument of Pre-Accession (IPA), for promoting modernisation, reform and alignment with the *acquis*. IPA has entirely replaced CARDS and other pre-accession financial instruments (PHARE, ISPA, SAPARD). The programming has five components - Transition Assistance and Institution Building; Regional and Cross-Border Cooperation; Regional Development; Human Resource Development and Rural Development. As a region, the Western Balkan countries and Turkey will benefit from almost EUR 11.5 billion of pre-accession financial instrument money between 2007 and 2013.

Under the objectives laid out in the Negotiating Framework, the negotiations are based on Croatia's own merits and the pace depends on the country's progress in meeting the membership requirements. Although the shared objective of the negotiations is accession, the very nature of discussions implies an open-ended process whose outcome cannot be guaranteed beforehand (European Commission, 2005b). The European Council laid out the principles, priorities and conditions for all principal areas regarding the Accession Partnership with Croatia in its decision of 20th February 2006. A distinction was made in terms of defining short-term and medium-term priorities, the former to be accomplished within one to two years and the latter within three to four years. Science, research and education were placed amongst medium-term priorities, advising the country to start designing and applying an integrated research policy, to step-up its efforts for creating a modern vocational education and training system and to ensure the implementation of the Bologna criteria for higher

education (European Council, 2006).

The 2006 “National Programme for the Integration of the Republic of Croatia into the European Union”, which is the fourth annual national programme for the implementation of the SAA, has also laid out ongoing and upcoming activities for the Ministry for Science, Education and Sports regarding the creation of required capacities in the field of RTD (Government of the Republic of Croatia, 2006c). Implementation capacity refers to the conditions necessary for effective participation in the Framework Programmes, thus in the field of RTD, Croatia needs to create certain implementation capacity, including an increase of personnel for the activities of the Framework Programmes. Due to its specificity, the *acquis communautaire* in the field of science and research does not require any transposition in the national legal order (European Commission, 2004).

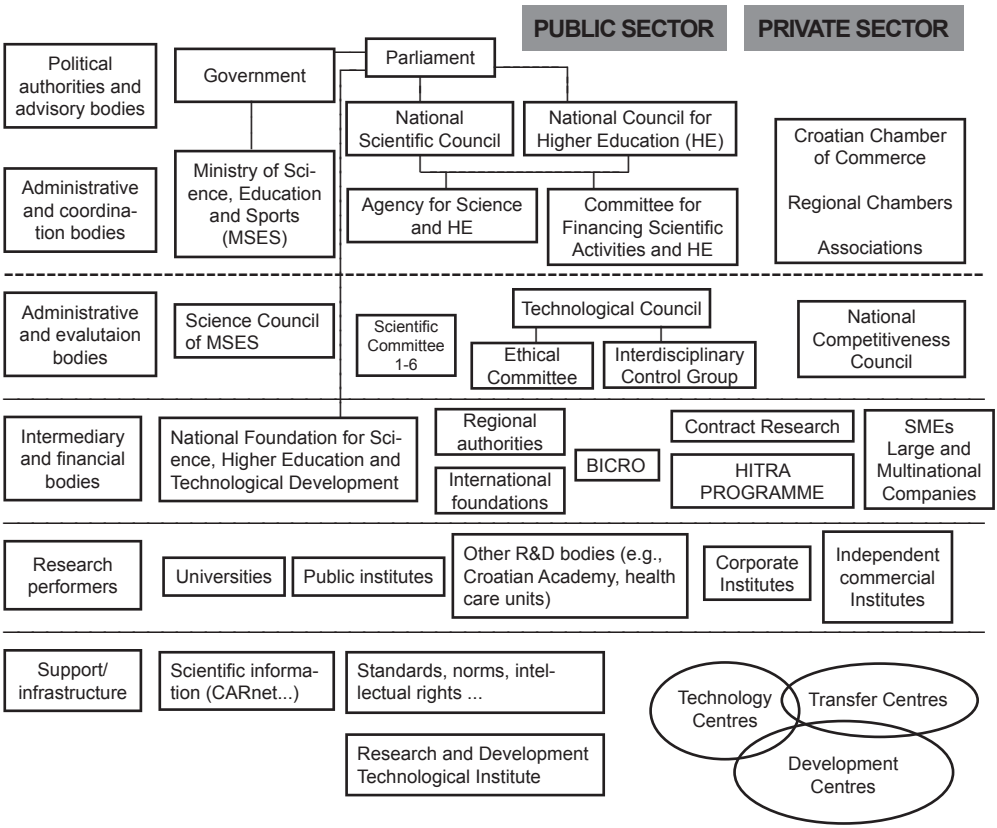
It is rather difficult to predict the possible accession date for Croatia, bearing in mind the internal issues within the European Union that need to be resolved before accommodating any new members after 2007 (under the Treaty of Nice, the EU can function with no more than 27 member states). This problem would have been solved with the approval of the EU Constitution in all 27 EU member states, but its rejection has made any future accession more difficult, requiring additional administrative reforms. Nevertheless, the closure of negotiations for all 35 chapters of the *acquis communautaire* is expected in 2008 or 2009.

A new EU treaty, which has been suggested to be drafted by 2009, should erase all legal blocks currently preventing accession by Croatia to the Union. With the entry into force of that treaty - probably May 2009 - Croatia will be able to join the European Union. On 25th April 2007 the European Parliament congratulated Croatia for making “rapid progress” towards membership, but stated that “it must make further efforts in areas such as cooperation with the ICTY, reform of the judiciary and the transition to a market economy”. The need for a new institutional framework for the EU by 2008 in order to accommodate Croatia was also stressed (EurActiv, 2006a).

2 Contemporary Institutional Landscape

After experiencing typical transitional problems in the field of S&T, Croatian official policy has started to pay this field more attention since the year 2000. The infrastructural system for promoting RTD (research and technological development) in Croatia has been enhanced with a variety of new institutions. Institutional measures for the formation and strengthening of the national system are ongoing and will also continue in the future (Dall, 2006).

Figure 2.1: Institutional Set-up for R&D in Croatia (Becic and Svarc, 2006)



2.1 Main Stakeholders Involved in Policy Making in Croatia

Over the last few years, measures have been implemented to create new institutional capacities in the Croatian innovation system and to strengthen the existing ones. Numerous initiatives have been promoted and it is almost impossible to track The national network of institutions engaged in the development, transfer, application and financing of new technologies and innovative entrepreneurship is constantly being updated and enlarged (Dall, 2006).

By the end of 2006, the infrastructure of the S&T stakeholders in Croatia included 26 public research institutes, five technological centres, one business and innovation centre, seven research institutes in industry and six private scientific institutes. The Croatian higher education system comprises seven universities (including 81 faculties, academies and other accredited constituent parts offering programs of study), 16 public colleges and polytechnics and 16 accredited private schools and polytechnics (Government of the Republic of Croatia, 2006d; Becic and Svarc, 2007). Furthermore, there are about 50 legal scientific research entities (in business, cultural, health and state institutions), the Interuniversity Centre in Dubrovnik (an association of about 200 Croatian and foreign universities), the Croatian Academy of Sciences and Arts, the Medical Academy, the Academy of Technical Sciences, the National and University Libraries, and the Croatian Academic and Research Network (CARNet) - a large network of Croatian academic and research institutions (European Commission, 2004).

Science and research in Croatia are under the authority of the Ministry of Science, Education and Sport (MSES). Administration and other tasks related to R&D are carried out by the following Ministry units: The Science Directorate, The Directorate for Higher Education, The Directorate for Information Society, and The Directorate for International Cooperation.

The National Science Council and the National Council for Higher Education are advisory bodies which formulate and monitor the functioning of R&D programmes and higher education organisations. The National Science Council attends to the development and quality of scientific activities and science system in the Republic of Croatia, while the National Council for Higher Education attends to the development and quality of the entire higher education system in the Republic of Croatia (Petrovecki, Paar et al., 2006). The National Science Council appoints Scientific Field Councils for Natural, Technical, Biomedical, Bio-technical and Social Science, Humanities and Art. The MSES carries out administrative activities along with other tasks concerning the development of scientific research, scientific-technical information and communication. For example, the ministry works for the foundation and development of science and the application of scientific achievements, it harmonises the financing programmes for permanent research activity, contracted projects and scientific projects of special interest, as well as planning, harmonising and developing IT activity and its integration into the overall information system in the Republic of Croatia. In addition, the MSES monitors, documents and implements scientific, technical and technological cooperation with foreign countries and international organisations according to international agreements, it sends Croatian experts abroad and helps to integrate foreign experts with activities in the Republic of Croatia. The Ministry prepares draft laws and ordinance in the areas of science, research, technology, education and sport to be submitted to the Croatian Parliament by the Government of the Republic of Croatia. The MSES also manages the budgetary funds for these areas (European Commission, 2004). There is also a Council for Science and Higher Education Funding, which advises the National Council for Science and National Council for Higher Education on financial matters (Petrovecki, Paar et al., 2006).

In July 2004, the government established the Agency for Science and Higher Education which carries out administrative tasks related to the evaluation of scientific activity, scientific projects, collaborative scientific programmes and higher education. It also carries out tasks related to the National Network for Quality Assurance of Higher Education and its integration into the European Quality Assurance Network. The agency is a state institution with autonomous powers to carry out the aforementioned tasks for the National Science Council and the National Council for Higher Education, thus complying with the European standards in science and higher education. The act envisages the National Science Council as a strategic body responsible for the development and quality of overall scientific activity in Croatia. Its major functions are to evaluate scientific organisations, to determine scientific disciplines and interdisciplinary fields of science and arts, to set detailed requirements for attaining authority to conduct a procedure for appointment into science ranks, evaluation of scientific projects, collaborative scientific programs etc. The National Science Council shares the task of submitting proposals to the Croatian government on the allocation of budgetary financial resources for scientific activity and higher education with the National Council for Higher Education.

The Technology Council of the MSES focuses on the establishment of a national network of institutions engaged in the development, transfer, application and financing of new technologies. It also works to gain specific measures of governmental support for technological development and innovative entrepreneurship.

Regarding industrial R&D and innovation, the Business and Innovation Centre of Croatia

(BICRO) is of central importance - it focuses on financing technology development programmes, such as RAZUM (which supports the development of knowledge - and new technology-based enterprises) and the promotion of Venture Capital in Croatia (which emphasises the commercialisation of R&D results and the development of private firms and research organisations). BICRO also finances the development of technology centres, incubators and R&D centres (which support the development of local technology-based companies), as well as sponsoring the "Research and Development Programme" (grants for financing of research projects of SMEs) (European Commission, 2004).

In March 2006, the government founded the Croatian Institute of Technology (CIT) under the authority of the MSES. The institute was founded in order to assist the government in its ambitious aim to develop Croatia into a contemporary, S&T oriented economy. In line with the official S&T policy objectives, the role of CIT will be coordinated with the role of the future European Institute of Technology (EIT). Hence, CIT mainly focuses on strengthening the education, research and innovation sectors (i.e. the "knowledge-triangle") by integrating the contributions of various important stakeholders in their unique goal of creating a knowledge society. CIT has also been entrusted to implement TEST (a sub-programme of HITRA - the Croatian Innovation Technology Development Programme, which deals with technology research and development) (CIT, 2006). CIT operates in the field of financial support to technology based and innovative entrepreneurs and coordinates cooperation with European-funded projects. CIT provides consulting services in the area of technology transfer and knowledge, and coordinates institutions in similar areas of work, with the aim of enforcing technological development on a national level. Furthermore, CIT provides expert advice in establishing *start up* and *spin out* companies, whereby the main criteria are innovation, development of new technologies and market logic and profitability of the new companies. CIT's tasks include building a Business Intelligence system and technology forecasting (Government of the Republic of Croatia, 2006d).

Business related affairs are also dealt with within the Euro Info Correspondence Centre (EICC) Zagreb. The main activity of the EICC is to inform, advise and assist SMEs on EU legislation and other non-legal related affairs of practical importance. EICC Zagreb is hosted and financed by the Croatian Chamber of Economy and co-financed by the European Commission. It is part of a large group of more than 260 Euro Info Centres and 13 Euro Info Correspondence Centres located in 40 European and Mediterranean countries (EICC Zagreb, 2006).

Another very important funding body in the field of science is the National Foundation for Science, Higher Education and Technological Development of the Republic of Croatia (NFS). This organisation was established in 2001 with the objective of promoting science, higher education and technology development, as well as strengthening the links between research institutes, higher education institutions and industry. The NFS supports scientific, higher education and technological programmes and projects, with the aim of producing innovations and patents. It also provides student grants and promotes mobility. The NFS contributes to Croatia's transformation into a society of knowledge, enhancing the development of a globally recognised research and knowledge-based economy through the strategic investment in people and ideas essential to outstanding research, and through its support of projects which could foster the development of Croatia (NFS, 2006).

Also important is the National Council for Information Society that monitors the development of an information society. Developing an innovative informational and communications infrastructure is in the domain of the Croatian Academic and Research Network - CARNet and the University Computing Centre - SRCE (Government of the Republic of Croatia, 2006d).

The National Council for Information Society evaluates, establishes, and promotes priorities in the development of information society in the Republic of Croatia, especially implementation of priority measures and development goals (Petrovecki, Paar et al., 2006).

The Ministry of Science, Education and Sport coordinates work with other involved ministries. For example, the Ministry of Economy, Labour and Entrepreneurship manages budgetary funds and adapts policies in education and science to suit economic needs. The Ministry of Defence funds the Institute for Research and Development of Defence Systems. The Ministry of Finance is engaged in removing a number of regulatory constraints in order to create an environment conducive to investors and to promote the development of venture capital in accordance with the government's EU Accession Action Plan (World Bank, 2005b).

Control over the proper implementation of innovation and technology programmes and initiatives is executed by the Interdisciplinary Control Group and the Committee for Ethics in Science and Higher Education (Government of the Republic of Croatia, 2003b; Ministry of Foreign Affairs and European Integration of the Republic of Croatia, 2005). The Committee for Ethics in Science and Higher Education promotes ethical principles and values in science and higher education, business relations and public relations, and also follows up the application of modem technologies and environment protection in scientific research and higher education (Petrovecki, Paar et al., 2006). Other important institutions within the framework of the Croatian innovation system are the National Competitiveness Council founded in February 2002; the Agency for Science and Higher Education; the Agency for Accreditation and Quality Assurance established in 2004; and the Croatian Innovation Council and the Croatian Accreditation Agency, both established in 2005 (National Competitiveness Council, 2004; World Bank, 2005b; World Bank, 2005a). Furthermore, the Croatian innovation system is supported by the Croatian Standards Institute, the State Office for Metrology, the State Office for Intellectual Property Rights and the State Bureau of Statistics. Jointly, the aforementioned institutions create the core technical infrastructure necessary for technological and innovation development (Svarc and Becic, 2006).

Another important professional body is the National Bologna Follow-up Group, that follows up the development and implementation of the Bologna Process at both European level and Croatian higher education institutions and implements activities and projects directed at promotion of the Bologna process in Croatia (Petrovecki, Paar et al., 2006).

Part of the reform of the education system is also founding the Agency for Adult Education - a public institution established by the Decree of the Government of the Republic of Croatia in May 2006. The activities of the Agency include monitoring, development, evaluation and improvement of the adult education. The Agency is established as a part of the Government Strategy for Adult Education, adopted in 2005 and based on the lifelong learning principle. Within the Agency a Centre for Mobility and EU Programmes has been founded. Its primary task is the implementation of the Lifelong Learning Programme - LLP, Erasmus, Leonardo, Comenius and Grundtvig (Agency for Adult Education, 2007).

The Croatian Academy of Sciences and Arts comprises nine scientific departments, 25 councils/committees and 20 research units. The Ruđer Bošković Institute is the most re-nowned non-university public research centre in the country. It is the largest Croatian Research Institute with 830 employees and 578 published research articles (1.13 articles per resident/year). 5% of Croatian researchers are employed at this institute which produces 27% of Croatian World Recognised Scientific Publications (Vikic-Topic, 2007). Scientific centres of excellence are a new feature envisaged by the new Science and Education Act passed in 2003. These centres should comprise groups of scientists or scientific organisations which

have been assessed by relevant evaluation bodies and proclaimed centres of excellence by the minister. As an additional method for encouraging innovation, higher education institutions and scientific institutes establish technology parks in order to commercialise scientific results, encourage cooperation between scientists and the business community, and enhance the knowledge-based economy (Dall, 2006).

Table 2.1: Main S&T Stakeholders of Croatia (Dall, 2006; Becic and Svarc, 2007)

The main ministry in Croatia with control over S&T	- Ministry of Science, Education and Sports - National Science Council - National Council for Higher Education
Other ministries with importance to the S&T sector	- Ministry of Finance - Ministry of Economy, Labour and Entrepreneurship - Ministry of Defence
Other important stakeholders	- Business and Innovation Centre of Croatia (BICRO) - National Foundation for Science, Higher Education and Technological Development - Council for the Financing of Scientific Activity and Higher Education - Croatian Institute of Technology (CIT) - Technology Council of MSES - Croatian Innovation Council - National Competitiveness Council - Committee on Education, Science and Culture - Technology and Innovation Centres (Centre for Technology Transfer (CTT), Zagreb; Technology Centre Split (TCS); Centre for Innovative Technology Rijeka (TIC); Technology and Innovation Centre, Osijek) - Research and Development Centre for Mariculture, Dubrovnik - Agency for Science and Higher Education - Research and Development Technology Institute - Committee for Ethics in Science and Higher Education - National Network for Quality Assurance of Higher Education - Rector's Conference - State Office for Intellectual Property Rights - Croatian Accreditation Agency - Croatian Standards Institute - State Office for Metrology - Agency for Accreditation and Quality Assurance - Central Bureau of Statistics (CBS) - National and University Library - Croatian Academic and Research Network (CARNet)

Other important stakeholders	- Institute RUĐER BOŠKOVIĆ - Interuniversity Centre of Dubrovnik - Euro Info Correspondence Centre (EICC) - Agency for Adult Education - Agency for Vocational Education - National Council for Curriculum - National Centre for External Evaluation of Education - National Council for Pedagogical Standard - National Council for Information Society - National Bologna Follow-up Group
Universities	- University of Zagreb - University of Split - University of Rijeka - University of Osijek - University of Zadar - University of Dubrovnik - University of Pula

2.2 International Cooperation

Croatia has been experiencing a constant renewal of international cooperation and support, especially in the last years. This cooperation has been substantially supported by many international organisations, as well as through the assistance of developed countries in bilateral programmes (also providing significant benefits to the R&D sector). The largest amount of financial support in this respect came from the funds of the Stabilisation and Association Process, the IPA/CARDS programme, the Stability Pact for South Eastern Europe, the European Investment Bank, and the European Bank for Reconstruction and Development.

The European Union's Tempus programme has been important in the area of higher education, while Croatia's inclusion into the Framework Programmes for R&D and the European Research Area (ERA) has also been of particular significance. Inclusion of the country into the European Investment Bank's Innovation 2000 Initiative ought to prove useful as well. Regarding multilateral cooperation in the area of science and research, Croatia has established close links with many specialised United Nations (UN) agencies, such as UNESCO, UNIDO, UNDP, UNECE[1], while some other international organisations, such as the World Bank, have also been important donors and have helped in the area of R&D (Uvalic, 2006).

The Croatian Ministry of Science, Education and Sports allocates a relatively small percentage of its budget to international S&T cooperation (0.45% in 2001, increasing to 0.62% in 2005) (Becic and Svarc, 2007). In 2006 there were about 176 ongoing international projects, involving approximately 600 researchers, or about 3-4 Croatian scientists per project. The number of research scholarships based on bilateral inter-governmental programmes has been increasing in recent years, and amounted to 143 in 2002. 15 scholarships were awarded under the Marie Curie Programme (mobility within the FP6) in 2004 and 2005. Moreover, there has been an increase in the number of scholarships for foreign researchers coming to Croatia: in 2002, 98 scholarships for 523 research months were granted on the basis of bilateral

[1] Please see the List of Acronyms, chapter 8.

inter-governmental programmes. The most frequent countries and regions participating in exchange of R&D personnel are Slovenia, Hungary, Austria, Germany, France, the United Kingdom, and the USA (Uvalic, 2006).

The European Research Area (ERA) was established with the objective of creating a genuine "internal market" in research in order to increase pan-European cooperation and coordination of national research activities. The main financial instruments of the ERA are the EU's Research Framework Programmes (EurActiv, 2006b). In FP5, Croatian participation was limited, mostly due to its third country status - the European Commission approved only nine projects with consortium members from Croatia. In FP6, although still with a third country status, Croatian partners significantly increased their activities. Between 2002 and September 2005 Croatian scientists submitted 417 project proposals, of which 98 proposals received a positive evaluation and 47 contracts were signed.

Croatia has demonstrated a high absorption capacity for FP6 projects and is one of the most successful countries in the region in terms of its utilisation of EU financial resources. As a fully associated member state, Croatia has participated in FP6 with EUR 6.4 million in 2006, of which EUR 3.18 million was provided by the state budget and the remaining came from the PHARE programme. Between 2003 and 2006, Croatian scientists concluded 95 research contracts with a total value of EUR 7.8 million. Only in 2006, did the total value of research contracts amount to EUR 3.6 million, exceeding the national contribution (Becic and Svarc, 2007). According to statistics, the greatest absorption capacities were in the fields of Information and Communication Technologies, Medicine and Biotechnology, Food Biotechnology, Constructions, Microelectronics and Physics (EurActiv, 2006b).

Following a positive evaluation by the European Commission, partners from Croatia are eligible to request the reimbursement of costs for the MSES proposal preparation. The activities of the National Contact Points for the Framework Programmes are carried out by the MSES Department for European Integration. The dissemination of information about FP6 is mainly performed through workshops at higher education institutions and research institutes, and through video-conferences. In March 2005, the MSES submitted a Memorandum of Understanding for full participation in the FP6 to the European Commission, in order to change the "*third country"* status into the "*associated candidate country"* status (Uvalic, 2006). The memorandum was signed in autumn 2005 and consequently, the EC announced that depending on the accomplishment of internal procedures, Croatia can participate as an Associated Candidate Country and receive Community contribution in all FP6 projects contracted after 1st January 2006 (MSES, 2006a).

In 2007 FP6 was replaced by FP7, designed to help the EU fulfil the goals set in the Lisbon Strategy and become the backbone in the construction of the European knowledge economy. FP7 runs from 2007 to 2013, with the main objective of achieving the European Research Area by 2010 (EurActiv, 2006b). On 13th June 2007 the Republic of Croatia (represented by the Minister for Science, Education and Sports, Dragan Primorac) signed Memoranda of Understanding (MoUs) with the European Commission (represented by Commissioner Janez Potočnik) to enable Croatia to participate fully in the EU's Seventh Research Framework Programme (FP7). Associated status allows Croatia to participate in all calls for proposals and compete on an equal footing with the EU Member States for research cooperation and support actions funded by FP7. Although the Memorandum of Understanding entered into force on 13th June, it is applied as from 1st January 2007 (see-science.eu, 2007d).

Croatia is also participating in SEE-ERA.NET - a fully fledged regional ERA-NET coordinated by Austria, and funded by the European Commission for a period of five years. The programme

came into operation on 1st September 2004 and incorporates 17 partners from 14 countries. The Croatian SEE-ERA.NET partner is the Ministry of Science, Education and Sports. The idea behind SEE-ERA.NET is to coordinate existing bilateral science and technology agreements and corresponding unilateral activities, which on their own often lack the level of threshold needed to progress and make unnecessary repetitions. Isolated activities are thus intended to be brought together under a system of flexible multilateral initiatives to support regional RTD cooperation. The regional approach adopted by SEE-ERA.NET was an attempt to compensate for the general lack of regional (i.e. international sub-European) RTD cooperation opportunities. Finally, SEE-ERA.NET aims to bring bilateral cooperation programmes to the level of multilaterally coordinated RTD collaboration activities (Schuch, 2006).

Croatia has been a full member of COST (European Cooperation in the field of Scientific and Technical Research) since 1992; its partners are currently participating in over 50 COST actions co-financed by the MSES. Throughout the last decade, COST has developed into one of the largest frameworks for research cooperation in Europe, with over 200 actions and 30,000 scientists from 46 countries involved in various projects (MSES, 2006a).

Croatian partners have also participated in the EUREKA programme with 15 projects, eight networks, and two cluster projects. Croatia gained full membership status in the EUREKA programme in 2002 and the MSES has co-financed all EUREKA projects that received positive evaluation. National contact points (NCPs) for all mentioned programmes are at the MSES Directorate for International Cooperation (MSES, 2006a). The MSES co-finances EUREKA projects with up to 50% of Croatian participation, or at most EUR 150,000 per project and the rest comes from the partner's side. On an annual basis, the MSES invests EUR 350,000 in EUREKA projects. Although a small investment, it proved to be very efficient due to the fact that EUREKA has strong partners, international recognition, high standard of international evaluation of projects, and flexible administration. First results after five years of participation show that return on investment in EUREKA projects is 4:1 with a good ratio of industry-academia participation (Government of the Republic of Croatia, 2006d).

In the field of higher education, Croatia has been actively involved in the Tempus III programme - the 36 Joint European Projects approved for Croatia include Curriculum Development, Institutional Building and University Management. Up-to-date statistics show that Tempus projects contributed to increased inter-university cooperation (AZVO, 2007).

The Republic of Croatia joined the Bologna Process in May 2001. It has signed the Bologna Decleration and committed itself to modifying its higher education system in order to harmonize it with the European system. This programme supports transformation of doctoral studies in Croatia as essential for further development of higher education and science and for overall development of the country (Government of the Republic of Croatia, 2006d). By the end of June 2005, the most demanding Bologna priority has been fulfilled - the restructuring of all study programmes in accordance with the principles of the Bologna Process. A new method for the recognition of foreign higher education qualifications was also introduced, which is much simpler and faster than the previous nostrification procedure. Last but not least, the creation of the Agency for Science and Higher Education created the institutional framework for the development of the quality assurance system. Four out of seven universities have already established quality assurance offices that will form the National Network for Higher Education Quality Assurance, to be coordinated and overseen by the Agency (Kovacevic, 2006).

The National Foundation for Science (NFS) developed a programme in cooperation with the Croatian Academy of Sciences and Arts, also a member of European Science Foundation

(ESF), to include Croatian scientists in ESF programmes. The main goal of the programme was to include Croatia in the European Research Area. The NFS provides financial support to Croatian scientists - to be eligible, scientists must be citizens of the Republic of Croatia, be working at a Croatian institution, have an independent research career, provide excellence in project leadership and any publications must fulfil the appropriate international standards. The NFS will also finance the inclusion of Croatian scientists in scientific and EUROCORES programmes of the European Science Foundation. An ESF Scientific Programme is a networking activity covering all domains in the research spectrum, bringing together key researchers and research groups to address a major scientific issue at European level. EUROCORES Programmes (European Science Foundation Collaborative Research Programmes) aim to create the conditions necessary for scientific excellence by enabling researchers from different European countries to collaborate and develop scientific synergy (NFS, 2006).

The NFS also provides the so-called EMBO (European Molecular Biology Organisation) Installation Grants. The aim of this new scheme is to strengthen Croatian science by allocating grants to help scientists set up laboratories in Croatia, allowing them to rapidly establish a reputation in the European scientific community. Successful applicants receive EUR 50,000 annually (for 3-5 years) from the NFS via EMBO (NFS, 2006).

NFS is also funding/has funded some other programmes as (Government of the Republic of Croatia, 2006d):

- Training of doctoral students
- 'Partnership in Basic Research' which seeks to increase non-governmental investment in basic research with investments based on public-private partnerships
- 'SCIENCE award' - which has the goal of promoting science and research activities among graduate students/researchers
- Reform of the Education system in Croatia
- Programme 'Brain Gain'

Other international organisations which have cooperated with Croatian partners in the field of science and research include the IAEA (International Atomic Energy Agency) working on infrastructural projects, scientific research and regional projects, as well as having prepared an additional five project proposals for the new biennial project cycle 2007/2008; UNECE (UN Economic Commission for Europe), which established cooperation through work groups and seminars, and participated in an international conference on technology transfer held in Zagreb in 2001; and NATO. There is also ongoing cooperation with the World Bank (TAL-2) within the *Science and Technology Project*, a project of high priority for the development of the national innovation system. Croatian teams participate successfully in various multilateral scientific organisations such as CERN (Geneva), the International Centre for Theoretical Physics (Trieste), and the International Centre for Genetics and Biotechnology Engineering (Trieste) (Uvalic, 2006). The wide range of international organisations which have established cooperation with Croatian scientific institutes in the last decade also includes the ICSU (International Council for Science), the IUPAC (International Union of Pure and Applied Chemistry), the EERO (European Environmental Research Organisation), the ALLEA (All-European Academies), the IAP (Inter-Academy Panel), the IAMP (Inter-Academy Medical Panel) and the UAI (Union-Académique International). Croatian higher education institutions, as well as the Croatian Academy of Sciences and Arts, also have their own cooperation agreements with foreign partners (European Commission, 2004).

Good cooperation has also been established with the German Research Foundation (*Deutche Forschungsgemainschaft*) through Research Units (DFG *Forschergruppen*), Collaborative Research Centres (*Sonderforschungsbereiche*, SFBs) and DFG International Research Training Groups (*Internationale Graduiertenkollegs*, IGKs), of which, the Research Units are the most flexible instruments of these coordinated programmes, as they bring together a group of five to ten individual research projects. In the scope of the SFBs, Croatian scientists could theoretically act as project leaders (NFS, 2006).

In the field of intellectual property, Croatia has been cooperating in the CARDS 2002 Regional Project "Industrial and intellectual property rights". The total value of the project was EUR 2.25 million. Although originally envisaged for a duration of three years, the project was later extended in accordance with a European Commission initiative, and expired in December 2006. The focus during the last year of implementation shifted from educational activities to promoting expert cooperation between the region's countries (SIPO, 2006). The programme's objectives has been to ensure a sustainable and self-supporting infrastructure enabling the R&D community to make full use of intellectual property rights and any related commercial exploitation (Vikic-Topic, 2007).

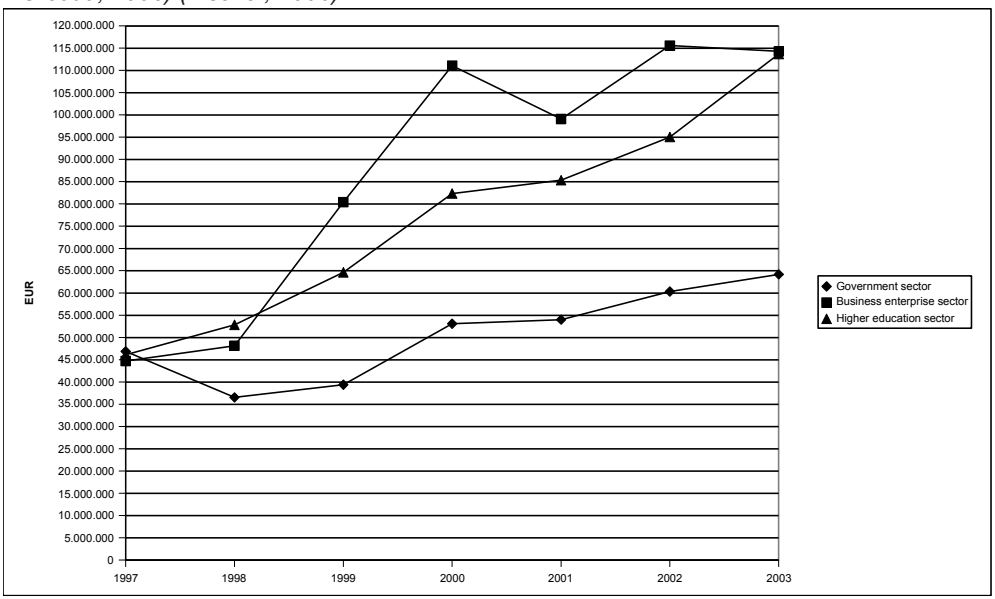
3 The Input Side of the National Innovation Systems

Scientific institutions play a key role in the economic and social development of a country, with state-funded research and educational institutions occupying a particularly central position. The quality and efficiency of their work has a crucial impact on the readiness of the private sector to invest in research and development. A country's ability to develop and maintain its competitive advantage largely results from its public and private sector scientific activities, thus there is no alternative to the continuous and significant investment in science, regardless of the source of funding (budgetary or non-budgetary). According to leading world experts, economic growth in this century will be driven by sectors with dominating high levels of technology, which highlights the need to further increase investments in science and innovation (Government of the Republic of Croatia, 2003a).

3.1 Development of Financial Resources Allocated to R&D

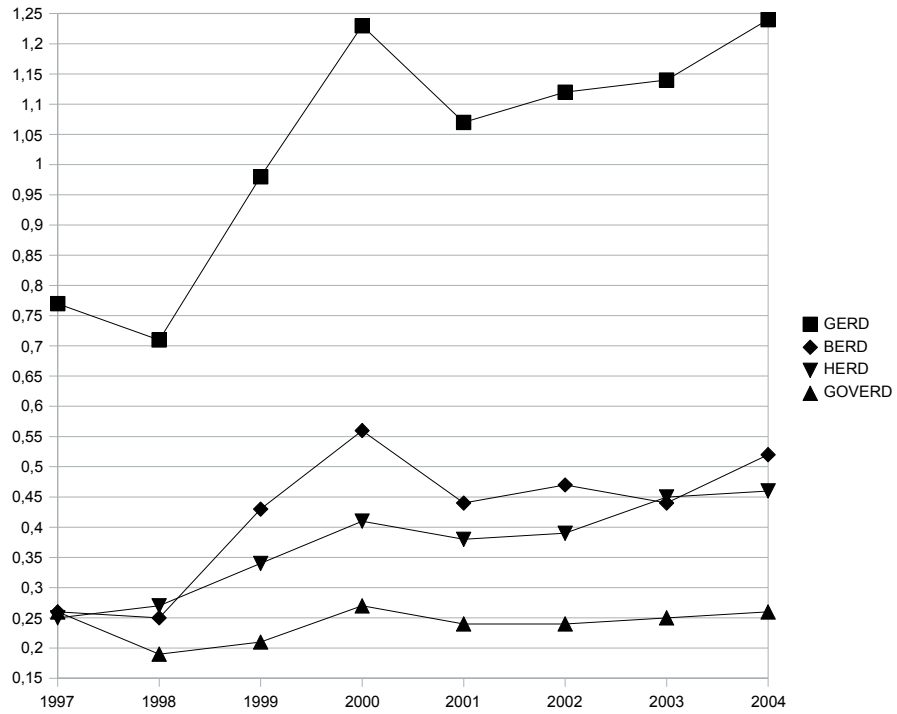
Regarding the general situation in the field of science, research and innovation in Croatia, various studies have shown that the country is still considerably behind the EU countries. The difficult economic situation and the collapse of major businesses brought about an end to corporate financing of R&D and largely severed the links between higher education institutions and professional R&D organisations. Furthermore, those companies that did survive the difficult transition period rarely preserved their internal R&D as a resource for strategic development. Nevertheless, Croatia invests rather higher resource in R&D, General Expenditure on Research and Development (GERD) in 2004 was 1.24% of GDP ((Svarc and Becic, 2006), and surpasses the R&D intensities of some EU member countries, such as Greece, Portugal, Spain and Italy (0.68%, 0.77%, 0.96% and 1.11% respectively; 2002) and the R&D intensities of most of the newly accessed countries (apart from Slovenia and the Czech Republic). According to DG Research, the EU-15 average in 2001 (GERD as % of GDP) was 1.98% (Government of the Republic of Croatia, 2006a). Compared to the other Western Balkan countries, Croatia has the highest R&D intensity and is one of the few with detailed statistics on R&D expenditure by sector (government sector expenditure - GOVERD, business sector expenditure - BERD and higher education expenditure - HERD).

Figure 3.1: Dynamics of Expenditure on R&D per Sector (Central Bureau of Statistics Croatia, 2006) (Fischer, 2006)



These measures are presented in Figure 3.2 as a percentage of GDP (compiled by Svarc and Becic).

Figure 3.2: Dynamics of Expenditure on R&D as Percentage of GDP per Sector (Svarc and Becic, 2006)



3.2 Government Sector Expenditure on R&D

It is obvious that the investment in Croatian science today is characterised by many weaknesses and structural problems.

One of the most striking particularities in this respect is the domination of the public sector over the private sector in S&T. As reported in 2004, the higher education and government sectors combined employ the vast majority of researchers in Croatia, almost 85%, and together invest 0.7% of the GDP in research and development. This represents a respectable pool of national knowledge and expert skills. However, the business sector in Croatia employs a modest 15% of researchers and invests 0.44% of GDP. The contribution of the private sector to GERD is 42%, while the state contributes 55% of GERD (Becic and Svarc, 2007).

Another problematic feature is the structure of the MSES budget. In most developed countries, the ratio regarding the proportion of salaries to investments to expenses is approximately 40: 30:30, whereas in Croatia, the ratio is 55:12:33. It indicates that presently the emphasis is on maintaining S&T base and enlargement of number of researchers instead of capital investments in research infrastructure (Becic and Svarc, 2008).

Between 1997 and 2002, a slight upward trend has been registered in available financial resources from the Ministry's budget for science. Since 2003 the share of total expenditure for science as a percentage of the MSES's total budget has been about 9% and is increasing continually.

However, in terms of the share of GDP, GOVERD (the Government Sector Expenditure on R&D) has remained more or less constant, fluctuating at around 0.26% of GDP from 1996 to 2004 (Svarc and Becic, 2006).

However, some experts report on the increase of the Croatian Government's investments in the sector of education and science. According to Petrovečki and Paar (Petrovečki, Paar et al., 2006), the Government has increased the MSES budget by 33.7% over the 2003-2007 period. In the last four years, the national budget allocated for education and science has increased by EUR 360 million.

Some new areas, such as technological development and informatics, have received a financial contribution from the budget since 2000, while the increased budgetary funds have also permitted an increase in the number of projects financed in all six scientific disciplines, especially in Medical Sciences, Technical Sciences and Humanistic Sciences - in each case, the number of projects during 1996-2003 has almost tripled (Uvalic, 2006).

Croatian experts are warning of the possible dangers if the country fails to pursue its planned increase in investments - inevitably this would jeopardise not only the recovery of Croatian science, but also the competitiveness of the whole economy, triggering long-term negative effects (Government of the Republic of Croatia, 2003c).

Table 3.1: Budget for Research Projects Financed by the MSES, by Fields of Science 1996-2003 (MSES, 2005b)[2]

Science discipline	Number of projects 1996	Number of projects 1997	Number of projects 1998	Number of projects 1999	Number of projects 2000	Number of projects 2001	Number of projects 2002	Number of projects 2003	Funding (in Euros) 2003
Natural sciences, Mathematics	193	215	221	223	230	240	306	316	4.043.438
Technical sciences	134	227	249	251	271	290	327	344	3.004.543
Medical sciences	124	190	206	209	239	267	387	436	4.682.107
Biotechnical sciences	76	113	119	119	125	131	153	173	1.610.453
Social sciences	93	133	148	155	167	182	219	261	1.609.931
Humanistic sciences	85	120	130	148	159	179	245	269	1.663.329
Total	**705**	**998**	**1073**	**1105**	**1191**	**1289**	**1637**	**1799**	**16.613.801**

142.5 million HRK (Croatian kuna)[3] is reserved in the state budget for the financing of science projects in 2007. This is a 34% increase of 48.7 million HRK since 2002 (Vikic-Topic, 2007).

Table 3.2: Financing of science projects from the budget of MSES in million HRK according to Vikic-Topic, MSES (Vikic-Topic, 2007)

2002	2003	2004	2005	2006	2007	Increase 2002/2007
93.72	112.86	115.84	118.98	126.04	142.5	34%

R&D expenditure broken down by type of activity in the government sector in Croatia (2003) was allocated in basic research (68%), applied research (27.8%), and experimental development (4.1%). The European average in the same year was 46.1% in applied research, basic research 30.9%, and experimental development 22.3%. Of course, the European averages mask differences at the national level, especially in the government sector, for example, basic research was the main activity in most of the New Member States (2004 and 2007 enlargements) (Wilén, 2007).

3.3 Business Sector Expenditure on R&D

Business expenditures on R&D is particularly important in science-based sectors (pharmaceuticals, chemicals and some areas of electronics), where most new knowledge is created in or near R&D laboratories (European Commission, 2005a).

The business sector in Croatia invests 0.41% of GDP (2005), which means it ranks well amongst countries of the region, but its position is still unfavourable in comparison to the EU average. The business sector of the EU-27 invests more than 1.1% of GDP (an average of 1.17% in the year 2005, ranging from 0.11% in Bulgaria to 2.92% in Sweden).

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[2] The data have been converted into EUR according to the exchange rate on 31st December of each year on http://ec.europa.eu/budget/inforeuro/

[3] 142.5 million HRK is EUR 19.47 million., 48.7 million HRK is EUR 6.65 million, 93.72 million HRK is EUR 12.81 million, 112.86 million HRK is EUR 15.42 million, 118.98 million HRK is EUR 16.24 million HRK, 126.04 million HRK is EUR 17.23 million.

The business sector's input into R&D activities in comparison to overall R&D activity reveals the relative importance of profit-oriented knowledge creation and absorption. Recent statistical data and analysis about R&D activities and costs by countries of the EU reveals that within the EU-27, each sector is more or less specialised in a particular type of R&D activity: the business enterprise sector in experimental development, the higher education sector in basic research and, to a lesser extent, the government sector in applied research (Wilén, 2007).

Table 3.3: R&D expenditure in EUR million and by type of activity as a percentage, all sectors, EU-27 and selected countries, 2003 (Wilén, 2007; Becic and Svarc, 2008)[4]

	Total	Applied Research	Basic Research	Experimental development	Not classified
EU-27	188 973 s	35,2 s	23,1 s	41,4 s	0,2 s
HR	292	33,5	36,4	30,2	:
AT	5 250	36,3 i	17,5 i	44,3 i	1,9
JP	119 748	21,3 i	12,6 i	61,0 i	5,1
US	258 519 ip	23,2 p	18,5 p	55,4 p	3,0

Source: Eurostat - R&D statistics, OECD MSTI[5]

As shown in Table 3.3, the breakdown of R&D expenditure in EU-27 by type of activity hides differences at the national level.

At the EU-27 level in 2003 in the business enterprise sector, 57% of business R&D expenditure is allocated to experimental development, 37% to applied research, and only 5% to basic research. This seems logical since the aim of both experimental development and applied research is to produce new goods or, at least, to create the expectation of a practical use in the near future (Eurostat, 2004; Wilén, 2007). The same trend was noted on the national level in Croatia. The highest share of business R&D expenditure was allocated to experimental development with 63%, while applied research received 35% and basic research only 2%.

3.4 Higher Education Sector Expenditure on R&D

University research represents one of the key activities within the higher education sector regarding the national innovation systems, providing scientific and technological knowledge to be disseminated in and utilised by the economy. However, as primary suppliers of fundamental research, higher education institutions do not only contribute to the economy through the direct provision of applicable results, but also through the diffusion and adoption of skills and techniques and through professional networks and other forms of communication channels created by academic research. Taking account of the various tasks of the higher education system, as well as the challenges of a knowledge-based society, a large increase in public sector R&D spending on the higher education sector is required (Fischer, 2006).

Statistical data shows that Croatia mainly satisfies this expectation. According to data compiled by Fischer, Croatia spent EUR 46.1 million on higher education in 1997, this amount doubled in 2000 to EUR 82.3 million, and reached EUR 113.7 million in 2003. Croatia also had the highest level of HERD relative to GDP (0.45% in 2003) compared to the other countries

[4] For general abbreviations used in the table please see chapter 8 List of Acronyms.
[5] Exceptions to the reference year: 2004: AT and CH
EU-27: Distribution by type of activity is estimated on the basis of available Member States.
AT, SE and JP: Underestimated or based on underestimated data.
PL, RO and RU: Excludes most or all capital expenditure.

of the region, a level which is on a par with the EU-15 average (0.42% in 2003)[6]. If population is taken into account, Croatia is once again the leading country in the region with EUR 25.6 per capita in 2003. Although Croatia is slowly catching up, it is still investing less per head than Portugal or Greece for example (EUR 31 and EUR 37 per capita respectively in 1999) (Fischer, 2006; Becic and Svarc, 2007).

According to Eurostat, statistical data shows that in Croatia basic research was the main type of activity in the higher education sector, allocated 53.4% (2003) of government R&D expenditure, while applied research received 34.7%. The same trend is already noted at EU-27 level, where basic research is given 72.8%, and applied research 21.7% (Wilén, 2007).

The comparison between Higher Education R&D Expenditure and other sources of funding can be observed in Figure 3.1.

3.5 R&D Infrastructure

Modernisation and renewal of R&D infrastructure are among the key priorities of policymakers throughout the Western Balkans region, including Croatia. These initiatives include purchasing new equipment, modernising laboratories and research facilities, promoting ICT systems, updating bibliographical databases and supplying university libraries with specialised literature. The main obstacle preventing a faster pace of reform is the limited financial resources. Private funding from the enterprise sector remains low and international donors show little interest in the modernisation of research facilities and laboratories (Uvalic, 2006).

Nevertheless, positive trends can be observed, especially in Croatia, which has recently been investing heavily in scientific infrastructure and technical equipment, funded by the large capital investment loans taken out by higher education institutions. The Ministry of Science, Education and Sports has allocated over EUR 30 million in equipment grants since 2002, significantly improving the technical equipment at higher education and research institutes. The private sector has also made significant investments in the research infrastructure, particularly in the pharmaceutical and the telecommunications sector. However, significant investments are still needed, especially in higher education institutions outside Zagreb. Croatia still lacks large research equipment, some of which is compensated for through international cooperation schemes.

Regarding computer networks, the Ministry of Science, Education and Sports established CARNet (Croatian Academic and Research Network) in 1991. One year later Croatia obtained its internet domain (.hr) and the MSES is demonstrating a high level of awareness regarding the importance of the information society. In 2006, 176 institutions at 263 locations in 31 towns throughout the country, were connected to CARNet (with links of 2Mbit/s and more), including all scientific and higher education institutions. The capacity of the CARNet link with the rest of the world is 622 Mbit/s. CARNet is working intensively to promote “Open Access”, encompassing all scientific publications, dissertations, research outcomes etc., regardless of whether the user’s library or institution is subscribed to a certain scientific magazine, thus making scientific resources accessible to the widest range of users. CARNet plays multiple roles in the education system - it encourages the use of new technologies in the learning process, providing its users with concrete help through the purchase of software and project-financing (CARNet, 2006).

The University Computing Centre (SRCE), founded in 1971 by the University of Zagreb, is

[6] Data was updated based on the latest available data from EUROSTAT during a review by Becic/Svarc.

the oldest infrastructural institution for establishing and using Information and Communication Technologies (ICT) in the academic community - today it is one of the foundations for planning, designing, establishing, maintaining and using the ICT system in Croatia's academic community. SRCE encourages intensive cooperation between all institutions involved in establishing information infrastructure and using ICT in the Republic of Croatia, especially with the MSES and CARNet. Moreover, the University Computing Centre has been actively participating in international (mostly European) Information Technology projects for more than 30 years. SRCE actively participates in EU projects like EQIBELT - Education Quality Improvement by E-Learning Technology, GEANT2 - a multi-gigabit pan-European data communications network, reserved specifically for research and education use, and EGEE II - Enabling Grids for E-science (SRCE, 2006).

The Ministry of Science, Education and Sports financially supports the establishment and operation of referral centres for issuing programme licences to different branches of science (for example, Mathematica, Mathlab, Statistica and SIS). The Scientific Information System (SIS) organises and finances the design of an information system, allowing any member of Croatia's academic and research community to get scientific and research information. Furthermore, the SIS supports the on-line database centre (Internet access to commercial reference databases) and CROSBI (Croatian Scientific References - data on scientific papers published by Croatian scientists) (MSES, 2006b).

The National Library Information System (NISKA) is a joint project of the Ministry of Science, Education and Sports and the Ministry of Culture, launched in 1996. NISKA connects all libraries in Croatia, irrespective of their type (school, university, scientific and city libraries), with the aim of establishing a system that will enable the collections of all libraries to be accessible to both the Croatian public, and the foreign public, in electronic, multimedia format.

The Young Scientists Network (MLAZ) was established in 2005 with the objectives of promoting and improving the role of postgraduate students and young scientists in society, enhancing the exchange of information and ideas, encouraging national and international cooperation, and stimulating legislative initiatives etc. On the European level, MLAZ actively cooperates with EURODOC (European Council of Doctoral Candidates and Junior Researchers) and WAYS (World Academy of Young Scientists) (MLAZ, 2006).

3.6 Human Resources in R&D

Human resources play a key role when it comes to knowledge production and, subsequently, economic and technological development, thus their current state and future potential are of critical importance. The quality of human resources is a major determinant of knowledge creation and the transmission and application of new knowledge. Generally, indicators of human resources are divided in two groups: education and learning, and employment (Aralica and Bacic, 2005). According to Fischer, the availability and quality of human resources (being both producers and users of knowledge) in S&T, are crucial elements on the path towards a knowledge society (Fischer, 2006). Awareness of the importance of scientific activity in the overall development of a state is clearly demonstrated by the increasing number of people with a higher education and the intensified employment opportunities for young scientists. Within this category, Croatia ranks relatively well in comparison to other countries of the region, but not compared to the EU average (Aralica and Bacic, 2005).

In 1990, the number of full-time employees in R&D was 18,361, of which 8,772 were researchers. In 1999, these values had dropped to 10,764 and 6,805 respectively, showing a severe fall in both the total number of R&D employees and the number of researchers during

the last decade. However, this decline is still smaller compared to other transitional countries, including some new EU member states such as the Czech Republic. The distribution of scientists by different scientific fields according to the data of the Croatian Central Bureau of Statistics (CBS) is illustrated below.

Table 3.4: Researchers by Scientific Fields (HC)[7], in 2001 and 2005 (Becic and Svarc, 2008)

	2001		2005	
Scientific Field	**Number**	**%**	**Number**	**%**
Natural sciences	1,517	15.3	1,402	13.5
Technical sciences	2,784	28.1	2,421	23.4
Medical sciences	1,714	17.3	2,523	24.3
Bio-technical sciences	788	8.0	941	9.1
Social sciences	2,282	23.0	1,953	18.8
Humanities	823	8.3	1,127	10.9
Total	**9,908**	**100.0**	**10,367**	**100.0**

Source: CBS, R&D Annual Report

Another key indicator of the S&T sector's structure is the qualification of the research personnel. The share of researchers with academic degrees in Croatia demonstrates how highly qualified the country's scientific personnel is, with more than half of all researchers holding a PhD degree. According to the Croatian CBS, there were 973 new Masters and Masters of science (MSc) titles awarded in 2005 and 385 Doctors of science in the same year. These numbers have remained more or less constant, with slight annual growth in recent years (Central Bureau of Statistics Croatia, 2006).

Table 3.5: Qualification Structure of Researchers in 2005 (Becic and Svarc, 2008)

	2005	
Academic Degrees	**Number**	**%**
B.A, B.Sc.	2,377	22.9
M.A, M.Sc.	1,938	18.7
Ph.D., Dr.	6,052	58,4
Total	**10,367**	**100.0**

Source: CBS, R&D Annual Report

The number of new graduates with training in science and engineering (S&E) is indicated using the number of tertiary S&E graduates.[8] Degrees in the S&E fields of study formally qualify their holders for employment as researchers, scientists and engineers. The most recent Eurostat publication of *Science, Technology and Innovation in* Europe (2007) provides statistics up to 2004 regarding the percentage of graduates in S&E. This report shows that of the 147,000 Croatian graduates in 2004, 23% of these were in the area of S&E (Eurostat, 2007). While this is comparable to the European average, Croatia still falls well behind when it comes to the number of S&E graduates per 1,000 population aged 20-29, as calculated by the European Innovation Scoreboard. This shows that in 2005 (the most recently recorded year), S&E graduates in Croatia numbered 5.7 per 1,000, far lower than the EU-25 average

[7] HC - Headcount data
[8] Science compiles science, mathematics and computing fields of study and Engineering compiles engineering, manufacturing and construction fields of study.

of 12.9 and the equivalent amount in the newly-accessed member states of Bulgaria and Romania, with 8.6 and 10.3 respectively (MERIT/JRC, 2007), and only marginally higher than the amount recorded in 2004. This is a situation that Croatia aims to ameliorate, following the Action Plan for S&T policy of the Republic of Croatia 2007-2010, by increasing this by 12% annually (Ministry of Science Education and Sports of Croatia, 2007).

According to the Eurostat database for tertiary education graduates, in the EU-25 in 2004, 10.5% of all graduates were in the fields of Science, Mathematics and Computing, compared to 5.6% in Croatia in the same year (but 7.3% in 2003). In the EU-25, 13.1% of students graduated in the fields of Engineering, Manufacturing and Construction, which is comparable with the 12.3% in Croatia (Becic and Svarc, 2007).

According to Fischer, around 30% of all students in Croatia in 2003/2004 were enrolled in science, engineering and technology programmes (science students with 26.08% account for most of the S&E students). There has also been a constant increase of S&E students in Croatia between 1997 and 2003 with an annual growth rate of 7.2% (Fischer, 2006). However, it is important to stress that the high share of S&E graduates only reflects the orientation of the Croatian education system and not necessarily its quality. Until quite recently, life-long learning in Croatia was rather neglected and the population with tertiary education was much lower than the EU average. The reason behind this could be the absence of any cooperative links between higher education institutions and the business sector (Aralica and Bacic, 2005). But there have been significant increases in these areas, for example, the population with tertiary education rose from 18.2% of working age population to 21.6% in the period 2002-2005 (MERIT/JRC, 2007) .

Generally, the largest part of research activities in terms of human resources and research institutions in Croatia is within the higher education sector, which makes up about 44% of all the research institutions and employs from 50% to 60% of all researchers. The university sector and the public science institutions make up almost 80% of all research institutions and employ 85% of all researchers in Croatia (Kovacevic, 2006).

Another important indicator of human resources in R&D is the share of researchers in the labour force. Since countries differ considerably in terms of their population and labour force sizes, this indicator signifies the relative importance of RSE jobs (Researchers, Scientists and Engineers) in the labour market and can thus be seen as an appropriate indicator of the knowledge base of an economy (Fischer, 2006). According to the CBS and Eurostat (2004), Croatia has reported 2.6 researchers per 1,000 labour force, which is below the EU-15 average of 4.74 researchers per 1,000 labour force and far below the average of EU-25: 3.9 researchers per 1,000 labour force in the same year (Becic and Svarc, 2008).

There have been 7,140 full-time equivalent (FTE) researchers in 2004, 52% of whom were employed in the higher education sector (plus 34% in the government sector and 14% in the business sector). The distribution of FTE by sectors at national level in Croatia is different to the EU-25 where only 37% (2004) of researchers (FTE) are employed in the higher education sector (13% in government sector and 50% in the business sector). The ratio in Croatia indicates those typically working part-time as researchers and full time as teaching staff. According to CBS data, this ratio in Croatia fluctuates at around 54% (2002-2005), demonstrating that on average, Croatian R&D personnel were generally employed part-time in any given R&D job (Becic and Svarc, 2008).

Table 3.6: Researchers by Full-time Equivalent (FTE), by sector (Becic and Svarc, 2008)

	2002	2003	2004	2005
Business sector	1,253	913	1,015	707
Government sector	2,022	2,158	2,420	1,899
HE sector	5,297	2,790	3,705	3,117
Total	**8,572**	**5,861**	**7,140**	**5,723**

Source: CBS, R&D Annual Report

Table 3.7: R&D Personnel (HC), by Scientific Field (MSES, 2005b; Becic and Svarc, 2008)

	1998	1999	2000	2001	2002	2003	2004	2005
Natural sciences, Mathematics	1,776	2,146	2,359	2,467	2,523	2,363	2,441	1,972
Technical sciences	3,881	4,281	4,242	3,969	4,217	4,335	5,119	4,440
Medical sciences	1,469	1,822	2,245	2,353	3,731	4,127	4,231	3,408
Biotechnical sciences	1,273	1,333	1,320	1,496	1,751	1,708	1,928	1,666
Social sciences	1,908	2,539	2,679	2,905	3,422	3,831	4,747	2,966
Humanistic sciences	554	980	983	927	871	852	1,273	1,575
Total	**10,861**	**13,101**	**13,828**	**14,117**	**16,515**	**17,216**	**19,739**	**16,027**

Source: CBS, R&D Annual Report

Table 3.8: Number of Doctors in R&D, by Scientific Field (HC) (Uvalic, 2006; Becic and Svarc, 2008)

	1998	1999	2000	2001	2002	2003	2004	2005
Natural science	569	678	683	648	739	757	770	897
Engineering	718	799	938	856	880	868	942	1,105
Medical science	212	304	522	416	705	1,068	1,079	1,529
Biotechnological science	305	322	358	364	361	356	416	519
Social science	409	667	685	698	726	762	816	1,303
Humanities	131	389	378	408	359	397	436	699
Total	**2,344**	**3,159**	**3,564**	**3,390**	**3,770**	**4,208**	**4,459**	**5,353**

Source: CBS, R&D Annual Report

MSES is taking special care to attract the best students to take up research careers. Integration of young scientists into the scientific community is conducted under a special program called the “Young researchers’ scheme”. Since 2004 a total of 1,084 new jobs for young researchers have been created. One measure is the opportunity for young researchers to use subsidised housing loans with the interest rate of 4.4% or 4.9%. The user pays the interest rate of about 1.7%, and the MSES subsidies the rest. By 2006, approximately 2,000 subsidized housing loans were approved (Kovacevic, 2006).

Like other countries of South Eastern Europe, Croatia could not avoid the phenomena of brain-drain in the last decade. In addition to the massive and continuous brain-drain, the region has also experienced negative effects from brain waste (specialists leaving their professions for better paid jobs in the private and/or informal sector of the economy). In response to this severely damaging trend, UNESCO (in cooperation with HP) launched

the Piloting Solutions for Alleviating Brain Drain in South Eastern Europe in 2003, in order to provide higher education institutions with grid computing technology and to provide financial support to encourage young scientists to remain in the region and cooperate with the diaspora. More specifically, the project aims to re-establish links between researchers who have stayed in their native countries and those who have left (with a focus on IT and physics) by connecting scientists with international colleagues and university resources. Staff and students at beneficiary universities are able to interact with the international scientific community, working on major collaborative research projects with other institutions around the world. As a result, higher education institutions in South Eastern Europe can bid for public and private sector funded research. The project also helps encourage scientists to remain in the area to continue their research (UNESCO & Hewlett Packard, 2003).

Two years after its creation, the joint UNESCO-HP project has resulted in the development of websites, databases and new research projects at several of the higher education institutions involved. Moreover, faculties and students from across South Eastern Europe have explored collaborative efforts with their international colleagues and improved research capacities, encouraging scientists to remain in the region. At the University of Split, UNESCO representatives linked the faculties of Natural Sciences, Mathematics and Education, creating various possibilities for active participation in European projects and providing an opportunity to use EU funds to develop and expand as an institution. Hewlett Packard resources have helped the university to use new high-tech equipment and a number of new activities and projects. In addition to other activities, the University of Split created a database and an interactive website of Croatian physicists around the world to share information with educational and research institutions abroad (UNESCO & Hewlett Packard, 2003).

The National Foundation for Science, Higher Education and Technological Development has also funded a programme, Brain Gain, which aims to repatriate Croatian scientists living abroad, permanently or temporarily (Government of the Republic of Croatia, 2006d).

Following the First Congress of Croatian Scientists from the Homeland and Abroad, organised in Zagreb and Vukovar on 15th-19th November 2004, by the Ministry of Science, Education and Sports, a programme called 'Unity Through Knowledge' was conceived. Given the strength of the Croatian scientific diaspora, an exemplary execution of the programme could have a significant international impact (Government of the Republic of Croatia, 2006d).

The Unity Through Knowledge Fund (EUR 5 million) was established with the purpose of enabling scientific and research work in Croatia for Croatian scientists and researchers working abroad, as well to enable their return to Croatia. The Fund supports 4 activities (Vikic-Topic, 2007):

1. To encourage Croatian diaspora to do science research in Croatia;
2. To establish a network of Croatia scientific diaspora;
3. To conduct short visits of prominent Croatian researchers to Croatia;
4. To encourage the Croatian diaspora to establish new commercial companies for advanced technology in Croatia.

The expected duration of the fund is until the end of 2009 (Vikic-Topic, 2007).

One of the initial goals, to create a Network of the Croatian scientific diaspora, is already underway, following the establishment of the Croatian Science Portal[9], as described in

[9] See www.znanstvenici.hr

chapter 4.2 (Government of the Republic of Croatia, 2006d). This portal has instruments to bring science closer to the public with forums, news items and expert opinions. Its goal is to consolidate information useful to the scientific community, to enable linkages between Croatian scientists in Croatia and abroad and to encourage their cooperation. The project is financed by the MSES and it is administered by Ruđer Bošković Institute, University Computing Centre (SRCE), National and University Library and Croatian Academic and Research Network (CARNet) (Vikic-Topic, 2007).

4 The Output Side of the National Innovation Systems

The output of an innovation system is manifested through the new knowledge, new products and new processes which are produced. Whereas indicators such as the 'Gross Expenditure on Research and Development' (GERD) and the 'Number of Researchers' provide a measure of the resources allocated to the innovation system, this chapter focuses on the results of the innovation system and its output indicators, such as patents and scientific articles published.

4.1 Patenting Activities in Croatia

Among other approaches (Hörlesberger, 2006), innovative output can be measured by patent data, the most important advantage of which, is the wealth of the information supplied. A patent file granted by the European Patent Office (EPO) provides data on the invention, which is protected by the patent through the title, abstract and technological classification. Furthermore, patent data provide the only output measure available for almost all countries in the world, including the Western Balkan countries (Hörlesberger, 2006). Patenting behaviour in countries of South and Eastern Europe has undergone a process of change of the same degree and scope as other transitional changes which started in 1989. Nevertheless, the patenting of inventions has become an important part of business activity in the new innovative climate, contributing to the process of innovation capacity building in the region (Kutlaca, 2002).

European inventors today have access to alternatives when seeking patent protection for their inventions: the European Patent Office (EPO), the World Intellectual Property Organisation (WIPO), the World Trade Organisation (WTO) and national patent offices. The EPO provides patent protection through a single procedure, defining the granting of patents in some or all of the contracting states of the European Patent Convention (EPC). In contrast to national patents that are valid in only one country, a European patent gives its proprietor equivalent rights to a national patent in each member state. Moreover, European patents may also be effective in some countries that have not yet acceded to the EPC but that have signed a "Cooperation and Extension Agreement" with the EPO. Croatia was one such country since 2004 but since 1st January 2008, the EPC now also applies to the Republic of Croatia (SIPO, 2007b). Articles 99 to 109 of the Croatian Patent Act, enforced since January 2004, govern the extension of European patents in the Republic of Croatia (European Patent Office, 2006).

The World Intellectual Property Organisation (WIPO) offers inventors and industries a simplified, cost-effective route for obtaining international patent protection. By filing a single "international" patent application under the Patent Cooperation Treaty (PCT), protection for an invention can be sought simultaneously in more than 125 countries (WIPO, 2005).

However, the costs associated with a patent application can result in a further barrier to patenting. Although it is difficult to calculate precise figures, estimates start from EUR 2,000 to EUR 14,000-20,000 for more complicated patent applications. Studies estimate that the

cost of an application and the 10-year maintenance of a patent at the EPO are approximately EUR 32,000 (Roland Berger Market Research, 2004). Applications to national patent offices, in contrast, may be less expensive (Hörlesberger, 2006). Whether an inventor decides to file an application at a national patent office or at the EPO will depend, among other factors, on the countries where he/she wishes to commercialise the invention (European Patent Office, 2006).

The most important body with responsibilities in the field of protection of intellectual property rights in Croatia is the State Intellectual Property Office of the Republic of Croatia. The Office carries out procedures for granting industrial property rights (patents, trademarks, industrial designs, geographical indications and designations of origin, topographies of semiconductor products) and performs the accompanying professional and legislative activities. In addition to the legislative and professional activities, including the procedures for granting rights, a significant segment of the Office activities involves the provision of information and services in the field of intellectual property, the cooperation with other institutions for the enforcement of intellectual property rights and support of innovation activity, as well as the cooperation with economic and R&D entities (SIPO, 2006).

According to Uvalić, the number of patent applications in Croatia has substantially increased during the last years, reaching 1,086 applications in 2003. However, the number of applications that have actually been granted a right to patent has generally been declining and is very low - only 13 in 2003, which is probably a result of the stricter criteria used in recent years (Uvalic, 2006). The number of patents granted directly reflects the registration of innovative ideas. Many experts believe a parallel can be drawn between the economic growth of a country and an increase in the number of patents.

Table 4.1: Number of Patents, 1996-2003 (Uvalic, 2006)[10]

	1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Number of patent applications	697	645	398	884	959	1,034	1,086
Number of granted patents	228	190	78	133	122	59	13

Patents in Croatia are granted by the State Intellectual Property Office. At the turn of the millennium, the number of patents in Croatia was still negligible, with an innovation coefficient ten times smaller than the EU-15 countries (and as much as fifty times smaller than countries traditionally characterised by high levels of innovation such as Finland, Ireland or the USA). Interestingly, on each patent application in Croatia there are 100 internationally refereed publications (Government of the Republic of Croatia, 2003c). A total of 14,223 patent applications have been filed with the State Intellectual Property Office in Croatia between 1st January 1992 and 19th December 2007 (5,670 from residents and 8,553 from non-residents), while between 1st January 2007 and 19th December 2007, 436 patent applications have been filed (342 from residents and 94 from non-residents (SIPO, 2007a).

[10] Source: State Intellectual Property Office of the Republic of Croatia, www.dziv.hr

Table 4.2: Number of Croatian Patent Applications to the EPO, 1998-2004, (Becic and Svarc, 2007).

Indicator	1998	1999	2000	2001	2002	2003	2004 (est)
Total number of patent applications to the EPO	20.83	18.37	14.53	22.02	36.83	38.53	48.40
Number of patent applications to the EPO per million inhabitants	4.628	4.034	3.271	4.962	8.287	8.674	10.897
European high-technology patents (per million inhabitants	0.444	0.292	:	0.300	0.788	0.074	0.315
Number of patents granted by the USPTO per million inhabitants	3.193	1.763	3.546	3.242	:	:	:

Croatia has made progress regarding the number of patent applications to international organisations like the EPO and USPTO (see Table 4.2). In comparison with EU member countries, countries such as Lithuania, Latvia, Romania, Slovakia, Bulgaria, Estonia as well as countries like Cyprus or Portugal fell behind Croatia in terms of their total number of patent applications to the EPO in 2003. The statistics show that as regards the number of patent applications to the EPO per million inhabitants, the situation is very similar, behind Croatia are countries such as Bulgaria, Estonia, Czech Republic, Greece, Cyprus, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia and Turkey. However, Croatia occupies an unfavourable position regarding European high-technology patents per million inhabitants in comparison with EU-15 countries (according to the EPO statistics data). This unfavourable position could be improved through the promotion of patenting in companies using financial provisions provided by the government (Aralica and Bacic, 2005; Becic and Svarc, 2007). An analysis of Croatia's position according to the number of patents granted by USPTO per million inhabitants for most recent available data (2000) shows that many new EU member states (excluding Hungary and Slovenia) lag behind Croatia with its 3,065 patents per million inhabitants (Becic and Svarc, 2007).

4.2 Publication Activity in Croatia

There has been a substantial increase in the number of scientific publications in Croatia, in particular in the natural and medical sciences, where the number in both cases has doubled between 2001 and 2003. However, it is quite the opposite in scientific disciplines, such as Biotechnological sciences, where the number of publications has declined. The largest number of scientific publications is produced by researchers in the higher education sector (around 65%).

The Croatian Science Portal is home to several relevant initiatives (Petrovecki, Paar et al., 2006):

- A database of Croatian scientific bibliography (CROSBI): Database of scientific and technical publications by Croatian scientists.
- A *Who's Who* in Croatian Science: Interactive interface for scientists to enter their own data and thus make them publicly available, while access and search of the database is open to public.

- On-line access to Croatian scientific publications (Croatian publications portal HRČAK): Includes all Croatian scientific and professional journals on an open-access basis. The management system of this web-service helps editorial offices to post electronic versions of their journals.
- The Open Access/Archives initiative: The basic purpose is to allow a free flow of scientific publication among scientists from different scientific disciplines via the Internet.

The Ministry of Science, Education and Sports launched CROSBI - the Croatian Scientific Bibliography project - in 1997, with the objective of collecting data on the scientific output of the current research projects financed by the MSES, and making them publicly available. CROSBI stores scientific papers published from 1997 to the present day. There are over 144,000 records in the CROSBI bibliography. Its bibliography has improved the publicity of scientific output, creating a positive impact on the scientific community, as well as establishing a permanent archive. There is now a comprehensive overview of all literature produced by Croatian scientists: journal articles, books, book chapters, conference papers, theses, reports, manuscripts, etc. Very often scientists submit their data to the database even before the paper has been published. Furthermore, CROSBI provides a digital archive of full-text papers and offers "on demand" access to institutions and scientists. Librarians are also active in database maintenance – they correct the data and communicate with scientists in order to improve the accuracy of the data. CROSBI has gradually evolved into a comprehensive bibliography, covering all scientific publications in Croatia. The data stored in the database are used for various purposes, such as in annual project reports to the MSES, new project application evaluations, and for scientific advancement (CROSBI, 2008).

Table 4.3: CROSBI, Statistical Data on 21st January 2008, 16hrs (data refreshed every four hours) (CROSBI, 2008)

Year	1997	2004	2005	2006	2007	Overall Total (1996-2007)
Books	303	600	584	481	220	5134
Book chapters	632	1397	1179	967	538	11650
Textbooks and Scripts	137	271	175	194	112	2252
Scientific papers in CC Journals	888	1558	1661	1627	1216	16726
Professional and other papers in CC journals	77	121	134	107	42	955
Articles in a journal stated in NN 2/97	717	0	0	0	0	5867
Papers in other journals	2294	4331	4071	3145	1599	37067
Conference report in CC journals	22	151	204	114	1	1038
Papers in the publishing process	0	150	334	642	846	1976
Invited lectures	392	1046	1088	1002	606	8140
Conference papers with international peer-review	1157	2251	2227	1930	1380	21196
Other conference papers	669	1141	1308	922	534	11868
Abstracts in Book of Abstracts and unpublished papers	1612	3400	3449	3166	1900	29039
Dissertations, master thesis	418	773	820	594	253	7079
Graduation thesis	817	1487	1443	1336	637	12687
Other papers	625	1254	1838	896	495	11636
Patents	30	48	18	16	9	389
Overall Total	10790	19979	20533	17139	10388	184699

[11] The Dublin Core metadata element set is a standard (NISO Standard Z39.85-2001) for cross-domain information resource description.

The distribution of the bibliography by scientific field shows that most works are published in Natural and Technical sciences.

HRČAK is an on-line portal of scientific journals in Croatia, which promotes the so-called "Open Access" initiative. Established through a cooperative project between the Croatian Information and Documentation society (HID), the SRCE and the library of the Ruđer Bošković Institute, HRČAK encompasses 83 journals and 3,599 full-text articles, covering all fields of science (2006). To its users, HRČAK offers easy access to scientific journals and works, while editors benefit from tools which help them publish their journals in electronic version free of charge. Through the OAI-PMH protocol (Open Archives Initiative Protocol for Metadata Harvesting), HRČAK provides metadata on every newspaper and article created to the Dublin Core standard[11] to all interested information servers (HRCAK, 2006).

There are about 100 published papers per one registered patent in Croatia, whereby it is apparent that the private sector is more inclined to registering patents, while the public sector is more successful in publishing scientific and expert papers (Government of the Republic of Croatia, 2006d). However, the Science Citation Index (SCI) places Croatia low on the scale of developed and relatively developed European countries, thus it is important to further increase the quality of scientific work and, particularly, to increase the number of scientific innovations. This would result in the improved relevancy, actuality and openness of research projects in Croatia, as well as improving the quality of the overall research process (Government of the Republic of Croatia, 2003c).

5 National R&D Strategy and Legal Framework

Both innovation policies and entrepreneurship-related policies are key pillars of the European Union's Lisbon Strategy. There is obviously a general understanding of the importance of innovation as a concept among the South Eastern European countries, but the kind of policies required to encourage innovation in a wider policy setting have not yet been properly implemented across the region. The transition to a knowledge-based society requires national strategies to be set up in order to sustain this new concept. Appropriate institutional regimes, skilled and creative human resources, a dynamic information and communication infrastructure and economic incentives, among other things, need to be provided in order to achieve an efficient innovation system (Dall, 2006).

R&D policy development in the Western Balkans region is often intertwined with the European Union accession process, although only Croatia has actually started the negotiation process with the European Union. In order to withstand the competitive pressure of the common market and become a fully fledged knowledge-based economy, it is of vital importance for the country to implement the required policies and strategies (Dall, 2006). As stated in the "Shared Vision" of the Thessaloniki Agenda for the Western Balkans, the citizens will need to exploit their high level of motivation for social mobility and their relatively good educational background, but also combine scientific and technological knowledge with entrepreneurship. In this respect, science, research and technological development are seen as essential tools for future economic stabilisation and growth in the region (CORDIS, 2003).

5.1 Legal Framework for National R&D System

The importance of science and technology is crucial for the development, progress and prosperity of a modern state. As part of the process of creating an effective and contemporary

scientific and technology system, the adoption of a functioning legal framework which effectively regulates the organisation of R&D institutes and the innovation infrastructure, and issues grants to research organisations and innovative companies, is indispensable. Even though the legislation in Western Balkan countries is still largely undergoing a process of transition, it has already profited from the stabilisation and association processes. As a leading country in the Western Balkans region, Croatia started accession negotiations with the European Union in October 2005, recently opening (and closing) the 25th Chapter of the EU's *acquis communautaire* on Science and Research (Dall, 2006).

Table 5.1: Important Laws in the Legal S&T Framework of Croatia (Dall, 2006; Becic and Svarc, 2007)

Law on Scientific Activities and Higher Education	Stipulates the systems of scientific activity: scientific research, development and higher education
Law on the National Foundation for Science, Higher Education and Technology Development of the Republic of Croatia	Regulates the National Foundation for Science, Higher Education and Technology Development (NZZ)
Law on the Croatian Academy of Sciences and Arts	
Law on Croatian State Science Awards	
Laws on IP Protection: Law on Patents, Copyright and Related Rights Law, Trademark Law, Law on Industrial Designs, Law on Indications of Origins of Products and Services, Law on Protection of Topographies of Semiconductor Products	The Croatian Intellectual Property Rights regime was supported by a CARDS project and comprises the Law on Patents and related laws.
Law on the Recognition of Foreign Education Qualifications	It was amended in 2006. The Amendment separated academic and professional recognition of higher education qualification.
Law on Professional and Academic Titles	

Most frequently, laws are prepared separately for the areas of S&T and education. However, in Croatia, the fundamental law in the field of science is the Law on Scientific Activities and Higher Education (see Table 5.1), which was adopted in 2003 as an attempt to harmonise national legislation with EU practices following the merger of the Ministry for Science and Technology and the Ministry of Education. This act stipulates the systems behind scientific research, development and higher education, emphasises the freedom and autonomy of scientific activity and lays out the framework for reforming the S&T system. It paves the way for strengthening university autonomy through the initiation of lump-sum financing, providing the framework for the implementation of the Bologna process (Becic and Svarc, 2007).

Furthermore, it defines research and higher education activities and stipulates the tasks and structure of the National Science Council and the National Council for Higher Education, as well as defining procedures for establishing scientific institutions (in terms of their basic

structures and the registration process), the framework of scientific and technological parks, and a structure for the categorisation of researchers and research assistants. In order to facilitate its implementation, the law was amended in 2004 (Dall, 2006). In 2005, the National Council for Science initiated a project to electronically register Croatian scientists. Since September 2005, the Council has been working intensively to update the application in line with the provisions of the new Law and Regulation (Government of the Republic of Croatia, 2006c).

Intensive reform of the Croatian higher education system commenced in 2003 with intensive legislative and institutional preparation, and continued in 2004 with the adoption of necessary amendments to the Law on Scientific Activity and Higher Education, and the adoption of a new Law on the Recognition of Foreign Educational Qualifications. In 2005, the Government adopted five Rules of Procedures covering the field of higher education. The MSES is preparing new amendments to the Law on Scientific Activity and Higher Education and the Law on Professional and Academic Titles (Government of the Republic of Croatia, 2006c).

Other important laws and subordinate legislation include the Law on the Croatian Academy of Arts and Sciences, the Law on Croatian State Science Awards, the Law on the National Foundation of Science, Higher Education and Technology Development, as well as several specialised ordinances, decisions and regulations, such as the Law on Geological Research and the Ordinance on the Conditions and Manner for Taking the Examination of Independent Geological Research and Contents of the Examination. Under the responsibility of the MSES, several decisions and guidelines on implementing the Croatian Programme for Innovative Technological Development (HITRA) and the Programme for the Development of Knowledge-Based Companies have also been included in the legal framework for technology and innovation policy (Government of the Republic of Croatia, 2003b).

In the field of telecommunications and information society, the government has amended the Telecommunications Law, adopted the Law on Electronic Identification and the Law on Information Security (all 2005). A number of strategies, recommendations and programmes were adopted for the efficient implementation of R&D policy, which will be discussed in the chapter below (Government of the Republic of Croatia, 2006c).

Intellectual property protection and patenting are regulated by the Patent Law, the Trademarks Law, the Law on Geographical Indications and Designations of the Origin of Products and Services, the Law on the Protection of the Topographies of Semiconductor Products, the Industrial Designs Law and the Copyright and Related Rights Law (all adopted in 2003). There are also several by-laws regulating the implementation of the above mentioned laws. The State Intellectual Property Office (SIPO) is the pivotal institution in the Croatian National Intellectual Property System which also maintains institutional connection with the international intellectual property system (EPO, OHIM, WIPO and WTO), as well as national offices in the Member Countries of the mentioned intergovernmental organisations[12] (Government of the Republic of Croatia, 2005).

The Croatian tax system allows imported scientific research equipment to be exempt from customs duty, and reimburses the value added tax paid for the procurement of scientific research equipment in Croatia and abroad. The broad Investment Funds Law aims to influence the development of venture capital, which is not yet at an advanced stage in Croatia (Dall, 2006).

[12] Please see chapter 4.1 for more information on Croatia's patent activity.

5.2 Main Documents Reflecting National Innovation Strategies

Too often, innovation is a topic subordinated to science or research policy, or even to development policy. Most S&T policies in the Western Balkans region encourage sustainable support for basic research at higher education and research institutions, for the development of human resources and for cooperation in the framework of the European Union's RTD Programmes, joint research programmes with the European Science Foundation and bilateral agreements (Dall, 2006).

The national innovation system (NIS) in Croatia is a complex, but not fully coherent, set of institutions. The most critical components of the Croatian NIS are the absorption capacity and the human capital, especially regarding quality-control management, the number of researchers in industry, the computerisation of the country, the investment in tertiary education and the number of new scientists in engineering. In order to create conditions for the sound development of the innovation system, Croatian policymakers will need to follow the objectives of the Lisbon agenda, which requests a shift from conventional science policy towards an integrated and pro-active innovation policy. In other words, the integration of science, industry and technology policy is needed in order to put scientific potentials into work (Svarc and Becic, 2006).

Table 5.2: Documents Relevant for Innovation Policy in Croatia (Svarc and Becic, 2006)

1996	The National Science and Research Programme
2001	Croatian Programme for Innovative Technological Development (HITRA)
2002	"Croatia Based on Knowledge and Application of Knowledge" adopted by HAZU
2003	Strategy of Development of the Republic of Croatia in the 21 Century - Science
2004	Strategic Plan of the National Foundation for Science 2004-2008
2005	A national Strategy for Development of the Intellectual Property System
2005	Education Sector Development Plan 2005-2010
2004	55 Recommendations of The National Competitiveness Council for Increased Competitiveness in Croatia
2006	Science & Technology Policy of the Republic of Croatia 2006-2010 adopted by the Government of the Republic of Croatia
2006	Strategic Development Framework for 2006-2013, adopted by the Government of the Republic of Croatia
2007	Action Plan of Science & Technology Policy of the Republic of Croatia accepted by World Bank and Government of the Republic of Croatia

The basis of the Croatian innovation system was laid out in the first 'National Science and Research Programme' of 1996, with the main objectives being the establishment of institutional technology infrastructure, adoption of adequate measures, and the development of a programme for technological development. However, the turning point in innovation policy development came in early 2001, when programmes to promote cooperation between industry and R&D systems were introduced. The national technology policy is based on the 'Programme for Innovative Technological Development' (HITRA) adopted in 2001 (see paragraph below). In 2003, the government adopted the 'Strategy of Development of Croatia in the 21st Century - Science', which replaced the 'National Scientific Research Programme'

of 1996. In April 2004, a Cooperation Agreement was signed between the Ministry of Science, Education and Sports and the Ministry of Economy, Labour and Entrepreneurship, regarding the harmonisation of education policies with the country's economic needs, and the development of the national innovation system (Uvalic, 2006).

The building of the national network of technological centres will require the establishment of business and innovation centres, centres for technology transfer, financial institutions, institutions for planning and control, innovation and engineering associations and other centres of technological excellence (Government of the Republic of Croatia, 2005).

HITRA, the Croatian Innovation Technology Development Programme was launched in 2001 by the Ministry of Science and Technology, specifically aimed to support the transfer of technology to new technology-based firms using both financial and non-financial incentives. There are three strategic long-term goals of the HITRA program: the creation of incentive policy measures for technology policy, the creation of a technological institutional structure and the establishment of control mechanisms for innovation and technology policy. HITRA is especially targeted at public-private partnerships or science-industry cooperation and provides a framework for direct cooperation between entrepreneurs, industry, Croatian higher education institutions and research institutes. The target groups are individuals, legal entities and technology-based companies, all with commercially and technically viable ideas (European Commission, 2004). HITRA is being implemented through two complementary sub-programmes - TEST (Technology Research and Development Projects) and RAZUM (Development of Knowledge-Based Enterprises). TEST is designed to support pre-commercial research activities in the development of new products, processes and services, until the design phase is complete (CIT, 2006). It is targeted at academia and research institutions, and provides financial support to the development of new technologies, as well as complex projects for technological development such as prototype, pilot solution, accredited laboratories and intellectual products. Projects related to industry application are encouraged, as well as those leading to new approaches in fundamental and applied research. Its main objective is to achieve cooperation between the research and economic sectors. Besides Technology Projects, further sub-categories of this programme are Complex Technology Projects (STIRP) that are focused on multidisciplinary, pre-commercial and cooperative research, and JEZGRA Projects, which are aimed at creating centres of excellence in research and technology, based on public-private partnerships. EUR 2.8 million has been secured in the state budget for 2006, for implementation of this programme (Government of the Republic of Croatia, 2006d). Implementation of TEST has been entrusted to the Croatian Institute of Technology (CIT), established in March 2006 under the authority of the Government of the Republic of Croatia. Since the establishment of HITRA, 482 projects have been submitted to TEST, 252 of which received positive evaluation and financial support. To this date, 150 projects have been completed, while 102 are still being financed (CIT, 2006).

RAZUM is an Innovation Commercialisation Programme and is designed to support entrepreneurial projects based on new technologies and higher value-added products (Government of the Republic of Croatia, 2005). The Business and Innovation Centre of Croatia (BICRO) is implementing the RAZUM sub-programme. The most important features of this service are the high professionalism of implementation, the absence of administrative constraints on decision-making, as well as the development of specific knowledge and a network of experts for financing, assessing and managing entrepreneurial projects. Until 2004, BICRO has analysed 70 entrepreneurial projects, 15 of which received financial support (European Commission, 2004). The programme operates based on public support and other sources of financing (such as the Croatian Bank for Reconstruction and Development (HBOR), the Ministry of the Economy, Labour and Entrepreneurship (MELE), the Fund for Development

and Employment (FDE), and a World Bank loan), contributing 70% of project costs in the form of conditional grants, and the remaining 30% is contributed by the private sector (Government of the Republic of Croatia, 2006d).

Overall monitoring of the performance of HITRA is organised through the submission of annual reports to the MSES and the government. The budget for HITRA has been steadily increasing, from EUR 7.2 million in 2001, to EUR 11.7 million in 2003 (European Commission, 2004).

The introduction of these programmes was a step to modernise the approach to innovation policy in terms of the "Triple Helix" model. This model consists of three basic actors with intertwined actions - the government, higher education institutions and businesses - working to shorten the time-span between discovery and utilisation. However, the programmes did not manage to strengthen all elements of the model; in particular they failed to promote links between R&D and business to the expected degree. The main reason is found in a weak industrial R&D sector and a low level of technological capability in the business sector. The implementation of HITRA and its contribution to the development of the Croatian NIS has so far been insufficient and requires further improvements (Aralica and Bacic, 2005).

To enable the right technology infrastructure to support commercialization of research outputs and development and growth of knowledge-based enterprises, the Government has initiated, with support from the World Bank, the Technology Infrastructure Development Programme (TehCro), administered by BICRO, which will grant support for creation of technology incubators, R&D centres and technology-business centres linked to research/academic institutions and R&D-based industry. The Government shall commit EUR 6.5 million to the programme, and Croatian financial institutions, like HBOR - Croatian Bank for Reconstruction and Development are expected to contribute around EUR 2 million (Government of the Republic of Croatia, 2006d).

The Research and Development Programme (IRCro), administered by BICRO, is intended to encourage and stimulate demand for services of public research institutions, as well as to encourage SMEs to invest in R&D activities. The Programme envisages utilization of extensive facilities available within the universities and research institutions in the country. Projects under the IRCro Programme involve cooperation between an industrial firm and research/academic institutions and are jointly funded by the IRCro programme and the industrial company involving a 50/50 matching grant scheme. Thus, the private sector participates 50% in funding of R&D activities. A total of EUR 1.5 million has been secured in the state budget up until the end of 2009 for this programme (Government of the Republic of Croatia, 2006d).

Research projects and programmes in Croatia are evaluated by one of 45 peer review groups, and each project proposal is evaluated by a group of nominated evaluators. Projects are contracted for a period of three to five years and principal researchers are required to submit a report of their research once a year. Based on the evaluation of the report, the ministry decides whether to continue financing the project. Following the completion of the project, a final report is submitted and is evaluated by its respective peer review group. Projects are classified according to the field of science, and priorities are set within each area (Uvalic, 2006).

Experts from the Institute of Economics in Zagreb have published an in-depth study evaluating Croatia's innovative capability using the framework of the European Innovation Scoreboard (EIS). According to their findings, Croatia ranks well in comparison to other countries of Central and Eastern Europe, but has not made significant progress in its innovation potential

and policy with respect to the European Union. Innovation policy in Croatia has so far been developing under the umbrella of R&D policy, resulting in the relative neglect of innovation policy's potential to contribute to higher economic growth - it is only in the last few years that the first elements of innovation policy, in the form of technological programmes, have appeared. The significance of innovation policy for the economy has traditionally been better recognised in advanced economies, which have promoted it as the main strategic tool for achieving competitiveness in industry, paving the way to the knowledge-based society. Some indicators of Croatia's human resource potential (for example, the share of science and engineering graduates) offer encouraging results, while others (for example, life-long learning) are totally neglected. While the high-tech service sector in Croatia appears relatively developed, the high-tech manufacturing sector is clearly underdeveloped. Furthermore, policies have mostly failed to create both public and business knowledge - expenditures on R&D while patenting applications made by Croatian residents to the EPO are the lowest among countries of Central and Eastern Europe (Aralica and Bacic, 2005). The key problems contributing to Croatia's low innovation capacity can be found in the low demand for innovation and technologies, the low investment rates in R&D by the business sector, the poor orientation of R&D towards the business sector, the undeveloped system of technology transfer and undeveloped statistical system, all of which are inappropriate for a knowledge-based society (Government of the Republic of Croatia, 2005).

The European Union has eased this transition process by establishing a European Area of Research and Innovation, in an attempt to encourage key interfaces in innovation networks; namely between companies and financial markets, R&D and training institutions, advisory services and technological markets (Aralica and Bacic, 2005).

The Croatian government has put the establishment of a modern innovation system among its microeconomic and structural priorities, defining its goal as a system that encourages cooperation among the education and science systems, government institutions and private enterprises, in order to achieve successful technological development. On the national level, a politically independent advisory body - the National Competitiveness Council (NCC) - put the development of innovativeness and technology as one of the top political and economic priorities. The results of the council's work are embodied in a document entitled '55 Recommendations for Improving Croatia's Competitiveness'. The council outlined several principles to help the country attain a modern approach to innovation policy which will strengthen the components of innovation capability (absorptive capacity, demand, innovation diffusion and R&D), lead to productivity growth and strengthen the knowledge component behind new investments (Aralica and Bacic, 2005). The general objectives of R&D policies are to restructure the scientific research sector, increase investment in science in order to reach 3% of GDP, financially diversify (increase private sector finance), utilise regional research methods and achieve optimal scientific research through international cooperation.

Regarding the development of an information society, the government of the Republic of Croatia adopted a strategic document in 2002 entitled 'Information and communication technology - Croatia in the 21st century'. The document encompasses seventeen recommendations for Information and Communication Technology-related activities (MSES, 2006b). During 2006, the government was working intensively on the preparation of the 'Strategy of Broadband Internet Access Development and Strategy of Telecommunication Development in Croatia' (Government of the Republic of Croatia, 2006b). The government should continue to implement its new strategy of broadband development which has set the goal to achieve 500,000 broadband subscribers by the year 2008 and mobilize all necessary support towards meeting this important target (SBRA-Great-IST, 2007). In 2005, the 'National Programme on Information Security in Croatia' was adopted, following the adoption of the 'Declaration of

Principles and Action Plan' (World Summit on Information Society, 2003). Furthermore, the government adopted an 'Operative Action Plan 2005-2008' for the successful implementation of the National Programme on Information Security (Government of the Republic of Croatia, 2006b).

Dynamic governmental activity was also present in the education sector. The MSES adopted an 'Education Sector Development Plan 2005-2010' and a number of support programmes in order to ensure the efficient implementation of the plan, with the assistance of the International Bank for Reconstruction and Development (IBRD). The programme design is built upon four broad pillars that form the basis of the sector reform priorities: Creating Learning Schools, Improving Management and Leadership, Strengthening Monitoring and Evaluation, and Supporting Regional Development and Innovations. Taking account of the current situation, in terms of the process of globalisation and stabilisation, economic restructuring and the pressures of competition, demographic factors, as well as the need for modernisation and the development of a knowledge-based society and economy in Croatia, there is a clear need for effective changes in the development of the education system. To ensure continuity, new educational policies rely on preserving the fundamental values of Croatian society, while also utilising new guidelines and activities in order to develop the Croatian educational system in line with the state-of-the-art standards of Europe and the rest of the world (MSES, 2005a).

The State Intellectual Property Office of the Republic of Croatia (SIPO) drafted a 'National Strategy for the Development of the Intellectual Property System of the Republic of Croatia 2005-2010', which was adopted by the government in October 2005. By adopting this strategy, the government secured fundamental conditions regarding the level of intellectual property protection, similar to those implemented by the European Union. The strategy should create the grounds for further implementation and development of intellectual property, as one of the key factors of the overall economic, social, cultural and scientific development of the country (SIPO, 2006).

On 5th May 2006 the Government of the Republic of Croatia adopted a document 'Science and Technology Policy of the Republic of Croatia 2006-2010'. This strategic document presents a vision of the development of the Science and Technology sector in the Republic of Croatia. The main goals of the Science and Technology policy are increased investment into science, research and development based on the principle of excellence, their greater impact, realignment of the science sector, fostering of scientific partnerships and the support system for outstanding young researchers, support and strong connection of science and industry, establishment of a motivating framework for their joint development, support of all measures leading to development of technology and innovations, with a more intensive participation of Croatian scientists in the European Union Framework Programmes (Government of the Republic of Croatia, 2006d).

The key objectives presented in the S&T Policy are (Government of the Republic of Croatia, 2006d):

- To increase funding for excellent science and technology projects,
- To restructure publicly-funded research institutes and R&D centres,
- To encourage research partnerships and strengthen support schemes for quality young researchers,
- To invest in science research infrastructure and knowledge transfer institutions,
- To introduce measures to promote commercialisation of academic research,
- To introduce measures to promote technological development and innovation,
- To administer stimulating and business-friendly legislation.

5.3 Main Fields of Intervention and Research Priorities

Innovation policy as such has only recently re-emerged in the Western Balkan countries, after having been reduced to a secondary role during the transition process. According to Radosevic, innovation policies in the region should recognise the structural weaknesses of their individual innovation systems and apply country-specific solutions, as opposed to the rather imitative mode that has so far prevailed (Radosevic, 2005). Investment in R&D and high-tech orientation are regarded as the dominant paradigm in innovation policy (Dall, 2006).

Serious long-term structural problems that affect the S&T sector need to be solved in order to assure further development. Amongst these structural problems are budgetary constraints and public debt, a generally low level of development, the need for industrial restructuring, widespread unemployment and massive migrations, pointing to the need for industrial restructuring in largely de-industrialised economies (Uvalic, 2005). Due to the overall lack of resources, prioritisation is of utmost importance and research orientation needs to be steered towards the economic and social needs of the present in order to make provision for the future. International programmes need to use foresight and support the process of prioritisation, as simply focusing on the RTD Framework Programme or imitating the strategies of other countries will not bring about the desired results (Uvalic, 2006).

Priority setting in S&T is intended to facilitate the efficient performance of certain identified S&T fields, by providing a predictable allocation of critical-size funds. The need to define thematic S&T disciplines and fields has been generally recognised across the region, especially in Croatia (Uvalic, 2006). The government of the Republic of Croatia has laid out strategic priorities for RTD funding in the upcoming period - amongst key priorities are the reform of the higher education system, brain-gain, Information and Communication Technology, Biotechnology, new materials and new production processes, Environmental Sciences and sustainable development, and the socio-cultural transition from an industrial- to a knowledge-based society etc. In the process, Croatia will surely benefit from the European funds which have become available since the start of the EU negotiation process.

The vision of the Croatian R&D programme is to develop a high quality S&T and higher education sector that would support economic, social and humane progress and, through its contribution, would serve as a backbone for the development of a knowledge-based society. The excellence of the R&D sector should be proven through innovativeness, originality, effectiveness, increase in the number and quality of patents, publication of top-level scientific papers and above all, through rationality, adaptability and the ability to transfer knowledge into the economy, as well as through cooperation with higher education institutions, research institutes and the industry (Government of the Republic of Croatia, 2006d).

The majority of financed projects demonstrate that researchers and institutes are interested in specific topics (curiosity-driven research). The overall distribution of funds reveals that the majority of research in Croatia falls within the Biomedical, Technical and Natural sciences. As mentioned above, most research activity is conducted at higher education institutions and public institutes. The substantive part of budget resources for R&D is distributed through the MSES programme, 'Research Projects', and is intended for all fields of science regardless of the thematic area and type of research. However, the budget is designed to assure the balanced development of the six main fields of science usually serviced by the MSES in terms of the planning, monitoring and evaluation of research activities. According to the MSES, 1,295 research projects covering all scientific areas were financed in 2002 and 1,760 were financed in 2005. The distribution by scientific fields in 2005 was the following (Becic and Svarc, 2008):

- natural sciences (24.5%)
- technical sciences (18.1%)
- bio-medical sciences (28.1%)
- bio-technical sciences (9.7%)
- social sciences (9.6%)
- humanities (10.0%).

With regard to socio-economic objectives, the largest share of research in the higher education and government sector is devoted to "non-oriented research", followed by "social structures and relationships" and "protection and improvement of human health". In the business sector, the majority of research is aimed at "industrial production and technology", "agricultural production and technology" and "protection and improvement of human health (see Table 5.3) (Becic and Svarc, 2008).

Table 5.3: Domestic R&D expenditure by sectors and socio-economic objectives, Croatia, 2005 (Becic and Svarc, 2008)

	All sectors	Business sector	Government	Higher education	Non-profit
Exploration and exploitation of the space	0.02	0	0	0.7	0
Non-oriented research	28.75	9.34	37.44	37.28	0
Other civil research	2.74	1.75	2.92	3.81	0
Defence	0	0	0	0	0
Exploration and exploitation of the Earth	4.42	0.32	12.32	3.84	0
Infrastructure and general planning land use	0.5	0.23	0.41	0.9	0
Control and care of the environment	2.74	1.35	5.31	2.63	0
Protection and improvement of human health	15.95	22.27	11.21	11.71	13.48
Production, distribution and rational utilisation of energy	2.25	1.63	3.72	1.97	0
Agricultural production and technology	16.72	24.17	7.37	14.41	0
Industrial production and technology	19.02	38.91	0	8.6	0
Social structures and relationships	9.88	0.02	19.3	14.8	86.52
TOTAL (in %)	100	100	100	100	100

Source: CBS, R&D statistics database.

The Croatian government and governmental bodies have recently been adopting development strategies and implementation policies with an accelerated pace. Achieving EU accession country status and beginning the negotiation process have had a positive impact on Croatia's development process, while access to EU financial funds and the distribution of know-how have also had a beneficial effect.

In the field of Science and Technology, the MSES started the preparation of a broad-based Technology Programme in October 2002, building on the earlier efforts and successes and prioritising the economy's needs in a systematic way. This work, supported by the World Bank Technical Assistance Project for Institutional and Regulatory reform for Private Sector Development (TAL-2), resulted in the 'Science and Technology Project'. The project was created with the objective of securing accession to the European Union, as well as building a dynamic and competitive economy that can rapidly achieve convergence to EU living standards. The project supports Croatian industry through various programmes, including the

modernisation of the S&T system, maintaining high-quality science infrastructure, upgrading the technological capabilities of firms, and developing a means of non-traditional financing, for example, venture capital. The high level of externalities which characterise these activities justifies the public assistance in these areas as firms invest at sub-optimal levels in R&D and once diffused, knowledge can be accessed by anyone as a public good. Increased productivity, an improved technological base, and strengthened links between research and development institutions, the scientific community and industry will help enterprises compete more effectively and facilitate Croatia's economic integration into the global market. The project consists of three main components (MSES, 2006b):

1. Restructuring of Research and Development Institutions (RDIs)
2. Establishing the Business Innovation Centre of Croatia (BICRO)
3. Unity Through Knowledge Fund

The restructuring of R&D institutions aims to strengthen the capacity of selected Croatian R&D institutions and to reorient their research infrastructure to serve the economy. The restructuring of RDIs, including the Brodarski Institute and the Ruđer Bošković Institute, is also supported in order to increase their applied and contractual research capacity, both within Croatia and in international markets. The project finances the purchase of equipment, consulting services and training; furthermore, it envisages support for the establishment of Science Parks (MSES, 2006b).

BICRO aims to upgrade technological capabilities of enterprises, to finance technology development programmes (e.g. RAZUM Programme), to promote Venture Capital in Croatia, to develop technology centres, incubators and R&D centres, and to establish a Sponsored Research and Development Programme (to provide grants to finance SME research projects).

The Unity Through Knowledge Fund (UKF), as described above, is a facility aimed at attracting the Croatian Diaspora, specifically scientists and researchers living abroad. The UKF supports the following activities: motivating expatriate Croatians to do scientific research, setting up a network of Croatian Scientific Diaspora and financing short-term visits of eminent Croatian expatriates to Croatia, attracting expatriate Croatians to launch start-up companies and other related initiatives in line with the project motto Connectivity - Cooperability - Creativity (MSES, 2006b).

The report of the Great-IST project (FP6) has stated some weaknesses and threats for Croatia, especially focussing on the domain of Information and Communication Technologies (SBRA-Great-IST, 2007): weak cooperation between ICT SMEs and research organisations; poor awareness of joint initiatives between ICT companies and research organizations; the level of innovativeness is ten times lower than in EU countries; insufficient following of EU trends in innovation and creativity; low support to the creation of centres of excellence in research and technology, based on public private partnerships.

On the other hand, some strengths and opportunities should not be neglected: high growth rate of the IT market; the telecommunication infrastructure is the most modern in the SEE region with 100% digitalized network; Croatia is a leader in the region according to the level of implementation and commercialisation of new technologies; relatively high efficiency and productivity of Croatian workforce; participation in FP6 has been rather successful, and in the IST area Croatia scored highest among the 20 target countries; implementing a new strategy of internet broadband development which has set the goal to achieve 500,000 broadband subscribers till the year 2008; harmonisation with the EU, prospect of joining the Union in the not too distant future (SBRA-Great-IST, 2007).

6 Summary and Draft Conclusion

In today's globalised world economy, enhanced by the constant pressures of competition markets, economic restructuring in transition countries is unavoidable. The transition towards a knowledge-based society is perceived as a way of keeping pace with the EU's global competitors. Unfortunately, countries of the Western Balkans region mainly disregarded the role of R&D systems and innovation activities during the 1990s, with public innovation policies only emerging at the end of the 1990s. Growth and innovation in the economy are globally recognised to be dependent on R&D, on the capability to absorb and diffuse technology and on the demand for its generalisation and utilisation. In Croatia, innovation policy has been marginalised, mostly due to the shifting of priorities towards macroeconomic policy and obsolete understanding of innovation policy in general. In order to improve such conditions, the ministry should adopt adequate measures to re-establish the vast national R&D base, educational system and the business sector. Knowledge will have to be applied and used commercially, as opposed to the current situation, where there is no incentive to turn to the market. Such a transformed market-oriented research and education system will be forced to monitor signals from the marketplace and improve its capacity to supply innovation. However, experts have warned about the possible outcomes of such shock-therapy, which could leave the national university and research system entirely dependent on the market. Such a turn would probably result in a shift from one extreme to another - from an emphasis on fundamental research to an emphasis on applied research (Aralica and Bacic, 2005).

Notwithstanding the devastating effects of war between 1991 and 1995, Croatia has managed to maintain the activities of all higher education institutions and scientific institutes, as well as its involvement in regional and international projects. Following its political efforts in gaining candidate country status to the EU accession process, Croatia has been adopting reforms with an accelerated pace. Research and development in Croatia is well integrated in the world R&D system and about 30% of its potential was oriented to international research projects. Substantial efforts were invested in formulating scientific and technological policies and commencing their implementation process. Reforms in the science and research sector include substantial institutional and legislative reform, emphasising the importance of creating synergy between science and economic development. Further incentives were provided by introducing new technologies, creating new knowledge, developing new products and services etc. The government has clearly expressed its determination to implement further policies which support and encourage the development of the RTD sector, since research, technology and development are perceived to be the driving forces behind employment, economic development and overall competitiveness of a state. Since 2003, Croatian science policy has been based on the concepts of the Strategy of Development of the Republic of Croatia in the 21st Century - Science, and the Science and Education Act. The overall goals of Croatian RTD are as follows: restructuring the scientific research sector, increasing investment in science (in order to achieve the goals adopted in the Lisbon Agenda - 3% of GDP allocated to science and research), financial diversification (i.e. more intensive integration of the economic and private sectors into financing science), regional diversification of research activity and optimal use of scientific research through international cooperation. The main targets of technology policy include the revitalisation of industrial research, the commercial use of scientific research, building-up technology capabilities of companies and developing private incentives for financial investments into technology-based entrepreneurship (European Commission, 2004).

Innovation and higher education indicators represent another aspect of Croatian R&D policy which requires further improvement, especially in terms of their construction and their inclusion in relevant European databases. Although participation in Eurostat significantly

improved during 2005, it is still confined to basic indicators. Sophisticated data, especially that relevant to technological performance, such as patent activity (EPO), high-tech exports, ICT expenditures, etc. are still missing.

According to Becic and Svarc, the status of R&D and innovation indicators reflects, in essence, the old paradigm of economic growth concentrated on labour- and capital-intensive sectors and production/service sectors with low R&D and innovation consumption (Becic and Svarc, 2006). However, the main boost towards the formation of a knowledge-driven economy and the modernisation of the S&T system in Croatia comes from Croatia's accession negotiations with the European Union. With candidate country status, the Lisbon goals were brought into Croatian national development plans, promoting research and innovation as the important drivers of development. Nowadays, it is commonly accepted that there is an urgent need for Croatia to integrate into global economic processes, primarily into the European Union. The role of science, technology and education is perceived as an important factor for European integration and for the transition from an industrial- to knowledge-based economy. The best illustration of this new orientation is the new Science and Technology Policy of the Republic of Croatia 2006-2010 accepted by the Croatian government in June 2006. The main challenge for science policy is to increase the funding for S&T in order to meet the "3% of GDP for research investment" as laid out in the Lisbon Strategy. The priority is to promote economic growth and job creation through research and innovation. Therefore, the key objectives for the science and innovation policy in the near future are as follows: to focus publicly-funded research projects on national priority areas and industrial needs, to encourage research partnerships, mobility and cross-sector cooperation, as well as to introduce new measures to promote the commercialisation of academic research.

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8 List of Acronyms

ALLEA	All-European Academies
AZVO	Agency for Science and Higher Education
BERD	Business Sector Expenditure on R&D
BICRO	Business and Innovation Centre of Croatia
CARDS	Community Assistance for Reconstruction, Development and Stabilisation
CARNet	Croatian Academic and Research Network
CBS	Central Bureau of Statistics of Croatia
CEEOL	Central and Eastern European Online Library
CEI	Central European Initiative
CIT	Croatian Institute of Technology
COST	Cooperation in Science and Technology
CROSBI	Croatian Scientific References
CTBTO	Comprehensive Nuclear-Test-Ban Treaty Organisation
CTT	Centre for Technology Transfer
DFG	Deutche Forschungsgemainschaft
EC	European Commission
EERO	European Environmental Research Organisation
EGEE	Enabling Grids for E-science
EICC	Euro Info Correspondence Centre (Zagreb)
EIS	European Innovation Scoreboard
EIT	European Institute of Technology
EMBO	European Molecular Biology Organisation
EPC	European Patent Convention
EPO	European Patent Office
ERA	European Research Area
ERA-NET	European Research Area Network
ESF	European Science Foundation
EUREKA	Pan-European Network for market-oriented, industrial R&D
EUROCORES	European Science Foundation Collaborative Research Programmes
EURODOC	European Council of Doctoral Candidates and Junior Researchers
EQUIBELT	Education Quality Improvement by E-Learning Technology
FP5, FP6, FP7	European Community Framework Programmes RTD
FTE	Full Time Equivalent
GDP	Gross Domestic Product
GÉANT	Multi-Gigabit Pan-European Data Communications Network
GERD	General Expenditure on R&D
GOVERD	Government Sector Expenditure on R&D
GVA	Gross Value Added
HAZU	Croatian Academy of Sciences and Arts
HC	Headcount Equivalent
HE	Higher Education
HERD	Higher Education Sector Expenditure on R&D
HID	Croatian Information and Documentation Society
HIDD	Croatian Information and Documentation Society
HIT	Croatian Institute of Technology
HITRA	Croatian Innovation Technology Development Programme
HRČAK	On-line Portal of Scientific Journals in Croatia
IAEA	International Atomic Energy Agency
IAMP	Inter-Academy Medical Panel
IAP	Inter-Academy Panel
IBRD	International Bank for Reconstruction and Development
ICSU	International Council for Science
ICT	Information and Communication Technology
ICTY	UN International Criminal Tribunal for the former Yugoslavia
IGK	Internationale Graduiertenkollegs
IPA	Instrument for Pre-Accession Assistance
ISOTEIA	Integrated System for the promotion of Territorial-Environmental Impact Assessment

ISPA	Instrument for Structural Policies for Pre-Accession
IUPAC	International Union of Pure and Applied Chemistry
MLAZ	Young Scientists Network of Croatia
MSES	Ministry for Science, Education and Sports of Croatia
NCC	National Competitiveness Council of Croatia
NCP	National Contact Point
NIS	National Innovation System
NISKA	National Information System in Croatian Libraries
NRDP	National R&D Programmes
NFS	National Foundation for Science, Higher Education and Technological Development of Croatia
OAI-PMH	Open Archives Initiative Protocol for Metadata Harvesting
PCT	Patent Cooperation Treaty
PHARE	Poland and Hungary: Assistance for Restructuring their Economies
R&D	Research and Development
RDI	Research and Development Institutions
RTD	Research and Technological Development
RSE	Researchers, Scientists and Engineers
SAA	Stabilisation and Association Agreement
SAP	Stabilisation and Association Process
SAPARD	Special Accession Programme for Agriculture and Rural Development
SCI	Science Citation Index
S&E	Science and Engineering
SEE	South Eastern Europe
SEE-ERA.NET	FP6 project “Southeast European Era-Net”
SEEFIRE	Southeast Europe Fibre Infrastructure for Research and Education
SEE-GRID	South Eastern European Grid-enabled e-Infrastructure Development
SEEREN	South Eastern European Research & Education Network
SFB	Sonderforschungsbereiche
SFRY	Socialist Federal Republic of Yugoslavia
SIPO	State Intellectual Property Office of Croatia
SIS	Scientific Information System of Croatia
SMEs	Small and Medium Size Enterprises
SRCE	University Computing Centre (Zagreb)
S&R	Science and Research
S&T	Science and Technology
STI	Science, Technology and Innovation
STIRP	Complex Technology Projects (Složeni tehnnologijski projekti)
TAL	World Bank’s Technical Assistance Project for Institutional and Regulatory Reform
TEMPUS	Trans-European Mobility Scheme for University Studies
TERENA	Trans European Research and Education Network Association
TRIPS	Trade-Related Aspects of Intellectual Property Rights Agreement
UAI	Union-Académique International
UKF	Unity Through Knowledge Fund
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNIDO	United Nations Industrial Development Organisation
USPTO	United States Patent and Trademark Office
WAYS	World Academy of Young Scientists
WIPO	World Intellectual Property Organisation
WB	Western Balkans
WBC	Western Balkan countries
WMO	World Meteorological Organisation
WTO	World Trade Organisation
ZSI	Zentrum für Soziale Innovation (Centre for Social Innovation, Austria)

Annex I - Main Institutions in Croatia

Quoted from Government of the Republic of Croatia (2006c): Science and Technology Policy of the Republic of Croatia 2006-2010. Available from: http://public.mzos.hr/lgs.axd?t=16&id=11958, accessed 15.02.2007.

State Institutions and Bodies

Agency for Science and Higher Education http://www.azvo.hr
Meteorological and Hydrological Service http://www.dhmz.htnet.hr
State Intellectual Property Office http://www.dziv.hr
State Office for Metrology http://www.dzm.hr
Central Bureau of Statistics http://www.dzs.hr
Croatian Academic and Research Network - CARNet http://www.carnet.hr
Croatian Accreditation Agency http://www.akreditacija.hr
Croatian Institute of Technology - HIT, Ltd. http://www.hiteh.hr
Croatian Parliament - Committee for Education, Science and Culture http://www.sabor.hr
Croatian Standards Institute http://www.hzn.hr
Ministry of Science, Education and Sports http://www.mzos.hr
National Foundation for Science, Higher Education and Technological Development http://www.nzz.hr
National Council for Information Society
National Council for Higher Education http://www.azvo.hr
National Science Council http://www.nvz.hr
Business Innovation Center of Croatia - BICRO, Ltd. http://www.bicro.hr

Important Scientific Organizations

Croatian Academy of Sciences and Arts* http://www.hazu.hr
Academy of Medical Sciences of Croatia http://www.amzh.hr
Croatian Academy of Engineering http://www.hatz.hr
“Miroslav Krleža” Lexicographical Institute* http://www.lzmk.hr

**Institutions of special interest for the Republic of Croatia*

Public Insitutes

Institute of Economics http://www.eizg.hr
Croatian Geological Survey http://www.hgi-cgs.hr
Croatian Institute for Bridge and Structural Engineering http://www.himk.hr
Croatian Historical Institute http://www.isp.hr
Croatian Veterinary Institute http://www.veinst.hr
Institute for Anthropological Research http://www.pub.srce.hr/antro/hrv/naslov
Institute of Archeology http://public.carnet.hr/iarh/
Institute for Social Research http://www.idi.hr
Institute of Social Sciences “Ivo Pilar” http://www.pilar.hr
Institute of Ethnology and Folklore Research http://www.ief.hr
Institute of Philosophy http://www.ifzg.hr
Institute of Physics http://www.ifs.hr
Institute of Croatian Language and Linguistics http://www.ihjj.hr
Institute of Public Finance http://www.ijf.hr
Institute for Adriatic Crops and Karst Reclamation http://www.krs.hr
Institute for Medical Research and Occupational Health http://www.imi.hr
Institute for International Relations http://www.imo.hr
Institute for Migration and Ethnic Studies http://www.imin.hr
Institute of Oceanography and Fisheries http://www.izor.hr
Institute of Art History http://www.hart.hr
Ruđer Bošković Institute http://www.irb.hr
Institute for Tourism http://www.iztzg.hr

Institute for Tourism http://www.iztzg.hr
Institute for Agriculture and Tourism http://www.iptpo.hr
Agricultural Institute Osijek http://www.poljinos.hr
Old Church Slavonic Institute http://public.carnet.hr/staroslavenski-institut/
Forest Research Institute http://www.jaska.sumins.hr

Private Scientific Institutions

Bc Institute for Breeding and Production of Field Crops* http://www.bc-institut.hr/
Brodarski Institute, Ltd. http://www.hrbi.hr/
Tobacco Institute Zagreb*
Energy Institute Hrvoje Požar http://www.eihp.hr/
Ericsson Nikola Tesla* http://www.ericsson.com/
GlaxoSmithKline Research Center Zagreb, Ltd. http://www.pliva.com
INA* http://www.ina.hr
Civil Engineering Institute of Croatia* http://www.igh.hr/
Energy Institute* http://www.ie-zagreb.hr/
I3 Information Innovation Institute http://www.svetikriz.com
Končar - Electrotechnical Institute* http://www.koncar-institut.hr/
Mediterranean Institute Grga Novak http://www.mign.org
Mediterranean Institute for Life Sciences http://www.medils.hr

**Joint stock company*

Technology and Research and Development Centers

Technology-Development Center Osijek, Ltd. http://www.tera.hr
Technology-Innovation Centre of Rijeka, Ltd. http://www.ticri.hr
Technology Center in Split, Ltd. http://www.tcs.hr
Center of Technology Transfer - Ctt, Ltd. http://www.ctt.hr
Research and Development Centre for Mariculture, Ston http://www.unidu.hr/ric.php
Center for Karst, Gospic

Universities and Colleges

Universities

University of Dubrovnik http://www.unidu.hr
Josip Juraj Strossmayer University of Osijek http://www.unios.hr
University of Pula
University of Rijeka http://www.uniri.hr
University of Split http://www.unist.hr
University of Zadar http://www.unizd.hr
University of Zagreb http://www.unizg.hr

Public Colleges and Polytechnics

Social Science Polytechnic of Zagreb http://dns.pravo.hr/veleuciliste/
“Lavoslav Ružička” Polytechnic of Vukovar http://www.vevu.hr
“Marko Marulić” Polytechnic of Knin http://www.veleknin.hr
“Nikola Tesla” Polytechnic of Gospić
Polytechnic of Karlovac http://www.vuka.hr/
Polytechnic of Požega http://www.vup.hr
Polytechnic of Rijeka http://www.veleri.hr
Polytechnic of Slavonski Brod
Polytechnic of Šibenik http://www.vstsi.hr
College of Electrical Engineering in Varaždin http://www.vels.hr
Teachers Education Academy in Čakovec http://www.vus-ck.hr

Teachers Education Academy in Petrinja http://www.vusp.hr
Police Academy - Zagreb http://pa.mup.hr
Agricultural College in Križevci http://www.vguk.hr
Technical Polytechnic of Zagreb http://www.tvz.hr
Health Polytechnic in Zagreb http://www.zvu.hr

Accredited Private Colleges and Polytechnics

American College of Management and Technology in Dubrovnik http://www.acmt.hr
International Graduate Business School Zagreb http://www.igbs.hr
RRiF Graduate School for Financial Management in Zagreb http://www.rrif.hr
"Matija Vlačić Ilirik" Faculty of Theology in Zagreb http://www.tfmvi.hr
Polytechnic College Velika Gorica http://www.vvg.hr
Business Administration College in Višnjan http://www.manero.hr
"Libertas" Academy in Zagreb http://www.vps-libertas.hr
"Utilus" Business School, Zagreb http://www.utilus-zg.com
"Agora" Academy in Zagreb http://www.vs-agora.hr
"Vern" Business School, Zagreb http://www.vern.hr
College of Business and Management "Baltazar Adam Krčelić", Zaprešić http://www.vspu.hr
Work Safety College in Zagreb http://www.vss.hr
Technical College - Polytechnic Studies in Pula http://www.politehnika-pula.hr
Evangelical Theological Seminary in Osijek http://www.evtos.hr
Zagreb School of Economics and Management http://www.zsem.hr
Entrepreneurial Economics College in Zagreb http://www.zsm.hr

Computing Centre

University Computing Centre - SRCE, University of Zagreb http://www.srce.hr

Web Pages of important Program and Projects of the Ministry of Science, Education and Sports

Scientifi c projects http://zprojekti.mzos.hr
HITRA - Technology projects http://tprojekti.mzos.hr/
Croatian Scientific Portal* http://www.znanstvenici.hr
Center for on-line databases* http://www.online-baze.hr
5. Cooperation with the European Union http://www.mzos.hr

**Joint projects of the Ministry of Science, Education and Sports, CARNET and "Ruđer Bošković" Institute*

Elke Dall
(ed.)
INFORMATION OFFICE OF THE STEERING PLATFORM
ON RESEARCH FOR THE WESTERN BALKAN COUNTRIES
see-science.eu

Science and Technology Country Report

The Former Yugoslav Republic of MACEDONIA

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1 Introduction

This country report is produced by the "Information Office of the Steering Platform on Research for Western Balkan Countries" and reviews the situation of Science and Technology (S&T) in the Former Yugoslav Republic of Macedonia (the FYR of Macedonia).

The report summarises main papers published by the United Nations Educational, Scientific and Cultural Organisation (UNESCO), the South-East European ERA-NET (SEE-ERA.NET), the Austrian "Gesellschaft zur Förderung der Forschung", and several independent scholars on the issue of S&T in the FYR of Macedonia. For the complete list of references please see References in chapter 7, starting on page 179 of this report.

The objective of this study is to enhance our understanding of the national innovation system in the Former Yugoslav Republic of Macedonia (the FYR of Macedonia). An overview of the situation in S&T regarding the main stakeholders, input and output indicators, the national strategies and priorities, and the main documents and laws in the field is given below.

The 'system of innovation' approach was taken into account when compiling this report, and it covers important factors influencing the development, diffusion and the use of innovations, as well as the relations between these factors. It does not place emphasis on individual firms or research organisations, but rather on innovation as an interactive and interdependent process.

Relevant organisations in this respect are firms, higher education institutions, government agencies, etc. interacting to create knowledge and innovation. The macro-level of the system is analysed using indicators such as R&D personnel ratios, R&D expenditure, patent application intensity rates, etc.

The report was compiled in autumn 2006 by the Information Office, Ms. Elke Dall and Ms. Maruška Bračić, Centre for Social Innovation, Vienna, Austria and reviewed by Mr. Klaus Schuch, Centre for Social Innovation, Vienna, Austria; Mr. Viktor Stefov, Ministry for Education and Science. A brief update was carried out in December 2007 by Mr. Jure Zrilič, Centre for Social Innovation. Further reviews were carried out by Ms. Katerina Sumanovska, Ministry for Education and Science; Ms. Stanka Petkovska, Ministry for Education and Science; Ms. Veronika Simonovska, European Commission, DG Research.

1.1 The Former Yugoslav Republic of Macedonia - A Brief Profile

The FYR of Macedonia is one of the smallest economies in the Western Balkans with a population of 2,050,554[1]. According to the CIA World Factbook (2006), at the time it gained its independence (without violence[2]) in September 1991, the FYR of Macedonia was the least developed of the Yugoslav republics, producing merely 5% of the total federal goods and services output.

[1] July 2006 estimation

[2] Nonetheless, latent tensions between the ethnic Albanian (roughly 30 percent of the total population) and the majority ethnic Macedonian populations raised the possibility of conflict. Ethnic conflict was avoided for a decade despite the social strains of both a weakened economy and the Kosovo crisis. But in early 2001, ethnic Albanian armed groups began a low-grade insurgency that brought the country to the brink of civil war (Mascarell, 2007).

The collapse of Yugoslavia saw an end to transfer payments from the central government and eliminated the advantages of being part of a *de facto* free trade area. Until 1996, economic growth in the FYR of Macedonia was further hindered by the absence of infrastructure, the UN sanctions on the downsized Yugoslavia (one of its largest markets), and a Greek economic embargo resulting from a dispute over the country's constitutional name and flag. Since then, GDP subsequently rose each year until 2000. However, due to the ethnic conflicts of 2001, the economy shrank by 4.5% as a result of the decreased trade, intermittent border closures, increased deficit spending on security needs, and investor uncertainty. Growth barely recovered in 2002 (0.9%), then rose by 3.4% in 2003, 4.1% in 2004, and 3.7% in 2005 (CIA, 2006). In 2006 the real GDP growth rate was 3.5% (OECD, 2006). Economic activity accelerated markedly in the first quarter of 2007. Preliminary data points to an increase of real GDP by 7% compared to the same period the year before. The main sources of growth were manufacturing and trade (European Commission, 2007a). The unemployment rate has been declining, in 2005 it was 37.3%, while in 2006 36%. In 2007 unemployment remained relatively stable on a very high level (European Commission, 2007a).

The FYR of Macedonia has managed to maintain macro-economic stability with low inflation, but lags behind in attracting foreign investment and job growth has been anaemic (CIA, 2006). The general macro-economic problems were reflected in the financial situation of the research institutes and the prevalent closure of business R&D divisions and departments.

1.2 Relations between the FYR of Macedonia and the EU

The report starts by discussing the position of the FYR of Macedonia and its current situation regarding the enlargement process of the European Union (EU). This process is closely intertwined with the development of the innovation system within the country under scrutiny. As official candidate countries, Croatia and the FYR of Macedonia are well on their way to joining the EU, while Serbia, Montenegro, Bosnia and Herzegovina and Albania hold only potential candidate country status and have a longer way to go in achieving EU accession.

Within the EU and among its national economies, research and development (R&D) is perceived to be the key resource for increasing competitiveness and long-term growth. As part of the transition to a knowledge-based economy, one of the actions called for by the Lisbon European Council in March 2000 is to stimulate the creation, absorption, diffusion and exploitation of knowledge through the European Research Area (ERA). The provision of education and training for the knowledge society, and the start-up and development of innovative businesses are also important. At the Barcelona Council meeting in March 2002, an agreement was reached, whereby R&D expenditure will be increased to 3% of GDP by 2010, two-thirds of which should originate from the private sector.[3]

The FYR of Macedonia began contractual relations with the EC in 1996, when it signed an agreement granting eligibility for assistance from the EC PHARE programme. In 1997, it signed a Cooperation Agreement, which remained in force until 2004. Meanwhile, the Stabilisation and Association Agreement was signed in Luxemburg in April 2001 and entered into force in April 2004. The FYR of Macedonia then submitted an application for EU membership on 22nd March 2004. After a thorough revision of the application, the European Commission adopted its opinion on 9th November 2005, taking into account the country's capacity to meet the Copenhagen criteria set out by the European Council (1993) and the conditions set out in the Stabilisation and Association Process for the Western Balkans (European Commission,

[3] In the EU-15 in 2000, average general expenditure for R&D was 1.93% of GDP (compared to 2.69% in the US and 2.98% in Japan), while in 2001 it was 1.98% (or 1.93% in the EU-25, according to the estimates of the European Commission); Industry-financed R&D in 2000 was 56.3% of total R&D spending (compared to 68.2% in the US and 72.4% in Japan) (European Commission, 2003).

2007c).

The opinion contained a detailed analysis on the country's ability to fulfil the obligations of the membership, based on 33 chapters of the acquis. It was concluded that the FYR of Macedonia should be in a position to take up most of the membership obligations in the medium term (5 years), but major efforts to ensure the effective implementation and enforcement of legislation will be necessary. In particular, the question of technical norms and standards, the protection of intellectual property rights, competition policy, environment, and financial control were identified as critical issues (European Commission, 2007c).

Following the Commission's recommendation, the European Council decided to grant candidate status to the FYR of Macedonia on 17th December 2005. Before further steps are taken, the European Council concluded that the FYR of Macedonia will first have to demonstrate further progress and achievements in meeting the Copenhagen political criteria, the requirements of the Stabilisation and Association Process and the effective implementation of the Stabilisation and Association Agreement (SAA). On 30th January 2006, the Council adopted a decision on the principles, priorities and conditions contained in the European Partnership with the former Yugoslav Republic of Macedonia (European Commission, 2007c). On 8th November 2006, after acquiring candidate country status, the Progress Report for the FYR of Macedonia was released by the European Commission. In this report, general remarks on the achievements and difficulties were given (Stefov, 2007). The second Progress Report for the FYR of Macedonia was released on 6th November 2007 by the EU Commission, covering the period from October 2006 to October 2007. The general assessment based on the decision taken, legislation adopted and measures implemented, is that the FYR of Macedonia has made progress and most of the obligations have been fulfilled in the field of competition, industrial property rights and telecommunication market, however, further progress is needed (European Commission, 2007b).

On 18th September 2007, the European Union (EU) and five West Balkan nations (among them, the FYR of Macedonia) signed nine agreements on visa facilitation and readmission, which will bring the two sides closer in cooperation in migration and movement of persons. The signature of the agreements is an important political decision toward closer cooperation between the EU and the Western Balkan countries in the sensitive areas of migration and movement of persons (see-science.eu, 2007a).

More information on the stakeholders in international and regional R&D cooperation is given in chapter 2.2 on International Cooperation below.

2 Contemporary Institutional Landscape

The FYR of Macedonia is amongst other countries in the region in undergoing radical changes and transitions since 1991[4]. The S&T system of the former Socialist Federation Republic of Yugoslavia, which the successor states inherited, was of comparatively good quality despite its uneven distribution. However, it was severely damaged by the wars of the 1990s, which had a significant impact on the innovation system. However, as the European Commission has recently acknowledged in its report on relations with the FYR of Macedonia, today the country is perceived to be a functioning democracy with stable institutions which are able to guarantee the rule of law and fundamental rights of its citizens (European Commission, 2007c).

[4] The FYR of Macedonia declared its independence from SFRY on 17th September 1991.

2.1 Main Stakeholders Involved in Policy Making in the FYR of Macedonia

In the decade following independence, the FYR of Macedonia was confronted with severe economic problems, resulting in the virtual disappearance of business sector R&D during the restructuring and privatisation period. State financing for science and research is very low and international donor participation in the S&T sector is also rather limited.

The governmental body responsible for S&T policy is the Ministry of Education and Science. Its competencies and responsibilities comprise the organisation, financing, development and promotion of science and technology, Information and Communication Technologies, and technical culture, as well as promoting international cooperation, supervising and monitoring the system, and drafting laws and bylaws (Government of the Republic of Macedonia, 2005b, p. 63f). The Ministry of Education and Science has at its disposal the following financial instruments for the support of scientific research (Government of the FYR of Macedonia, 2007a):

- financing the national research and technology development projects;
- awarding scholarships for post-graduate and doctoral studies at local and foreign universities;
- financial support for research workers participating at international conferences;
- financial support in organising international scientific conferences;
- contribution for publishing scientific and research publications;
- development of the research and technology development (RTD) infrastructure.

The MES's activities are largely restricted to co-financing activities such as (Polenakovik and Pinto, 2007; Sumanovska, 2007):

- Developmental and innovation projects (up to 30% of total cost);
- 45 scientific journals per year;
- Publication of approximately 200 scientific books per year;
- Participation in around 50 domestic scientific conferences;
- Participation in international conferences, seminars, etc. (500 people);
- International study visits for around 100 young scientists;
- About 300 research projects in 2003 and some 186 projects in 2004;
- About 150 innovative projects supported by the Ministry in the period 2003 to 2007.

In cooperation with the Ministry of Economy, a new fund has been created and efforts have been made to secure a loan from the World Bank in order to set up a new centre of excellence[5]. Other ministries with activities in the field of S&T include the Ministry of Agriculture, Forestry and Water Management, the Ministry of Health, the Ministry of Environmental Protection and the Department for European Integration (Barbutov, 2004; UNESCO Office Venice, 2004; Government of the Republic of Macedonia, 2005b; Popovski, 2005).

The primary national institution to promote the development of science, research, innovation and new technologies is the Macedonian Academy of Sciences and Arts (MASA). MASA is facing serious problems such as a lack of funding, a low level of human capital, outdated

[5] The Government of the FYR of Macedonia signed the Agreement on the First Programmatic development Policy Loan PDPL 1 in 2005. PDPL 1 is part of the World Bank's three-year strategy supporting the FYR of Macedonia between 2004 and 2006. The scenario anticipates that the FYR of Macedonia will receive financial support as a loan totalling USD 165 million in the three-year period (2004-2006). The loan from the International Bank for Reconstruction and Development - World Bank will be allocated to the FYR of Macedonia as an amount of EUR 24.4 million (USD 30 million).

equipment, with the consequence that it is not in a position to fulfil its role satisfactorily. MASA implements its activities through five departments (Linguistic and Literary Sciences; Social Sciences; Mathematical and Technical Sciences; Biological and Medical Sciences; and Arts) and five research centres (Research Centre for Genetic Engineering and Biotechnology, Research Centre for Energy, Informatics and Materials, Centre for Strategic Research, Centre for Linguistics and the Lexicographical Centre). The first two centres are internationally recognised for their research, but there is an overlap in the focus of the other three centres and other scientific institutions such as the Institute of Economics, the Institute for Sociological, Political and Juridical Research, the Institute for Macedonian Language and the Institute for Macedonian Literature. MASA's difficulties are compounded by the fact that researchers and scientists are not always allowed to apply for MES research projects (Polenakovik and Pinto, 2007).

According to the National Report on Bologna Process, state universities are expected to be managed from a central structure for the sake of enabling strategic and transparent management. This innovation was aimed towards transforming public, state-funded universities into an integral structure, and creating faculties that will become parts of universities and lose their status of independent units. This will integrate fragmented universities and create a possibility for internal mobility of studies, programmes and staff (Uzelac, 2006).

The vast majority of R&D is carried out through the Ss. Cyril and Methodius University in Skopje, established in 1949 and comprising of 23 faculties and 10 public scientific institutes and other institutions. The network of scientific institutions also includes universities in Bitola and Tetovo, the European University in Skopje, the Macedonian Academy of Sciences and Arts, other public scientific institutes (for example, the Institute for Seismologic Engineering, the Economic Institute, the Veterinary Medicine Institute, the Agriculture Institute etc.) and a few R&D institutions within industry and independent researchers (Dall, 2005; Stefov, 2007).

The University of Bitola - St. Clement Ohridski was established in 1979 and currently offers 5 faculties and 3 scientific institutes. The University of Tetovo was (illegally) established in December 1994 with the objective of providing the country's Albanian minority with university instruction in their own language. Despite ongoing harassment, the authorities did not shut down the university, which continued to function, albeit underground. In 2004, the Macedonian government legalised the University of Tetovo, which comprises of four faculties and a polytechnic centre, with approximately 5,000 students currently enrolled in its programmes.

There is also a competing institution that offers education in the Albanian language – the Southeast European University (SEE University) at Tetovo - a private university established in 2001, sponsored by the OSCE, the European Commission and others.

Three public universities in Skopje, Bitola and Tetovo educate some 45,000 students. Although they combine education with science and research, the level of contact with industry is insufficient. Research and scientific papers are used by the scientific and research staff primarily for the purpose of career development. The weak link between the universities and the economy has been noted in the past and continues to be an issue (Polenakovik and Pinto, 2007).

Further information on the financial input for the national innovation system of the FYR of Macedonia is given in chapter 3, The Input Side of the National Innovation Systems, below.

The Ministry for Education and Science also supports technological development and technical culture and provides some support to enterprises. It provides programmes to en-

courage innovation, but the impact on the business community is rather limited as only a small percentage of the projects funded under these programmes are implemented in private sector enterprises (Small and Medium Size Enterprise Development, 2005). On the other hand, the Ministry of Economy is responsible for entrepreneurship policy and tries to improve competitiveness with support from regional and local centres for economic development. There is also a National Council for Entrepreneurship and Competitiveness.

The Council for Science and Research has been the strategic body for the promotion and development of science and research since July 2005. It delivers recommendations, opinions and proposals regarding the annual programmes for the implementation of the Scientific Research Programme, and participates in the drafting of procedures and rules for the allocation of resources (Dall, 2005).

Another important institution in the science and technology area is the Euro- Regional Technology Centre - Bitola. This is a foundation established on 31st July 2003 by the Faculty of Technical Sciences - Bitola and the Council of Municipality Bitola, with support from GTZ (German Technical Cooperation) through their Project for Technology Transfer. The Euro-Regional Technology Centre - Bitola acts in the field of technological brokerage and facilitation of the transfer of technology, technology information and knowledge between research centres and private enterprises, primarily SMEs, in order to become competitive on EU markets. It also supports and helps the research institutes sustain and enhance their research activities, and stimulates technology - oriented entrepreneurship initiatives in the region, if they comply with regional technology requirements. All this is meant to lead towards accomplishing the aim – creation of a regional system of innovation which would be the future driving force of regional development (The Euro-Regional Technology Center - Bitola, 2004).

Another institution worth mentioned is the Euro-Balkan Institute. Its mission is to advocate, concert and disseminate the EU principles and values in the FYR of Macedonia and to promote transatlantic cooperation and interdependence. The areas in which Euro-Balkan Institute is particularly striving to promote and introduce these values are the research-based policy development and the democratic and multicultural higher education incorporating the contemporary standards of excellence in teaching (Euro-Balkan Institute, 2007).

When talking about IT industry and its development, the MASIT organisation should not be ignored. The Macedonian association for informatics technology (MASIT) is a voluntary, non-profit association and it represents an organisational form for all interested private companies that have primary business activities in the area of production, trade and services in IT that are registered in the FYR of Macedonia. MASIT was established in 2000 due to the joint efforts of the managers of 15 leading companies on the Macedonian IT market. It plays an important role in the lobbying with different governmental and other international bodies (MASIT, 2007).

Table 2.1: Main S&T Stakeholders in the FYR of Macedonia (adapted from Dall, 2005; Sumanovska, 2007)

Main ministry in the FYR of Macedonia competent for S&T	- Ministry of Education and Science
Other ministries with importance to the S&T sector:	- Ministry of Economy (and Department for European Integration) - Ministry of Health - Ministry of Agriculture, Forestry and Water Supply - Ministry of Foreign Affairs - Ministry of Environment and Physical Planning - Ministry of Transport and Communications
Other important stakeholders	- Macedonian Academy of Sciences and Arts (MASA) - Council for Science and Research - Council for Entrepreneurship and Competitiveness - The Euro-Regional Technology Centre - Bitola - Euro-Balkan Institute - MARNET - MASIT (Macedonian association for informatics technology) - Agency for development of SMEs - Bureau for Patents - Business Start-up Centre - Union Of The Inventors And Authors Of Technical Improvements Of Macedonia - UATIM Further information on relevant stakeholders is provided in Annex I - List of Further Institutes
Main research institutions / universities	- University Ss. Cyril and Methodius, Skopje - University St. Clement of Ohrid, Bitola - University St. Goce Delcev, Stip - University of Tetovo - European University, Skopje - South-East European University, Tetovo - University American College Skopje - 14 Scientific Research Institutes

2.2 International Cooperation

The Macedonian scientific community became quite isolated from Western and Central Europe as a result of the war in the region. Today, the country is ready to reintegrate into the scientific community of the so-called European Research Area. An excellent way to achieve this is to exchange researchers, familiarise Western Balkans researchers with EU opportunities etc. Due to their apolitical nature, scientific relationships may support peace and stability in the region as well as having an impact on future economic development.

Countries of the Western Balkans have experienced a constant renewal of international cooperation and support, especially in the last five years. Cooperation has been substantially supported by many international organisations, as well as through the assistance of other countries in bilateral programmes (also providing significant benefits to the R&D sector). The vast majority of financial support in this respect came from the funds of the Stabilisation and Association Process, the CARDS programme[6], the Stability Pact for South-East Europe, the European Investment Bank[7], and the European Bank for Reconstruction and Development[8], while the Tempus programme has been important in the area of higher education. Inclusion of the Western Balkan countries into the 5th and 6th European Framework Programmes for R&D, and their gradual integration into the European Research Area, has also been of particular importance[9]. The recent inclusion of these countries into the European Investment Bank's Innovation 2000 Initiative ought to prove useful as well. Concerning multilateral cooperation in the area of science and research, the Western Balkan countries have closely cooperated with many United Nations' specialised agencies, such as UNESCO, UNIDO, UNDP and UNECE[10]. Some other international organisations, such as the World Bank, have also been important donors and have helped in the area of R&D (Uvalic, 2006).

The Instrument for Pre-Accession (IPA) replaced CARDS in 2007. The IPA remains focused on institution building and socio-economic development, aims to provide targeted assistance to candidate countries and potential candidate countries with their EU membership applications, and has entirely replaced CARDS and other pre-accession financial instruments. The programming has five components - Transition Assistance and Institution Building; Regional and Cross-Border Co-operation; Regional Development; Human Resource Development and Rural Development - only the first two of which apply to potential candidate countries. The IPA allocates over EUR 11 billion during the 2007-2013 period (see-science.eu, 2006).

During recent years, the Ministry has promoted and stimulated international cooperation in all fields of scientific research and technological development. This strategy produced a substantial increase in the international scientific cooperation with many countries, especially the EU countries. Scientific cooperation is realised through the Framework Programmes, COST, NATO, UNESCO, IAEA and JICA. The increased participation of Macedonian scientists in the 6th Framework Programme should also be particularly highlighted. According to data

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[6] The programmes wider objective is to support the participation of the countries of the Western Balkans in Stabilisation and Association Process (SAP). Through the programme, EUR 4.6 billion has been provided to this region in the period 2000 to 2006 for investment, institution-building, and other measures to achieve main objectives. It was replaced by IPA - see below.

[7] As of December 2005, the European Investment Bank had supported projects in the FYR of Macedonia with funds totalling EUR 163 million. These funds were concentrated in the area of transport - in particular road construction and small and medium enterprise financing as well as the energy sector (European Commission, 2006)

[8] The volume of the Bank's support to the FYR of Macedonia increased modestly during the last Strategy period (mid-2004 through mid-2006) with seven new commitments for EUR 86 million, bringing total cumulative commitments to EUR 403.7 million, 55.7% of which are in the private sector. It is encouraging that two projects were signed with foreign sponsors, despite a general perception about a difficult investment climate in the country (EBRD, 2006)

[9] Framework Programmes (FPs) have been implemented since 1984 and cover a period of five years, with a short overlap between the last year of one FP and the first year of the following FP. FP6 ran up until the end of 2006. FP7 runs for a seven-year period from 1st January 2007, and expires in 2013. It is designed to build on the achievements of its predecessor, working for the creation of a European Research Area, but also carries the work further, developing the knowledge economy and society in Europe (CORDIS, 2006)

[10] See Chapter 8 List of Acronyms.

available to the Ministry, more than 50 projects run by Macedonian scientists have been approved, which is 4-5 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 and 7th Framework Programme (SEE-ERA.NET, ERA-WEST-BALKAN and ERA-WEST-BALKAN Plus), and in WBC-INCO.NET which will further contribute to better and wider incorporation of the FYR of Macedonia into European scientific research and development activities. Also, the Ministry has already committed a special fund from its Budget for 2008 as a financial contribution of the FYR of Macedonia in the next proposal for SEE-ERA.NET Plus (Stefov, 2007; Sumanovska, 2007).

On 13th June 2007, the FYR of Macedonia (represented by Minister of Education and Science Sulejman Rushiti) signed a Memoranda of Understanding (MoU) with the European Commission (represented Commissioner Janez Potočnik) to enable the FYR of Macedonia to participate fully in the EU's Seventh Research Framework Programme (FP7). Associated status allows the FYR of Macedonia to participate in all calls for proposals, compete on an equal footing with the EU Member States for research co-operation and support actions funded by FP7. The Memorandum of Understanding entered into force on 13th June 2007, but it is applied as from 1st January 2007 (see-science.eu, 2007d).

SEE-ERA.NET is a networking project, which aims to integrate EU Member States and South-East European countries into the European Research Area by linking research activities within existing national, bilateral and regional RTD programmes, was launched in September 2004 for a duration of five years. SEE-ERA.NET is financed by the European Commission and represents a consortium of 17 institutions from 14 European countries, including ministries in charge of international RTD cooperation from Austria, Bosnia and Herzegovina, Bulgaria, Croatia, France, the FYR of Macedonia, Germany, Greece, Hungary, Montenegro, Romania and Slovenia. In 2006, the network extended to include two more countries: Albania and Serbia. The Austrian Centre for Social Innovation (ZSI) co-ordinates the project. The idea behind SEE-ERA.NET is to coordinate existing bilateral S&T agreements and unilateral activities, incorporating isolated activities into a flexible system of multilateral initiatives which support regional R&D cooperation (Schuch, 2006).

The FYR of Macedonia participated in 15 FP5 projects - with Greece, Croatia and Bulgaria as its main cooperation partners. In the FP6, 44 R&D projects were recorded (according to the evidence available from MES), with awarded grants amounting to a total of EUR 4.5 million. Several National Contact Points (NCPs) have been set up and trained within the ERA WESTBALKAN Project (FP6-SSA), including those for IST and for Food Quality and Safety. Seventeen promotions and 'Information Days' were organised with the expert assistance of the EU and the NCPs and one workshop for all NCPs, which was facilitated by the experts from the agency *Welcomeurope* (Paier and Roediger-Schluga, 2006; Uvalic, 2006; Stefov, 2007; Sumanovska, 2007).

According to the published EU Commission Main List, up to 31st December 2007, 129 applications have been submitted by the FYR of Macedonia in the first calls for proposals in FP7 and 15 have been successfully evaluated for financing. The total amount for these funded projects is EUR 2,023,980 (Sumanovska, 2007).

In addition, for the implementation of FP7, 11 National Contact Points have been nominated for the areas of ICT, Food and Agriculture, Health, JRC, Ideas, Legal and Financial, NPM and SMEs, Energy, Environment, Infrastructure and Transport, SSH, People and SIS (Sumanovska, 2007).

IST2WEB, a project assisting the integration of scientists into the IST Programme of FP6 and SEE-INNOVATION (focusing on the integration of SMEs in the same field), also operates in the FYR of Macedonia, collaborating with the Faculty of Economics at the University of St. Cyril and Methodius and the Macedonian Association for Information Technology respectively.

The participation of Macedonian scientists in the COST Programme during the last three years has also significantly increased from five actions in 2003 to 31 actions in 2007 (Stefov, 2007; Sumanovska, 2007).

In 2007, the FYR of Macedonia took steps towards joining the pan-EU Network for Industrial R&D. This is just one of the activities aimed at strengthening the competitiveness of the country through support to businesses, research centres and universities and at improving innovative projects, processes and services, with the long-term goal of European integration. During the first EUREKA meeting held under the Slovenian Chairmanship, in Maribor (October 2007), the Former Yugoslav Republic of Macedonia joined as a cooperating NIP country (Sumanovska, 2007; see-science.eu, 2007c). One result of this meeting was the EUREKA Information Day on 30th January 2008 in Skopje, as organised by the Ministry of Education and Science. It is hoped that, having fulfilled all required conditions, the FYR of Macedonia can become a full member of the EUREKA Network (Sumanovska, 2007).

In the last few years, the MES has promoted a European-oriented science policy, as well as stimulating and assisting in the establishment of international cooperation in every way. In 2003, bilateral project cooperation only existed with Slovenia and Germany, but since then, cooperation has been established with Bulgaria, Serbia, Croatia, France, Albania, the Russian Federation, Japan and China, totalling over one hundred bilateral projects. On 23rd July 2007, the FYR of Macedonia and Austria signed a scientific cooperation memorandum, which will provide further opportunity for the mobility of scientists and the existence of joint project proposals in FP7. It is the intention of the Macedonian MES to continue with its policy of widening and develop its scientific cooperation with other countries from the region and beyond (Stefov, 2007; Sumanovska, 2007).

The FYR of Macedonia has allocated a relatively high level of resources to international cooperation in the last few years (namely 15.9% of the Ministry of Education and Science's budget for science). The largest number of bilateral projects were with Slovenia (12 projects in 2001, 12 in 2002, 12 in 2003, 16 in 2004, 18 in 2005 and 23 in 2007), Bulgaria (9 in 2005, and 9 in 2006), Serbia (7 in 2005), Croatia (8 in 2005 and 8 in 2007), Albania (6 in 2006), Turkey (4 in 2005), France (3 in 2004) and Germany (2 in 2004) (Stefov, 2007; Sumanovska, 2007). The main areas of international cooperation are Agriculture, Biotechnology, Food processing, Chemistry, Pharmaceutical research, and Environmental protection. More information on the thematic priorities is provided in chapter 5.3.

All these activities are intended to facilitate the incorporation of the FYR of Macedonia into the European scientific research area, which, according to the European Commission, is necessary for the status of this sector; "In the fields of Science and Research, the FYR of Macedonia should not have major difficulties in applying the acquis in the medium term" (Government of the Republic of Macedonia, 2005b).

For these purposes, the Ministry has adopted the Action Plan for 2008. According to the 2008 Government Programme, its implementation will be supported by the 34.97% increase in the budget for R&D (Sumanovska, 2007).

Many regional projects have been launched with the objective of promoting regional cooperation in South Eastern Europe. Regional scientific cooperation of the Western Balkan countries is currently being promoted within several regional organisations: the Central European Initiative (CEI), the Alps-Adriatic Task Force, the Adriatic-Ionian Initiative, and the Stability Pact for South Eastern Europe. In 2007, a decision was made to transfer the responsibilities of the Stability Pact to locally managed bodies in the region. This decision came into force in Sofia, on 27th February 2008, when the Special Co-ordinator of the Stability Pact for South Eastern Europe, Erhard Busek, handed over the responsibility for regional cooperation in South Eastern Europe to the Regional Cooperation Council and its Secretary General, Hido Biscevic. The Regional Co-operation Council will play a key role in consolidating achievements of the Stability Pact to date and in making further progress in the different areas of co-operation. It will also continue to provide a platform for supporting further Euro-Atlantic integration of South Eastern Europe (Stability Pact for South Eastern Europe, 2008).

Regional networks also include initiatives for the participation of Western Balkan countries in the EU Framework Programmes for R&D, as defined by the EU-Balkan countries Action Plan on Science & Technology adopted at the Ministerial Conference in Thessaloniki on 26th-27th June 2003. In most countries, current bilateral S&T cooperation within the region has been used as a starting point for identifying partners for FP6, COST and EUREKA. Positive examples of regional networks include the Inter-Balkan Forum on IST and the Balkan Physical Union (Uvalic, 2006).

In 2006, 130 Macedonian researchers were involved in international cooperation projects. As for the researchers' mobility, in 2004, 230 Macedonian researchers were awarded study grants for individual research, participation at conferences and other scientific events, in the fields of Biology, Chemistry, Agriculture and Technology. Furthermore, 68 foreign researchers were enrolled, mostly in the same fields, in institutions in the FYR of Macedonia in 2004. The countries most frequently participating in the exchange of R&D personnel are Slovenia, Turkey, Germany and Bulgaria. Macedonian institutions also participate in the Regional Centre for Technology Transfer (for the countries of Central and Eastern Europe) in the domain of Biotechnology and Applied Sciences at the University in Zagreb, Croatia. In 1992, a regional innovation centre was established in Štip. Furthermore, the FYR of Macedonia participates in 25 actions in the COST programme (Uvalic, 2006; Stefov, 2007).

2.2.1 Further International Cooperation Programmes for Science

The FYR of Macedonia has also cooperated with the International Atomic Energy Agency (IAEA). Based on the Agreement on Technical Co-operation with the IAEA and the Country Programme Framework, several national projects for the direct application of nuclear techniques in human and veterinary medicine, agriculture, ecology and industry, have been carried out. Furthermore, regional projects related to the strengthening of radiation protective infrastructure are being carried out through collaborative projects with the North Atlantic Treaty Organisation (NATO), especially within the Science for Peace Programme. UNESCO is also funding projects in the fields of education and science. The FYR of Macedonia has also been included in UNESCO's Programme for Basic Sciences.

The Macedonian Ministry of Foreign Affairs lists 37 international organisations of which the country is a member (Ministry of Foreign Affairs of the FYR of Macedonia, 2006); some of these are relevant to the field of S&T, such as:

- WIPO (World Intellectual Property Organisation)
- UNIDO (United Nations Industrial Development Organisation)
- WHO (World Health Organisation)
- UNESCO (United Nations Educational, Scientific and Cultural Organisation)
- ILO (International Labour Organisation)
- IMO (International Maritime Organisation)
- WMO (World Meteorological Organisation)
- INTELSAT (International Telecommunications Satellite Organisation)
- GEF (Global Environmental Facility)
- IAEA (International Atomic Energy Agency)
- WB (The World Bank Group)
- FAO (Food and Agriculture Organisation)
- ICCROM (International Centre for the Study of the Preservation and Restoration of Cultural Property)
- OIML (International Organisation for Legal Metrology)
- ITU (International Organisation for Telecommunications)
- IFAD (International Fund for Agricultural Development)
- ICGEG (International Centre for Genetic Engineering and Genetics)

The Norwegian Centre for International Cooperation in Higher Education and the Research Council of Norway have established the Norwegian Cooperation Program on Research and Higher Education with the Western Balkan countries. The programme is due to span the period between 2006 and 2009. The objective of the agreement is to initiate, develop and fund collaboration within higher education and research institutes between universities, university colleges and research institutions in the Western Balkans and Norway (SIU, 2006).

The FYR of Macedonia is also a recipient of numerous financial contributions from the USA, e.g. the Paul Getty Institute, which funds international research, and the South-East Europe Project organised by the Woodrow Wilson International Centre for Scholars, which provides grant opportunities.

2.2.2 Participation of the FYR of Macedonia in Education Programmes

The Trans-European mobility scheme for university studies (TEMPUS) programme is especially important for the higher education sector, which carries out most of the educational activities in the FYR of Macedonia. Within TEMPUS, during 1996-2006, there were 93 joint European projects, 23 structural and complementary measures, 10 compact measures, 333 individual mobility grants and 3 projects for the establishment of transfer technology structures, implemented in cooperation with Macedonian organisations (e.g. Electro-Technical Faculty, Faculty of Technology and Metallurgy, and Faculty of Agriculture; Faculty of Mechanical Engineering; Faculty of Geology and Mining; Law Faculty) (Uvalic, 2006; Stefov, 2007). The FYR of Macedonia participated in the phase TEMPUS II bis and TEMPUS III, which ended in 2006. The specific aim of TEMPUS III was to promote the development of higher education systems in eligible countries by encouraging understanding between, and rapprochement of, cultures, by addressing the reform of structures and management in higher education, and by improving links with business actors (European Commission, 2000; Stefov, 2007; Sumanovska, 2007).

As higher education and training have been regarded as key areas in the process of economic and social reform, the European Community actively works to develop the content and modalities for the fourth phase of the trans-European cooperation scheme for higher education for the period 2007 - 2013.

The Directors-General of DG EAC, AIDCO, RELEX and ELARG have signed a Memorandum of Understanding (MoU) on the implementation of the fourth phase of the Tempus programme that will cover the period from 2007 - 2013. The Tempus IV programme will introduce some important novelties, will strengthen the role of EC Delegation in policy discussions, and will provide closer linkages with National Tempus Offices (Sumanovska, 2007).

Tempus IV finances two types of action through regular calls for proposals. Joint Projects are based on multilateral partnerships between higher education institutions in the EU and the partner countries. They can develop, modernise and disseminate new curricula, teaching methods or materials, boost a quality assurance culture, and modernise the management and governance of higher education institutions. Structural Measures contribute to the development and reform of higher education institutions and systems in partner countries, to enhance their quality and relevance, and increase their convergence with EU developments. The first call for proposals was issued in January 2008, with the deadline for submission of proposals on 28th April 2008. The total budget for this call amounts to approximately EUR 51 million in total, and for individual projects from EUR 0.5 to EUR 1.5 million (European Commission, 2008c).

For the academic year 2008/2009, new opportunities for students and higher education institutions are opened for students of the FYR of Macedonia through the Erasmus Mundus External Co-operation programme. The European Commission adopted a financing decision, which allows for the possibility of awarding a limited number of scholarships (Action 2) for nationals of the FYR of Macedonia who submit their applications to Erasmus Mundus Masters Courses selected under Action 1 for the academic year 2008/2009 (European Commission, 2008a; European Commission, 2008c).

In addition, the FYR of Macedonia has participated in the CEEPUS programme since 2006. This programme supports student and academic mobility in the countries from the South East European region (Sumanovska, 2007).

The FYR of Macedonia became a member of the Bologna Process in 2003, having begun the changes in the higher education system earlier on in 2000 when the Ministry of Education and Science passed the new Law on Higher Education. The Law requires universities to start introducing the ECTS and designing study and subject programs according to the principles of the Bologna Process. Updating of the laws, bylaws and other legal instruments in the field of higher education and in areas linked to its development, especially the financial legislation, legislation on labour and social security and movement of citizens will be necessary. The FYR of Macedonia pays special attention to development of the European dimension in higher education. Numerous modules, courses and curricula with European content have already been developed and implemented under the EC Tempus Programme, the Council of Europe, as well as some EU Member States through bilateral projects. However the main emphasis in the entire implementation of the Bologna Process needs to be placed on its level of quality (Macedonian Bologna Group, 2005). The commitment of the FYR of Macedonia to reforming its higher education system in compliance with the pledges declared in Bologna Declaration is very strong. The FYR of Macedonia has already endorsed a concept that fully corresponds to the needs related to joining the European integration process (Uzelac, 2006).

Decentralisation is a key policy challenge in the FYR of Macedonia and forms part of the country's broader political agenda connected with the Stabilisation and Association Process and the 2001 Ohrid Framework Agreement (between the FYR of Macedonia and Albania). In education, the decentralisation process started in July 2005 and the MES needs to ensure the smooth and gradual transfer of responsibilities to local authorities over the next few years. The "National Strategy for the Development of Education 2005-2015" was approved by parliament in 2005. It was aimed at: promoting education for all; introducing reforms in all subsystems of education; increasing social partnerships, supporting activities of non-governmental and voluntary associations in the field of lifelong learning, linking formal and informal education, increasing the opportunities for educational mobility and raising adults' professional and social competences (ETF, 2006).

In addition, four successive PHARE and CARDS programmes have been supporting the reform of Vocational Education and Training (VET) in selected pilot schools since 1998. The Macedonian government has developed a macroeconomic policy that gives high priority to employment issues and employment policy. In December 2003, it endorsed the National Action Plan for Employment (NAPE) 2004 - 2005 developed under the EU CARDS 2002 Employment Policy I project. While initially implementation proved to be difficult due to the lack of resources, gradually new IT equipment was provided and 11 pilot projects for active labour market measures (ALMMs) were funded.

This was followed by the CARDS 2004 Employment Policy II project, which assisted the ministry with the development of a National Employment Strategy (NES) 2010 and a new NAPE for 2006-2008. Two working groups were set up - one on policy-making and the other on administrative matters, intended to be permanent bodies for monitoring NES and NAPE implementation and its revision (ETF, 2006). A third Employment Policy project is currently being prepared.

In 2007, with a view to streamline and unite all pre-accession assistance in a single framework, the new Instrument for Pre-accession Assistance (IPA) replaced CARDS and the other pre-accession programmes (following an EU Council decision on 17th July 2006). As a candidate country to the EU, the IPA was open to the FYR of Macedonia. The four strategic areas that the IPA concentrates on are: supporting institution building; improving cross-border cooperation; preparing for participation in the Community's cohesion and rural development policy; and preparing for decentralised management of EU funds (European Commission, 2007b). The programme adopted by the Government of the FYR of Macedonia on 3rd April 2007 defined the activities that would be conducted in relations to the IPA funds and the strategic priorities for the start of the negotiation of its EU membership.

Another new law was introduced in 2007, establishing a national agency for the Youth in Action programme and the EU integrated Lifelong Learning programme. The latter programme consists of four sub-programmes: Comenius (for schools), Erasmus (for higher education), Leonardo da Vinci (for vocational education and training - VET) and Grundtvig (for adult education), as well as a transversal programme and the Jean Monnet programme. Further progress has been made towards implementing EU Lifelong Learning objectives through the amended law on secondary education provides that from the academic year 2008/2009 onwards, secondary education (including VET and general education for students aged 15-18), will become compulsory (European Commission, 2007b; European Commission, 2008b). It is expected that the FYR of Macedonia and Croatia will be the first countries in the South Eastern Europe region to have access to both of these programmes, depending on the full implementation of all educational reforms.

Further important actors involved in this field are the German Gesellschaft für Technische Zusammenarbeit, Kulturkontakt Austria, USAID, the World Bank, the Soros Foundation, the UK Department for International Development and the UNDP.

3 The Input Side of the National Innovation Systems

Regarding the input indicators for the S&T system, some questions (for example, the share spent in terms of the gross domestic product (GDP), volumes and growth rates) need to be addressed. Here a distinction is made between private and public investment. R&D investment is used as an indirect measure of a country's innovation capacity (Fischer, 2006).

The current economic situation in the Western Balkan countries still poses significant constraints on national policies in R&D. Most countries of the region are still at less than 30% of the EU-25 GDP per capita average, hardly reaching 60-80% of their 1989 GDP. Restrictive fiscal and monetary policies, necessary for attaining macroeconomic stabilisation, allow for limited public expenditure and generally contribute to the low investment rates in the R&D sector. Although financial assistance received from abroad is significant, it is not usually provided on a continuous basis (Uvalic, 2006).

The Unit for Technological development and technical culture (within the Department of Science and Technology of the MES) has responsibility for encouraging and supporting the technological development, innovation and culture of the FYR of Macedonia. This is done mainly through the application and development of research projects, innovative projects, support of technological infrastructure, programs and projects for the development of the technical culture and the promotion of this culture, directed, in particular, at the younger population. These activities are focused on (Sumanovska, 2007):

- encouragement and support of the cooperation between universities and the economy;
- fostering the application of the research results in the economy;
- improvement of the technological capacities of the enterprises in order to increase their competency on the market;
- training as a means of developing the technical, technological and informatics knowledge and skills of the young population;
- Progress in inventive works;
- Sharing the scientific and technological achievements among the young population;
- Support of the creative and scientific work;
- Technical education.

In addition, the Ministry publishes an annual call for proposals for co-financing of applicative and innovative projects to support the technological development of SMEs. It also contributes 30% of the total project value. The actions supported include (Sumanovska, 2007):

- development of the new products and technologies;
- improvement of the existing production processes;
- improvement of the quality of life regarding labour humanisation and environmental protection;
- building the improvement of the existing necessary technological infrastructure.

In the period 2002-2007, the Ministry financially supported about 150 projects. Since 1992, it has also financially supported the establishment of the Regional innovative centre in Stip and assistance and support of technological nucleus at the Faculty of Natural Sciences, Electro-technical Faculty and Faculty of Medicine (Sumanovska, 2007).

3.1 Development of Financial Resources Allocated to R&D

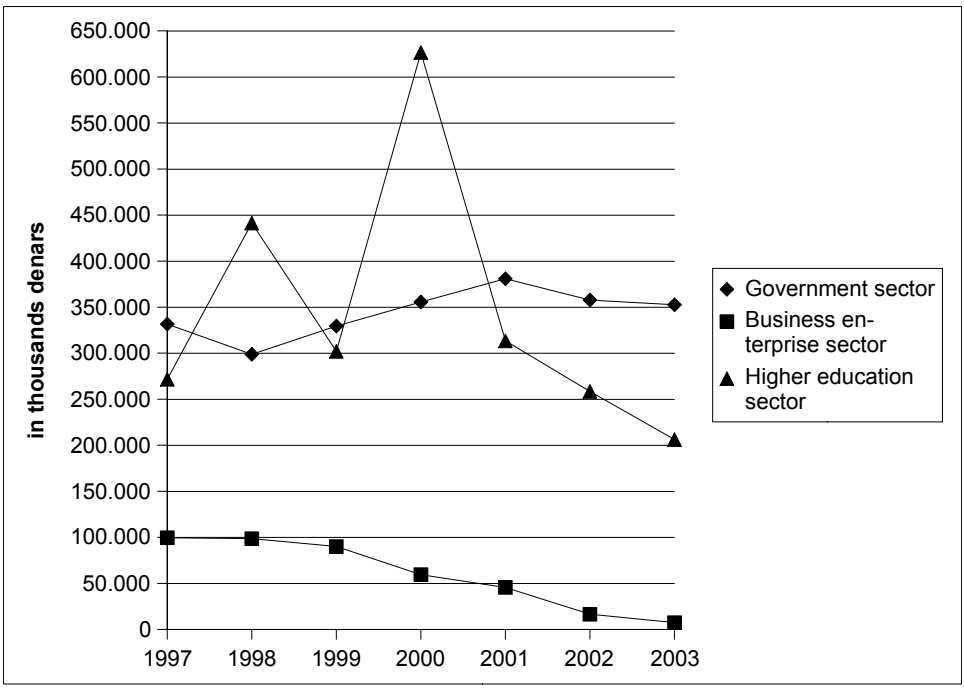
General expenditure on R&D in the FYR of Macedonia between 1997 and 2003 shows the volume of gross domestic expenditure on R&D (GERD). Figures show that R&D expenditure was on an upward trend between 1997-2000, while it decreased dramatically following the 2001 political crisis and was down to 50% of the 2000 level, at a low of 0.22% of GDP by 2003 (Fischer, 2006; Uvalic, 2006)[11]. The most recent records show this percentage resting at 0.25% in 2004 and 2005 (UNESCO Institute for Statistics, 2006).

R&D intensity (R&D expenditure or investment as a proportion of GDP) provides a useful measure of how countries invest in R&D in relation to the value of their total production. It is important to stress that the question of the absolute volume of R&D investment and the level of R&D intensity is not only one of money. Both investment and intensity indirectly reflect - and are dependent upon - the availability of a sufficient stock of human resources (discussed in chapter 3.4), a regulatory environment for R&D (discussed in chapter 5.1) and a general capacity to exploit these resources effectively. R&D intensity for the FYR of Macedonia in 2003 was measured at 0.18%. Like many other countries in the region, the FYR of Macedonia had a lower level of R&D intensity in 2003 than in 1999. The negative growth rate was -9.2%, mainly due to the growth of the economy, which outpaced the development of R&D expenditure (Fischer, 2006). In 2004 GERD was only 0.25% (INA - Great-IST, 2007).

Financial sources for R&D are provided by the government budget, as business enterprise funds were rather negligible and decreased after 1997[12]. There was also a threefold reduction in higher education spending on R&D, from 0.27% of GDP in 2000 to only 0.08% of GDP in 2003 and an almost threefold reduction in the government budget for science from 1997-2003. In 2003, the budget for science was mainly used to finance Science and Research (around 85%), around 10 % was allocated for technical culture (promotion of science, conferences, seminars etc.), and the remaining part went to so-called technological development (see Table 3.3 below). Regarding the financing of projects according to scientific discipline, the situation has been rather variable during the last ten years; in 2003, the major part (almost 40%) was allocated to Technical sciences, another 20% to Bio-technical sciences, 14% to Natural sciences and Mathematics, 13% to Medical sciences, while Humanistic sciences and Social sciences attracted a much lower percentage of resources (Uvalic, 2006).

[11] EUR 13 million in 1997, EUR 17 million in 2000 and EUR 9 million in 2003.
[12] In Chapters 3.2, 3.1 and 3.3, the general structure of R&D expenditure, divided between the business sector, the government sector and the higher education sector is discussed.

Figure 3.1: Dynamics of Expenditure for R&D per Sector



3.2 Government Sector Expenditures on R&D

Research institutions outside the business and higher education sector provide important links with the national innovation systems, as fundamental research often calls for high R&D investment and a specific research environment in which researchers can collaborate and exchange ideas.

The government's research priorities in the wider region have reshaped the system already. The current tendency is to make it necessary for institutions to generate income that is more commercial and to emulate business practices. In some cases, research institutions have been privatised, but more commonly, institutions have been further supported by the government on a contractual basis (Fischer, 2006).

The volume of government expenditure on R&D (GOVERD) between 1997 and 2003 was largely stable and remained at a low level, fluctuating at around EUR 5.9 million in 1997, 2000 and 2003. However, GOVERD as a percentage of GDP declined over the observation period (from 0.18% in 1997 to 0.14% in 2003). Government R&D expenditure per capita in the FYR of Macedonia increased insignificantly over the observation period (EUR 2.7 per capita in 1997 and EUR 2.8 in 2003) (Fischer, 2006; Stefov, 2007).[13]

Government research institutions generally play a significant role in national innovation systems. In the FYR of Macedonia, the government's share of public R&D is higher than that of the higher education sector. Although the government's contributions to public sector research institutions across the wider region seem to be diminishing, the same cannot be said for the FYR of Macedonia (Fischer, 2006).

[13] Percentages differ between the sources. This report has used the data provided by Stefov (2007), data for 2005 by Sumanovska (2007).

The figures described by Fischer show that the government sector's share of total R&D expenditure in the FYR of Macedonia in 2003 was 62.3%. The average annual growth rate of GOVERD in the FYR of Macedonia between 1997 and 2003 is -0.5%. The EU-15 were characterised by a 0.2% average growth in the period between 1995-2000 (Fischer, 2006).

Table 3.1: Government Sector R&D Expenditure (GOVERD)[14]

	1997	2000	2003	2004	2005
Government Sector Expenditure (in thousands of denars)	331,524	355,567	352,518	314,762	325,602

The Ministry of Education and Science in the FYR of Macedonia has used various financial instruments to support scientific research, for example: financing national R&D projects, granting scholarships for post-graduate studies at national and foreign universities, supporting researchers in their participation in international events, supporting institutions in organising scientific events, as well as contributing to the publishing of scientific papers and developing the R&D structure. Moreover, the Ministry of Education and Science has also financially supported the establishment of technological nuclei at several faculties (Uvalic, 2006).

Table 3.2: Ministry Budget for Science 1997-2003 (in Euro)[15] *(Uvalic, 2006).*

	1997	1998	1999	2000	2001	2002	2003
Science and Research	3,393,443	2,754,098	1,754,098	2,786,885	2,573,770	2,393,443	1,147,541
Technological development	81,967	81,967	81,967	163,934	8,197	196,721	83,672
Technical culture	196,721	196,721	196,721	196,721	131,148	163,934	114,754
Total	3,672,131	3,032,787	2,032,787	3,147,541	2,713,115	2,754,098	1,345,967

Table 3.3: Ministry Budget for Science 2004-2006 (in Euro)[16] *(Stefov, 2007)*

	2004	2005	2006
Science and Research	1,442,623	1,941,170	1,883,980
Technological development	81,967	147,050	196,080
Technical culture	100,000	106,210	106,210
Total	1,624,590	2,194,430	2,186,270

[14] Source: State Statistical Office, data for 2004 provided by Stefov (2007)
[15] Source: Ministry for Education and Science
[16] Source: Ministry for Education and Science

3.3 Business Sector Expenditure on R&D

The input of the business enterprise sector is evaluated by looking at the level and dynamics of business sector R&D expenditure at the aggregate country level. The R&D activities in the business enterprise sector are particularly essential for the innovative output and competitive dynamics of a country.

The relative importance of the business sector R&D efforts is indicated by the level of business expenditure on R&D (BERD) as a share of GDP. The relative importance of BERD in total economic activity in the region of South-Eastern Europe (0.24% in 2003 as calculated by Fischer (2006), including Bulgaria and Romania but not BiH and Albania due to the lack of data) lags considerably behind that of the EU-15 (1.26% in 2000). In the FYR of Macedonia, the level of BERD expenditure as a percentage of GDP was extremely modest - insignificant at 0.002% in 2003 (Fischer, 2006).

The input of the business sector in R&D activities in comparison to overall R&D activities reveals the relative importance of profit-oriented knowledge creation and absorption. Nevertheless, thorough examination of the business sector's share of total R&D expenditure shows considerable variation between the Western Balkan countries. In the FYR of Macedonia, a very low proportion of total R&D (below 15%) was spent on business research, thus reflecting a relatively low level of business sector knowledge investment in comparison with knowledge invested by the government and higher education sectors (Fischer, 2006).

Furthermore, the dynamics of BERD can be added as an important indicator of knowledge creation and absorption. Compared to the EU-15 (4.3%, 1995-2000), the business sector R&D expenditure increased relatively slowly in South-East Europe[17] (growth rate 2.3%, 1997-2003). Figures for the FYR of Macedonia demonstrate negative dynamics and the low level of business R&D activity results in sub-optimal absorptive capacities that could otherwise enable firms to take advantage of R&D activities undertaken elsewhere (Fischer, 2006).

Table 3.4: Business Sector R&D Expenditure (BERD)[18]

	1997	2000	2003	2004	2005
Business Sector Expenditure (in thousands of denars)	99,464	59,445	7,294	38,954	85,314

3.4 Higher Education Sector Expenditure on R&D

University research represents one key activity within the higher education sector regarding the national innovation systems, providing scientific and technological knowledge to be disseminated and utilised in the economy. However, as primary suppliers of fundamental research, universities do not only contribute to the economy through the direct provision of applicable results, but also through the diffusion and adoption of skills and techniques and through professional networks and other forms of communication channels created by academic research (Fischer, 2006).

In 1997, the FYR of Macedonia spent around EUR 5 million on R&D. In 2003, it was amongst those countries of the Western Balkans, which recorded the lowest levels of HERD (Higher Education Expenditure on R&D), allocating only between 0.03% and 0.07% of their GDP to

[17] Fischer has included Bulgaria and Romania in this calculation but not Albania and BiH – due to the lack of data.
[18] Source: State Statistical Office, data for 2004 provided by Stefov (2007), data for 2005 by Sumanovska (2007)

R&D activities in the higher education sector (Fischer, 2006).

Further examination of HERD as a share of total R&D expenditure reveals that HERD was at an exceptionally high level in the FYR of Macedonia in 2003; in the range of between 35% and 40% of the total, a figure comparable to Portugal for example (1999) (Fischer, 2006).

Taking into account the population, the amount spent on the higher education sector (per capita) in the FYR of Macedonia was EUR 2.44 in 1997 and EUR 1.66 in 2003. The higher education sector share mirrors the structure of government spending on public research. With 36.9%, the FYR of Macedonia is well below the EU-15 average of 59% (Fischer, 2006).

Table 3.5: Higher Education R&D Expenditure (HERD)[19]

	1997	2000	2003	2004	2005
Higher Education Sector Expenditure (in thousands of denars)	271,663	626,506	206,172	298,754	293,120

3.5 Human Resources in R&D

Human resources are key factors in the development of a knowledge based economy and society. The best-known indicator of human resource use for technological and economic purposes is the number of R&D personnel by sector (i.e. in the higher education, government and business enterprise sector). A further indicator is the numbers of students in science and engineering (S&E), the university level fields most relevant to S&T (Fischer, 2006).

Table 3.6: R&D Personnel by Sector [20]

	1997	2000	2003	2004	2005
Government Sector	916	1,044	829	754	754
Business Enterprise Sector	370	241	67	136	158
Higher Education Sector	1,650	1,809	1,693	1,662	1,730
TOTAL	**2,936**	**3,094**	**2,589**	**2,552**	**2,642**

Among R&D personnel, a distinction is made between researchers (i.e. researchers, scientists and engineers - RSEs), technicians, and other support staff. According to Fischer (2006), 1990 researchers were working in the FYR of Macedonia in 2003[21], although between 1997 and 2003 the number of researchers recorded a negative growth rate of 0.8%. Nevertheless, it is important to stress that the FYR of Macedonia has the highest proportion (76.9%) of researchers within total R&D personnel, which places it on a par with Portugal's 75.7% (1999), thus reaching the highest levels in the EU-15 (Fischer, 2006).

[19] Source: State Statistical Office, data for 2004 provided by data for 2004 provided by Stefov (2007)
[20] Source: State Statistical Office, data for 2004 provided by Stefov (2007), data for 2005 by Sumanovska (2007)
[21] Source: State Statistical Office, data for 2004 provided by Stefov (2007), data for 2005 by Sumanovska (2007)

Table 3.7: R&D Personnel Total by Occupation[22]

	1997	2000	2003	2004	2005
Researchers	2,088	2,246	1,990	1,887	1,988
Technicians and Equivalent Staff	382	397	228	306	309
Other Supporting Staff	466	451	371	359	345
TOTAL	**2,936**	**3,094**	**2,589**	**2,552**	**2,642**

The share of researchers in the labour force signifies the relative importance of RSE jobs in the labour market and can thus be seen as an appropriate indicator for examining the knowledge base of an economy. In 2003, the FYR of Macedonia reported 2.3 researchers per 1,000 labour force, compared to 5.4 researchers per 1,000 labour force in the EU-15 area (Fischer, 2006).

However, it is important to stress that RSEs are not the only category of employees engaged in R&D activities. Indicators such as the total number of R&D personnel and the percentage of RSEs within that total must also be considered. In the FYR of Macedonia, there were three R&D workers per 1,000 labour force in the year 2003, which places the country significantly below the EU-15 average of 9.8 R&D workers per 1,000 (1999) (Fischer, 2006).

Table 3.8: R&D Personnel by Scientific Fields[23]

	1997	2000	2003	2004	2005
Natural Sciences	287	370	32[24]	40	55
Engineering and Technology	850	674	594	632	639
Medical Sciences	710	632	735	758	792
Agricultural Sciences	388	418	392	380	478
Social Sciences	185	285	299	223	130
Humanities	516	715	537	519	548
TOTAL	**2,936**	**3,049**	**2,589**	**2,552**	**2,642**

[22] Source: State Statistical Office, data for 2004 provided by Stefov (2007), data for 2005 by Sumanovska (2007)
[23] Source: State Statistical Office, data for 2004 provided by Stefov (2007), data for 2005 by Sumanovska (2007)
[24] Questionnaires from Faculty of Natural sciences and Mathematics were not received.

Table 3.9: R&D Personnel by Age[25]

	1997	2000	2003	2004	2005
Below 29	147	203	152	119	122
30-59	2,169	2,254	1,905	1,932	2,000
Above 60	154	186	161	142	174
TOTAL	**2,470**	**2,643**	**2,218**	**2,193**	**2,296**

Table 3.10: Number of Students Enrolled in Tertiary Educational Institutions by Scientific Field[26]

	1997	2000	2003	2004	2005
Natural Sciences	2,589	3,090	2,963	2,843	2,824
Engineering and Technology	8,450	8,825	9,143	9,125	10,468
Medical Sciences	3,224	3,388	3,639	3,788	4,588
Agricultural Sciences	2,468	3,270	3,228	3,140	3,407
Social Sciences	11,303	17,250	22,432	26,520	29,515
Humanities	4,014	4,423	5,232	3,948	6,209
TOTAL	**32,048**	**40,246**	**46,637**	**49,364**	**57,011**

Of the total number of students enrolled in tertiary education in the FYR of Macedonia, 54% are female and 46% are male (2006). According to official statistics (2003), the general distribution of the population by gender in the FYR of Macedonia is 50.2% males and 49.8% females (Sumanovska, 2007).

The last statistical surveys for doctors of science (for 2006) show that during 2006, 85 persons have gained the title Doctor of sciences. The majority of candidates (32.9% - 28 candidates) received the doctorate in the field of social sciences, in humanities - 21 candidates (24.7%) and 10 candidates (11.8%) received their doctorate in the field of medical sciences. The rest gained their doctorate in the field of technical-technological sciences, natural-mathematics and biotechnical sciences. From the total number of the persons that have gained the title Doctor of sciences, 63 of them are working in University institutions, 10 persons are working in health care and social security services and other persons are working in construction and other activities. 49 women candidates (57.6%) gained the title Doctors of sciences in 2006 (State Statistical Office of the FYR of Macedonia, 2007).

According to the National Report on the Bologna Process, almost all doctoral candidates have research activities before defending the doctoral dissertation but the extent varies depending of their scientific commitment. The results of the research carried out by doctoral candidates are assessed and publicised by means of reviews, publication, scholar critiques, assessment of professional experts and application in practice (Uzelac, 2006).

Like other South Eastern European countries, the FYR of Macedonia also deals with the problem of brain drain. A joint UNESCO/Hewlett Packard (HP) project on piloting solutions for alleviating regional brain drain was implemented in 2003 in several Southeast European countries. By providing resources, including technological and financial facilities, to various universities, the initiative has enabled young scientists from the region to work within the framework of joint research projects with their fellow-nationals living abroad. The project

[25] Source: State Statistical Office, data for 2004 provided by Stefov (2007), data for 2005 by Sumanovska (2007)
[26] Source: State Statistical Office, data for 2004 provided by Stefov (2007), data for 2005 by Sumanovska (2007)

has provided grid technology to various universities from Albania, BiH, Croatia, the FYR of Macedonia, Serbia and Montenegro. Moreover, at the regional level, regular project meetings have also acted as a stimulus for transcending boundaries. Not only has the project strengthened scientific and educational capacities at the national level, it has re-established dialogue among young researchers from the region after years of broken communication. The networks created with UNSECO/HP support function autonomously, with the objective of sharing innovative experiences to help researchers from the region consolidate local capacities and undertake research beyond borders, without leaving their home countries permanently (Preda, 2007).

4 The Output Side of the National Innovation Systems

The output of an innovation system is manifested through the new knowledge, new products and processes that are produced. Whereas indicators such as the Gross Expenditure on Research and Development (GERD) and the Number of Researchers provide a measure of the resources potentially allocated to innovation, this chapter focuses on the results of the innovation processes and their output indicators such as patents and scientific papers.

4.1 Patent Activities in the FYR of Macedonia

Among other approaches (Hörlesberger, 2006), innovative output can also be measured by patent data, the most important advantage of which is the wealth of the information supplied. A patent file granted by the European Patent Office (EPO) provides data on the invention, which is protected by the patent through the title, abstract and technological classification. Furthermore, patent data provide the only output measure available for almost all countries in the world, including the Western Balkan countries (Hörlesberger, 2006).

European inventors today have a choice between two alternatives when seeking patent protection for their inventions: the European Patent Office and national patent offices. The EPO was set up to provide patent protection through a single procedure, defining the granting of patents in some or all of the contracting states of the European Patent Convention. The procedure for obtaining a patent at the EPO consists of two phases and sometimes a third phase dealing with possible objections. In contrast to national patents that are valid in only one country, a European patent gives its proprietor equivalent rights to a national patent in each member state. Moreover, European patents may also be effective in some countries that have not acceded to the EPC, including the FYR of Macedonia[27] (EPO, 2006).

A second barrier to patenting is the cost associated with a patent application. Studies estimate that the cost of an application and the 10-year maintenance of a patent at the EPO are approximately EUR 32,000 (Roland Berger Market Research, 2004). In contrast, applications to national patent offices may be less expensive (applications to local patent offices in the Western Balkans in particular can be expected to incur a considerably lower cost than an application to the EPO) (Hörlesberger, 2006).

Patent applications to the Macedonian Office of Industrial Property began in 1992 with an insignificant 14 applications, all from the FYR of Macedonia. In 1993 and 1994, the process of transferring applications from the Federal Patent Office of the former Socialist Federal Republic of Yugoslavia led to a large increase in the number of patent applications to the Macedonian Office of Industrial Property (Hörlesberger, 2006).

[27] The FYR of Macedonia has a so-called “Extension state” status at the EPO – this means it recognises the European Patents, although it is formally not a member of the organisation.

Between the years 1997 and 2003, 438 national patent applications and another 855 foreign patent applications were received in the FYR of Macedonia, either through the Patent Cooperation Treaty or the European Patent Office (as many as 591). The total number submitted to the State Office for Industrial Property for this seven-year period was 1293 patents. In the category of national patents, the number of annual applications has continuously declined, from 66 in 1997 to 47 in 2003, whereas foreign patent applications have increased, especially during the last few years – from only 65 in 1997 to 388 in 2003.

Analysis by the Macedonian Office of Industrial Property shows that the industrial property rights are improving (see Table 4.1). The Macedonian Office of Industrial Property is promoting creativity and innovation through initiatives such as the International Intellectual Property day, the Patent of the Year, participation in international exhibition of ideas/inventions/new products, etc (Polenakovik and Pinto, 2007).

Table 4.1: Intellectual property rights (2001-2005)[28]

	Year				
	2001	2002	2003	2004	2005
Total number of patent applications	125	241	435	452	436
National	65	44	47	44	53
Foreign	60	197	388	408	383
Total number of trademark applications	1186	1035	993	1056	1050
National	440	411	478	458	433
Foreign	746	624	515	598	617
Total number of industrial design applications	80	41	71	47	60
National	75	29	45	31	47
Foreign	5	12	26	16	13

Source: State Office for Industrial Property, Annual Report 2006.

In accordance with the classification proposed by the OECD, all patents have been assigned to one of the following six broad technological fields according to their IPC classification:

- Electricity - Electronics
- Instruments
- Chemicals, Pharmaceuticals
- Process Engineering
- Mechanical Engineering, Machinery
- Consumer Goods, Civil Engineering

More recently, patent applications (and thus patents granted) in the FYR of Macedonia have centred on the field of drug production and medical applications (about 1,250 patent applications representing 50% of all applications) including: organic fine chemistry (705), pharmaceuticals, cosmetics (386), the chemical industry and petrol industry, basic materials chemistry (82) and medical engineering (75). Other important fields for patent applications include civil engineering, building and mining (122), agriculture and food (92) electrical devices and electrical engineering (89), materials and metallurgy (68), machine tools and engines, pumps, turbines (97) (Hörlesberger, 2006).

[28] Source: Polenakovik and Pinto, 2007

4.2 Publication Activity in the FYR of Macedonia

The FYR of Macedonia is a member of the Cooperative on-line bibliographic system and services system (COBISS) which is a shared cataloguing system adopted by the former Association of the Yugoslav National Libraries as a common platform for the library information system and the system of scientific and technological information in Yugoslavia. It is now managed by the Institute of Information Science (IZUM) in Maribor, Slovenia.

Regarding scientific output, the overall number of scientific publications in 2003 was higher than six years before (1,659 in 2003, in comparison with 1,174 in 1997), though the number has since stagnated. There are, however, some scientific fields, for example, Biotechnology, where the scientific publication output has significantly increased in the last three years. The largest contribution to scientific publications has been made by researchers employed in the higher education sector (54%) and in the governmental research sector (45%), while only a small percentage is contributed by the business sector (less than 1%) (Uvalic, 2006).

The available data shows the low share of articles published when compared to Croatia for example, the most advanced country in the region (Simeonova, 2006), although the available data is rather old:

Table 4.2: Number of Articles Published (NSI data base) (Simeonova, 2006)

	FYR of Macedonia	Croatia
Number of current contents articles, 1993	1,397	11,505
Number of ISI articles 1991-2004	1,779	14,272

For the first time in the FYR of Macedonia, during 2004 and 2005, a complete database of publications from scientific journals with impact factors (journals referred in Science Citation Index and citations of institutions and researchers) was built up. A database of all patent activities in the country was also built (Stefov, 2007).

As an organisational unit within the St. Cyril and Methodius University, the Macedonian Academic and Research Network (MARNeT) was founded in 1994. Its primary mission is to organise and manage the only academic and research network in the country. MARNeT is also responsible for the provision of membership in international networking organisations and associations and participations in projects of interest for the academic community.

5 National R&D Strategy and Legal Framework

In this chapter, the innovation policies applied in the FYR of Macedonia are analysed, i.e. the official public documents that influence the policies on technical change, scientific development and innovation support. Furthermore, the legal framework and the strategies that have been adopted are presented. The aim is to acquire knowledge about the existing national strategies and programmes and their implementation mechanisms, taking into account policy aspects in the educational system, the development of Information and Communication Technologies, intellectual property protection, tax regimes, and so on.

5.1 Legal Framework for the National S&T System

A legal framework is indispensable in the organisation of R&D institutes, the innovation infrastructure and programmes that provide grants to research organisations and innovative

companies. Most commonly, laws are prepared separately for the areas of S&T and higher education. Legislation in the FYR of Macedonia is still undergoing a process of transition; new laws are subject to public debate, with ministerial regulations and governmental decisions also playing important roles. Legislation has improved and will further improve due to the stabilisation and association processes[29] (Dall, 2005).

In accordance with Article 47 of the Macedonian Constitution, the state has an obligation to stimulate and facilitate scientific research and technological development. Issues related to R&D are regulated by the following laws:

Table 5.1: Overview of the Important Laws in the Legal S&T Framework of the FYR of Macedonia (Dall, 2005, p. 187)

Law on Scientific Research Activities	Regulates the system, principles, public interest, forms of organisation and management of research
Law on Stimulation and Facilitation of Technological Development	Regulates the stimulation and facilitation of technological development and programming- and financing-related activities. Its goal is to foster and support the technological development at a national level, and to programme and fund these activities.
Law on the Macedonian Academy of Sciences and Arts	Defines the Academy as the highest autonomous scientific and art institution in the FYR of Macedonia
Law on Stimulation and Assistance of the Technical Culture	Regulates the dissemination of research results, stimulates research excellence, and technical and vocational education and training, especially among young people
Law on Higher Education	Insists upon equal opportunities for access to higher education, gives autonomy to all higher education institutions, provides a system for quality assessment of higher education, specifies degrees offered and qualifications granted
Law on Amendment and Supplement to the Law on Higher Education	In the line with the principles of the Bologna Process, it creates a legal framework for a system of higher education based on three cycles.
Law on Industrial and Intellectual Property Protection Law on Copyright and Related Rights	Determine intellectual property rights and the conditions regarding the enforcement and protection of copyright of the original work of authorship, including research studies
Law on Small Enterprise Development Support and the Establishment of an Agency for Supporting Entrepreneurship	Has recently been adopted; a strategy for implementing the principles of the European Charter for Small Enterprises has also been set up
Law on Electronic communications	Presented in February 2005. Main goals are new foreign investments, protections of users, monopoly abolition, allowing competition and market liberalisation.
Law on Vocational Education and Training	The Law regulates the establishment, management, and operational aspects of vocational education institutions.

[29] The FYR of Macedonia was the first country in the region to sign the Stabilisation and Association Agreement in April 2001. Leaders of the EU granted the country candidate status on 17th December 2005.

The bylaws to the law on Scientific Research Activities (rulebooks) determine the conditions and criteria regarding the allocation of resources for the stimulation and facilitation of scientific research, as well as governing the procedure for technological development, training scientists, and implementing annual programmes in these domains. In 2005, the Ministry of Education and Science reached the final phase in adopting new regulations on the funding of scientific research and finalised a draft proposal for a new Law on Science and Technological Development, bringing legislation closer to European regulations. This law was scheduled in the Working Plan of the Ministry for 2006 (Ministry of Education and Science of Republic of Macedonia, 2005b). After the election of the new government on 5th July 2006, the drafts of the strategic and programmatic documents were still waiting to be approved.

Most of the West Balkan countries have adopted some laws (but not all) required for eGovernment, eCommerce and eBusiness infrastructure. Complete legislation in these areas is missing. The FYR of Macedonia still lacks digital signature infrastructure due to lack of five legislative documents (regulations) based on the Digital Signature Law adopted in 2001. Among them is the final document which defines the procedure for establishment of a company which can act as Certificate Authority (Gusev, 2006).

The legislation on industry and intellectual property is based on the Law on Industrial and Intellectual Property Protection and several bylaws, such as the Patent Rulebook, the Rulebook on Industrial Design, on Trademarks, on the Product Mark of Origin and Geographic Marking and the Law on Copyright and Related Rights. Industrial property and patent rights protection comes under the remit of the State Bureau of Industrial Property (Dall, 2005). According to the European Commission, little progress has been made concerning enforcement and there are still no reliable statistics. An operation led by the state market inspectorate led to almost 400 charges being brought under the Laws on Copyright and Related Rights and on Trade, and eleven criminal charges under the Law on Copyright and Related Rights. The State Market Inspectorate has urged the public to report any illegal sale or renting of pirated materials and has provided a toll-free number for this purpose. There are no developments concerning the seizure and destruction of equipment used to make pirated goods. Enforcement is lagging behind the legal framework (European Commission, 2007c).

The Macedonian Customs Law exempts the import of donated equipment intended for research projects at higher education institutions and other public research institutions from customs duty and value added tax (Dall, 2005).

5.2 Main Documents Reflecting National Innovation Strategies

In many South East European countries and in the FYR of Macedonia, innovation is a topic subordinated to science or research policy. Most S&T policies in Western Balkan countries encourage sustainable support for basic research at universities and research institutes, for the development of human resources and for cooperation with the European Union's RTD programmes, joint activities with the European Science Foundation and bilateral agreements. In technology policy, emphasis is placed on linking research institutions as sources of knowledge with industry and SMEs, and on encouraging the establishment and functioning of intermediary institutions - although the success of such institutions in practice is still currently being questioned (Kobal, 2005). Policy development is in many ways intertwined with the accession process to the European Union. Negotiations with the European Union on the 31 chapters of the acquis communautaire cover various policy fields including research, SME and industry policy. The economic accession criteria, such as withstanding competitive pressure

and forces in a functioning market economy within the European Union, require policies and strategies to create an innovative knowledge-based economy (Dall, 2005).

The process of becoming a European Union candidate country and starting membership negotiation has resulted in the preparation of a National Strategy for Integration of the FYR of Macedonia into the European Union and the Action Plan for the European Partnership. In 2006, the government accepted a programme for the development of scientific research activities in the FYR of Macedonia during the period of 2006-2010. This is the first official document regarding the development of R&D adopted by government in the independent FYR of Macedonia. The programme was prepared over the course of one year by experts and officials from all fields of science. The future activities are set in the Action Plan of this Programme (Government of Macedonia, 2006; Stefov, 2007). In this work programme, the new government admits that science needs to undergo a substantive reform. Among the steps listed in the Action Plan are an increase in public investment in S&T and a provision of incentives for science through taxation policy, devising strict criteria for the selection of researchers in institutes. Nevertheless, economic reform also remains the top priority for this government (Government of Macedonia, 2006). In the meantime, the Ministry of Education and Science has established several programmes for which the government is attempting to provide funds (Popovski and Stefov, 2005), such as the Programme for Encouraging and Supporting National RTD Projects, the Programme for Granting Fellowships for Postgraduate and Doctoral Studies, both at home and abroad, the Programme for Supporting Researchers for Participation in International Meetings, a target Research Programme for Coordination of RTD Activities within Governmental Bodies, a Programme for Development of RTD Infrastructure and finally a Programme for Encouraging and Supporting Technological Development for the 2002-2006 period. The latter encompasses the objectives and activities of the Ministry of Education and Science for stimulating and facilitating technological development as well as criteria for priority setting. Annual programmes stipulate the co-financing of RTD projects. Projects of mutual interest for science and economics are implemented in accordance with the Annual Scientific Research Programme of the Ministry of Education and Science. Within the framework of the ongoing educational reforms, the ministry is making efforts to transform higher education with the objective of improving collaboration and knowledge transfer with the business sector. The latest valid document for the Education Development Strategy concerns the 2001-2010 period (OECD, 2001).

The process of formulating a national information society policy and action plan resulted in the identification of activities and the formulation of a legal and fiscal framework necessary for implementing e-governance and education, e-business initiatives and the development of the ICT infrastructure (Committee for Information Technology, 2005; Government of the Republic of Macedonia, 2005a). In 2002, the Assembly of the FYR of Macedonia adopted the e-Declaration 2002, which makes the development of the information society and the knowledge-based society a national priority. In the same year, the Committee for Information Technology and the National Task Force for the Information Society prepared a draft of the National Strategy on Information Society Technologies for Development that has been approved. The strategy is divided into seven basic development pillars: infrastructure, e-business, e-Government, e-education, e-health, e-citizenship and legislation. Education and science are mentioned as priority areas for strategic activities and the continuous development of the National Academic Research Network MARNeT is one of the basic priorities for infrastructure development (Government of the Republic of Macedonia, 2005a; Government of the Republic of Macedonia, 2005b).

The National Environmental Action Plan developed by the Ministry of Environment and Physical Planning identifies priorities and determines the investments and obligations deriving

from international agreements (Government of the Republic of Macedonia, 2005b; Ministry of Environment and Physical Planning of the Republic of Macedonia, 2005).

Research projects from the military domain are under the competence of the Ministry of Defence, which has a special fund for that purpose. The National Security and Defence Concept (Ministry of Defence of the Republic of Macedonia, 2003) recognises the importance of improving the scientific, technical, ICT and infrastructural basis of the state to enhance the security capabilities of the FYR of Macedonia. There are, however, no national research and production capacities directly operated by the Ministry of Defence.

The National Economic Programme of the Government (2006 - 2010) sets also goals for the Science and Information Technology area. It states that Macedonian science needs encouragement and essential reform. Enhancement of scientific and research work will create conditions for keeping quality university educated personnel to stay in the country and using scientific-research activity in function of private sector development. The policy of the Government will be motivating for repatriation of scientific personnel from the diaspora. In this respect, the following reform measures and policies are anticipated (Government of the FYR of Macedonia, 2006): increase investments in scientific-research infrastructure to create basis for application of modern research methods; budgetary funds for scientific-research work in function of the private sector, following the example of more developed European countries; encourage and support science through fiscal policy; granting favourable and stimulating loans with payment deadlines up to 30 years for newly-weds with university education; promotion of cooperation with scientific-research institutions abroad for better knowledge transfer; establishment of strict and fair criteria for personnel selection in scientific research institutions; support of the cooperation between scientific-research institutions and economic institutions.

The basic preconditions for decreasing unemployment are economic revival, entry of private domestic and foreign capital, as well as investments in high quality and educated labour force. In this respect, improving the quality of IT education is of highest importance. Accordingly, the primary objective of the Government will be urgent and continuous investment in computer science and IT in order to keep pace with the modern information technologies in Europe and worldwide (Government of the FYR of Macedonia, 2006):

- setting up IT Ministry;
- computerisation of the FYR of Macedonia: supplying 50,000 inexpensive computers in cooperation with the private sector, partly as donations for schools and partly offering to citizens (at purchase price with instalment payment);
- wireless network installations and temporary usage of free Internet services throughout the country;
- wide-encompassing training in computer literacy, Internet usage and office administration programmes, as well as providing second hand computer equipment at acceptable prices;
- introduction of a mandatory IT subject in primary schools, as well as full computerisation of schools;
- implementation of an integrated medical information system and introduction of e-health card;
- digitalisation of the Cadastre and application of geographic-information system (GIS);
- promotion of non-cash payment, e-trade, e-banking and e-government.

Table 5.2: Main Documents Reflecting National Innovation Strategies for Research, Technological Development and Innovation (Dall, 2005; Stefov, 2007)

The National Economic Programme of the Government (2006 - 2010)	It sets many goals, among them as well those considering improvement on education, science, and informatics technology and e-society areas.
National Strategy for the Integration of the FYR of Macedonia into the European Union (2004) Action Plan for the European Partnership	Sets out the fundamental aims, policies and priorities in the process of acquiring membership in the European Union.
Programme for development of the scientific research activities in the FYR of Macedonia for the period of 2006-2010 and Action Plan of this programme	The programme provides a platform for all institutions and individuals working in the scientific research area.
Technological Development Programme (2002-2006)	Describes the activities that stimulate and facilitate technological development, along with the criteria for setting priority areas.
National Strategy for the Information Society Development and Action plan (2005)	Defines activities in e-government, e-education, e-business initiatives and the development of ICT infrastructure, etc. Education and science are priority areas.
National Environmental Action Plan (2005)	Encourages educational, research and development studies, and organises programmes and projects to protect and improve the environment and nature.
National Security and Defence Concept (2003)	Aims to improve the scientific, technological, IT and infrastructural basis in order to enhance security capabilities.
Education Development Strategy (2001-2010)	Aims to transform the higher education sector and improve knowledge transfer to the business sector.
National Programme for development of Education in FYR of Macedonia 2005-2015	The National Programme is devoted to knowledge development and improvement and to the enhancement of living standards in the FYR of Macedonia. Its goal is to contribute to the realisation of sustainable development and improvement in society, achieving equal status as a member of the European and international surroundings.
Governmental Programme for Scientific Research 2006-2010	Includes focus on e-Business, e-Government, e-Education, e-Health, e-Citizenship (INA - Great-IST, 2007).

5.3 Main Fields of Intervention and Research Priorities

A key challenge for all Western Balkan countries in the process of transition to a market economy is to create stable and favourable conditions for economic growth. Against this background, innovation policy has to enlarge its scope from the current focus on research to

include a broad productivity agenda (Dall, 2005). As stated by Radošević, innovation policy as such has only recently re-emerged in the Western Balkans, after having been reduced to a secondary role during the transition process. “In order to be effective, innovation policies in the CEECs should recognise the structural weaknesses of their individual innovation systems. This will require a search for country-specific solutions, as opposed to the rather imitative mode that has so far prevailed” (Radosevic, 2005, p.37).

Serious long-term structural problems that affect the S&T sector need to be solved in order to assure further development. Amongst these structural problems are budgetary constraints and public debt, a generally low level of development, , widespread unemployment, poverty and massive migrations, pointing to the need for industrial restructuring in largely de-industrialised economies (Uvalic, 2006). Due to the overall lack of resources, prioritisation is of the utmost importance and research orientation needs to be steered towards present and future economic and social needs. International programmes need to use foresight and support the process of prioritisation (Uvalic, 2006), as simply focusing on the RTD Framework Programme or imitating the strategies of other countries is unlikely to bring about positive results.

The goals of R&D policy are to (Georgievska, 2007):

- Increase the use and transfer of knowledge for economic, social, cultural and environmental development of the FYR of Macedonia;
- Encourage and promote international cooperation and transfer of knowledge from abroad;
- Introduce a monitoring and evaluation system of scientific and technological quality and output of research groups using internationally accepted standards and criteria;
- Increase the use of international funds, technical assistance, etc.;
- Define and establish interdisciplinary programmes for target research

Priority setting in the S&T sector is intended to facilitate efficient performance of certain identified science and technology fields through a predictable allocation of critical-size funds. However, much remains to be done, such as implementing national foresight studies in order to support the prioritisation process. It would also be worth considering a complementary comparative regional foresight exercise to assist the diverse national attempts (Uvalic, 2006).

The 2006-2010 programme outlined by the new government of the FYR of Macedonia identifies the following main areas for improvement: living standards, employment opportunities, interethnic relations, political stability, fight against corruption, development of democracy, and integration of the country into the EU and NATO. The basic economic principles of the programme are economic freedom and equal conditions for everyone, dynamic implementation of structural reforms and establishment of cooperation, especially with the private sector partner, aimed at its faster development and creation of better employment conditions (Stefov, 2007).

As a strategic objective, five potential centres of excellence have been identified in the FYR of Macedonia based on their results in scientific research: the Institute of Chemistry at the Faculty of Natural Sciences and Mathematics; the Research Centre for Genetic Engineering and Biotechnology at the Macedonian Academy of Sciences and Arts; the Nephrology Clinic at the Faculty of Medicine; the Research Centre for Energy, Informatics and Material Science at the Macedonian Academy of Sciences and Arts and the Institute for Earthquake Engineering and Engineering Seismology. They are recognised not only within the country, but also internationally through their publications, citations and international cooperation (Government of the Republic of Macedonia, 2005b; Stefov, 2007).

Furthermore, efforts have been made to attain a credit from the World Bank, which will be used to improve scientific infrastructure and establish centres of excellence in the country.

Table 5.3: Thematic Priorities in the FYR of Macedonia, (Dall, 2005, p. 207)

Sources: (Government of the Republic of Macedonia, 2005b; Ministry of Education and Science of Republic of Macedonia, 2005a; Popovski and Stefov, 2005)	Sustainable development Water resource management Energy New materials Environmental protection Information and communication technologies Health Biotechnology Production of high quality food Geological science and engineering.

Policies and practices around ICT in FYR of Macedonia are still in very early stages. The internet penetration rate is among the lowest in Europe (estimated at 6.4%), while the lack of the overall capacity and access infrastructure results in the low uptake and the slow development of the ICT sector. The entire regulatory environment falls behind, followed by small number of users (private and public) and a very basic ICT-based service oriented culture. The broadband is nearly unheard of outside academic and business communities; in 2004, there were only 2,400 broadband users. Similarly, the number of ISPs in the country did not exceed 15 in 2005, of which very few were operational. The government should thus take robust action to develop the country's infrastructure, especially outside of the capital, and allow more competition to flourish - whilst at the same time create a national strategy to raise awareness of ICT opportunities (eGovernment, eBusiness, e-Health). Thus the major effort underway must not be hampered, the installation of routers and upgrading of connections to cities such as Ochrid, Bitola, Tetovo, Kumanovo and Stip must not be stalled (SBRA- Great-IST, 2007).

On 12th December 2006, new Government projects for IT development have been presented. The first Government project for increase of the degree in IT use envisages a computer for every pupil in 2007, while each citizen can buy one at the price of USD 100 in 12 instalments, stated Vice Premier Zoran Stavreski. He added that half of the funds have been provided from the 2007 budget, while the rest would be allocated from the 2008 budget, with a total project cost of EUR 20-22 million. Stavreski then pointed out that in the framework of the second project, all citizens and children throughout the FYR of Macedonia would be able to receive free training on basic computer skills, in partnership with the private sector. The third project in 2007-2008 will provide free Internet for citizens, while the fourth one, which was scheduled to begin in January 2007, should provide financial assistance for 5,000 students to study informatics at Macedonian faculties, 500 of whom to receive a 4-year fellowship in amount of Denar 5,000 per month (EUR 81.2). According to the Government, the realisation of these projects should make the FYR of Macedonia a leader in the Balkans regarding the level of IT use, supported by a number of international institutions (Government of the FYR of Macedonia, 2007b).

According to SBRA - Great-IST Report there are many developments in the ICT field for the FYR of Macedonia that show a positive trend: a new Law on Electronic communications; major effort to install routers and upgrade connections to cities other than Skopje, like Ochrid, Bitola, Tetovo and Stip; raise of the average speed of dial-up connections; entrance of the second mobile operator; great interest in investment by Slovenia, Greece, Bulgaria, Hungary and Austria; positive regional ICT trends and potential for a "spillover", innovation and

experimentation through peer networks and open communities of knowledge.

However there are some weaknesses and threats on the other side, for example: very limited IT market; especially lagging behind in areas such as electronic communication regulatory framework, e-government, e-business and e-health; large discrepancy between the normative regime and the actual state of affairs in the ICT domain; inaction concerning more robust broadband infrastructure development and uptake (SBRA- Great-IST, 2007).

6 Summary and Draft Conclusions

S&T governance still represents an important structural problem in the FYR of Macedonia. Nevertheless, a variety of formal and informal institutions, mechanisms and procedures for managing S&T infrastructure, designing, delivering, selecting and evaluating S&T policy programmes, and specifying and implementing standards can be observed. However, in the Western Balkan countries, discrepancies between the functions described in the laws and their actual implementation often exist; some institutions do not function properly or merely exist 'on paper' (Dall, 2005).

Science policy in the FRY of Macedonia is closely intertwined with higher education but not yet with technology or economic policy. The need to adapt the higher education sector in accordance with European Higher Education Area standards (Bologna Process etc.), means that teaching and learning are consequently of higher priority than investment in scientific research. However, innovation should not just be limited to higher education. It needs to be part of many policies, such as competition, enterprise, research, finance and taxation policy (Dall, 2005).

The main difficulties in the FYR of Macedonia revolve around the unsatisfactory level of public budgetary funds for financing S&T activities. The lack of funds results in insufficient infrastructural facilities, equipment and materials; an inefficient institutional infrastructure; insufficiently developed mechanisms for transferring knowledge and research results in the business sector; an unbalanced distribution of researchers by sector; low investments in applied research and innovation and a low level of private investments in the R&D sector, as well as an unsatisfactory number of young researchers as a proportion of the total number of researchers; and serious brain-drain problems (Popovski, 2005; Popovski and Stefov, 2005). The Macedonian government intends to pay special attention to certain priority tasks, such as developing an academic research network and a library information system, supporting existing technology development capacities, renewing research equipment and stimulating the creation of new R&D units in the business sector, establishing technology transfer centres, and providing favourable working conditions for publicly funded researchers (Ministry of Education and Science of Republic of Macedonia, 2005a; Popovski and Stefov, 2005). Nevertheless, there is a lack of continuity in the criteria for distributing S&T funds, as they tend to change with the different governments.

The FYR of Macedonia aims to become better integrated with mainstream international research; in particular, it hopes to be able to participate actively in the European Research Area. It is therefore committed to harmonising its research policy with EU policy on research and development. An important step in this direction has been the sharp increase in GERD during the 2006 budget year, albeit from a very low starting point.

It is strongly advisable for the FYR of Macedonia to develop sustainable strategies, taking into account regional and European dimensions. Foresight and the identification of innovation capacities will help in the development of policies and the formation of a long-term strategy

in a regional context. A high level of awareness about the relevance of RTD and a dialogue between the economy, academia and the administration will provide the basis for developing a science policy that is in line with economic policies and priorities. Benchmarking and evaluation can help to improve the performance of research institutions and to concentrate capacities in priority areas in coherence with regional development and European integration. A close dialogue with important foreign stakeholders with shared experiences is inevitable, but since there are no ready-made solutions, simply imitating policy approaches will not produce the desired results (Dall, 2005).

The dialogue with the European Union will become increasingly based on a regional approach. The Steering Platform on Research provides a forum for the Western Balkan countries to communicate their needs and their potential in research, technological development and innovation. The Western Balkan countries INCO-NET supports these activities and other projects such as SEE-ERA.NET provide additional platforms for the integration of the national innovation system in the wider European Research Area.

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8 List of Acronmys

ALMMs	Active Labour Market Measures
BERD	Business Sector Expenditure on R&D
CARDS	Community Assistance for Reconstruction, Development and Stabilisation
CEI	Central European Initiative
CEEC	Central and Eastern European countries
CIA	Central Intelligence Agency
CIT	Committee for Information Technology
COBISS	Cooperative On-line Bibliographic System and Services
CORDIS	Community Research and Development Information Service
COST	“Co-operation in Science and Technology” Programme
DG EAC	Directorate General for Education and Culture
DG AIDCO	Directorate General for External Cooperation Programmes
DG RELEX	Directorate General for External Relations
DG ELARG	Directorate General for Enlargement
EC	European Commission
ECTS	European Credit Transfer and Accumulation System
EPC	European Patent Convention
EPO	European Patent Office
ERA	European Research Area
ERA-NET	European Research Area Network
ETF	European Training Foundation

EU	European Union
EUR	Euro, currency
FAO	Food and Agriculture Organisation
FP6	Sixth EU Framework Programme for R&D
FP7	Seventh EU Framework Programme for R&D
FYR	Former Yugoslav Republic
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on Research and Development
GOVERD	Government Sector Expenditure on R&D
GTZ	German Gesellschaft für Technische Zusammenarbeit
HE	Higher Education
HERD	Higher Education Sector Expenditure on R&D
IAEA	International Atomic Energy Agency
ICCROM	International Organisation for Conservation of National Heritage
ICT	Information and Communication Technology (also acronym for the related FP7 'Cooperation Programme' theme)
IFAD	International Fund for Agricultural Development
IP	Intellectual Property
IPC	International Patent Classification
IPA	Instrument for Pre-Accession Assistance
IS2WEB	FP6 project "Extending Information Society Networks to the Western Balkan Region"
ISP	Internet Service Provider
IST	Information Society Technologies (Programme line in FP6 - in FP7 it changed to ICT)
ITU	International Telecommunication Union
IZUM	Slovenian Institute of Information Sciences
JICA	Japan International Cooperation Agency
JRC	Joint Research Centre
MARNET	Macedonian Academic Research Network
MASA	Macedonian Academy of Sciences and Arts
MASIT	Macedonian Association for Informatics Technology
MES	Ministry of Education and Science
NAPE	National Action Plan for Employment
NATO	North Atlantic Treaty Organisation
NCP	National Contact Point
NES	National Employment Strategy
NGOs	Non-governmental Organisations
NPM	"Nanosciences, Nanotechnologies, Materials and new Production Technologies" (Programme Line in FP7/Cooperation)
OECD	Organisation for Economic Cooperation and Development
OIML	International Organisation of Legal Metrology
OSCE	Organisation for Security and Co-operation in Europe
PHARE	Pologne, Hongrie Assistance à la Reconstruction Economique
R&D	Research and Development
RSE	Researchers, Scientists and Engineers
RTD	Research and Technological Development
RTDI	Research, Technological Development and Innovation
SAA	Stabilisation and Association Agreement
SAP	Stabilisation and Association Process
SBRA	Slovenian Business Research Association
SCI	Science Citation Index

SEE	South Eastern Europe
SEE-ERA.NET	FP6 project “Southeast European Era-Net”
SEE INNOVATION	FP6 project “Facilitating innovation for ICT SMEs in South Eastern Europe”
SEE-SCIENCE.EU	FP6 project “Information Office of the Steering Platform on Research for Western Balkan Countries”
SFRY	Socialist Federation Republic of Yugoslavia
SIU	Norwegian Centre for International Cooperation in Higher Education
SMEs	Small and Medium Size Enterprises
S&T	Science and Technology
SIS	“Science in Society” (Programme Line in FP7/Capacities)
SSA	Specific Support Action (activity in the Framework Programmes)
SSH	“Socio-economic Sciences and the Humanities” (Programme Line in FP7/Cooperation)
STI	Science, Technology and Innovation
TEMPUS	Trans-European Mobility Scheme for University Studies
UATIM	Union of the Inventors and Authors of Technical Improvements of Macedonia
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNIDO	United Nations Industrial Development Organisation
USAID	United States Aid
USD	US-Dollar (currency of the United States of America)
VET	Vocational Education and Training
WB	Western Balkans
WBC	Western Balkan countries
WHO	World Health Organisation
WIPO	World Intellectual Property Organisation
WMO	World Meteorological Organisation
ZSI	Centre for Social Innovation (Zentrum für Soziale Innovation), Austria

Annex I - List of Further Institutes

Research Centre for Energy, Informatics and Materials
Research Centre for Genetic Engineering and Biotechnology
Centre for Strategic Research
Centre for Research and Policy Making
Economic Institute
Institute of Earthquake Engineering and Engineering Seismology
Macedonian Academic Research Network MARNET
Agency for Development and Investments

Annex II - Main Research Institutions Publishing in Scientific Journals

Table: Total Number of Published ISI Scientific Journals Covered by Institutions in the FYR of Macedonia for the Period 1971-2004

Institution	Total number of articles	Abstracts	Works published as whole articles	Participation of Institution in the total number of articles published as whole articles
Faculty of Agricultural Sciences and Food	53	0	53	3.11 %
Institute of Mathematics	45	0	45	2.64 %
Faculty of Philosophy	50	7	43	2.53 %
Faculty of Pharmacy	37	1	36	2.11 %
Faculty of Mechanical Engineering	34	0	34	2.00 %
Institute of Biology	30	6	24	1.41 %
Institute of Informatics	23	0	23	1.35 %
Faculty of Technical Sciences, Bitola	18	0	18	1.06 %
Faculty of Veterinary Medicine	16	0	15	0.88 %
Institute of Earthquake Engineering & Eng. Seismology	13	0	13	0.76 %
Museum of Natural History	13	0	13	0.76 %
Hydrobiology Institute, Ohrid	12	0	12	0.70 %
Faculty of Mining & Geology	9	0	9	0.53 %
Faculty of Civil Engineering	9	0	9	0.53 %
Macedonian National Grid - ESM	9	0	9	0.53 %
OHIS - Chemical Industry	9	0	9	0.53 %
Institute of Ecology	8	0	8	0.47 %
Faculty of Economics, Skopje	8	0	8	0.47 %
Faculty of Philology	8	0	8	0.47 %
Faculty of Biotechnology, Bitola	7	0	7	0.41 %
Alkaloid - Pharmaceutical Industry	7	1	6	0.35 %
Institute of National History	5	0	5	0.29 %
Strezevo - Public Enterprise, Bitola	5	0	5	0.29 %
Institute of Mining & Steel	3	0	3	0.18 %
Higher Agricultural School, Bitola	3	1	2	0.12 %
Faculty of Forestry	2	0	2	0.12 %
Institute of Agricultural	2	0	2	0.12 %
Institute of Animal Breeding	2	0	2	0.12 %
Ministry of Agricultural	2	0	2	0.12 %

Institution	Total number of articles	Abstracts	Works published as whole articles	Participation of Institution in the total number of articles published as whole articles
Ministry of Agricultural	2	0	2	0.12 %
Institute of Mining	2	0	2	0.12 %
Tobacco Institute -Prilep	2	0	2	0.12 %
Centre for Radioisotope Application	2	0	2	0.12 %
Faculty of Law	1	0	1	0.06 %
Military Academy	1	0	1	0.06 %
Institute of Geographic	1	0	1	0.06 %
Institute of Hydrometeorology	1	0	1	0.06 %
Pedagogical Faculty	1	0	1	0.06 %
High Music School	1	0	1	0.06 %
Macedonian Radio Broadcasting Council	1	0	1	0.06 %
Usje - Cement Production Plant	1	0	1	0.06 %
Faculty of Dentistry	1	0	1	0.06 %
Faculty of Architecture	1	1	0	
Faculty of Physical Culture	1	1	0	
Ministry of Internal Affairs	2	2	0	
Others	12	5	8	0.47 %
Medical Institutions in RM	612	323	289	16.98 %
- Faculty of Medicine	15	12	3	0.18 %
- Centre for Clinical Global Health Education	5	5	0	
- Nephrology	127	39	88	5.17 %
- Paediatrics	81	18	63	3.70 %
- Neurology	44	35	9	0.53 %
- Haematology	39	23	16	0.94 %
- Physiology	31	19	12	0.70 %
- Transfusion	27	13	14	0.82 %
- Pathophysiology	25	14	11	0.65 %
- Experimental Biochemistry	23	3	20	1.18 %
- Pulmology	23	22	1	0.06 %
- Institute of Clinical Biochemistry	21	11	10	0.59 %
- Cardiology	21	13	8	0.47 %
- Gynaecology	18	10	8	0.47 %

Institution	Total number of articles	Abstracts	Works published as whole articles	Participation of Institution in the total number of articles published as whole articles
- Urology	16	3	13	0.76 %
- Immunology	16	9	7	0.41 %
- Pharmacology	16	2	15	0.88 %
- Radiotherapy & Oncology	15	9	6	0.35 %
- Forensic Medicine	14	12	2	0.12 %
- Endocrinology	13	6	7	0.41 %
- Dermatology	11	1	10	0.59 %
- Pathology	11	1	10	0.59 %
- Gastroenterology	10	6	4	0.23 %
- Epidemiology	7	5	2	0.12 %
- Surgery	7	4	3	0.18 %
- Rheumatology	7	5	2	0.12 %
- Radiology	7	3	4	0.23 %
- Psychiatry	6	5	1	0.06 %
- Social Medicine	5	0	5	0.29 %
- Toxicology	5	5	0	
- Abdominal Surgery	5	4	1	0.06 %
- Ophthalmology	5	2	3	0.18 %
- Nuclear Medicine	5	4	1	0.06 %
- Institute of Physiology & Anthropology	4	2	2	0.12 %
- Heart Institute	4	4	0	
- Infective Disease	3	0	3	0.18 %
- Inst. of Spec. Education & Rehabilitation	2	1	1	0.06 %
- Neurology	2	0	2	0.12 %
- Preventive Medicine	2	0	2	0.12 %
- Thoracic Surgery	2	1	1	0.06 %
- Trauma Centre	2	0	2	0.12 %
- Histology	2	2	0	
- Anatomy	1	1	0	
- Digest. Surgery	1	1	0	
- Internal Medicine	1	1	0	
- Inst. of Cardiovascular disease	1	1	0	
- Inst. of Mental Health	1	1	0	
- Inst. of Radiology	1	0	1	0.06 %

Institution	Total number of articles	Abstracts	Works published as whole articles	Participation of Institution in the total number of articles published as whole articles
- Medical Informatics	1	1	0	
- Microbiology	1	0	1	0.06 %
- Orthopaedics	1	1	0	
- Haemostasis & Thrombosis	1	1	0	
Paediatric Hospital-Kozle	11	5	6	0.35 %
Mental Hospital	9	7	2	0.12 %
Med. Centre Bitola	6	6	0	
Med. Centre Veles	5	0	5	0.29 %
Ins.of Labour Medicine	4	4	0	
Rep.Inst.of Health Protection	4	0	4	0.23 %
Ministry of Health	4	2	2	0.12 %
Med. Centre Strumica	4	1	3	0.18 %
Military Hospital	4	0	4	0.23 %
State Cen. For Persons with Intellectual Disability	3	2	1	0.06 %
Med. Centre Struga	3	1	2	0.12 %
Cardiology Centre Fillip II	2	1	1	0.06 %
Med. Centre Gevgelija	2	0	2	0.12 %
Macedonian Red cross	2	0	2	0.12 %
Health Care Centre- Steel Company	2	2	0	
WHO EUROMH	1	1	0	
Maxi facial Surgery	1	0	1	0.06 %
City Hospital Skopje	1	0	1	0.06 %
Health Centre - Dojran	1	1	0	
Fran-Mac. Association of Oncologists	1	0	1	0.06 %
Gjorgov Private Med. Centre	1	0	1	0.06 %

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Science and Technology Country Report

MONTENEGRO

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1 Introduction

This country report is produced by the "Information Office of the Steering Platform on Research for Western Balkan Countries" and reviews the situation in Science and Technology (S&T) in Montenegro.

The report summarises main papers published by the United Nations Educational, Scientific and Cultural Organization (UNESCO), the South-East European ERA-NET (SEE-ERA.NET), the Austrian "Gesellschaft zur Förderung der Forschung", and several independent scholars on the issue of S&T in Montenegro. For the complete list of references please see References in chapter 7, starting on page 222 of this report.

The objective of this study is to enhance our understanding of the national innovation system in Montenegro. An overview of the situation in S&T regarding the main stakeholders, input and output indicators, the national strategies and priorities, and the main documents and laws in the field is given below.

The 'system of innovation' approach was taken into account when compiling this report, and it covers important factors influencing the development, diffusion and the use of innovations, as well as the relations between these factors. It does not place emphasis on individual firms or research organisations, but rather on innovation as an interactive and interdependent process.

Relevant organisations in this respect are firms, higher education institutions, government agencies, etc. interacting to create knowledge and innovation. The macro-level of the system is analysed using indicators such as R&D personnel ratios, R&D expenditure, patent application intensity rates, etc.

The report was compiled in autumn 2006 by the Information Office, by Ms. Elke Dall and Ms. Maruška Bračić, Centre for Social Innovation, Vienna, Austria and reviewed by Ms. Carmen Siller, Centre for Social Innovation, Vienna, Austria and Mr. Sreten Škuletic, University of Montenegro, Montenegro. A brief update was carried out in summer 2007 and a final review carried out by Ms. Tatjana Knezevic from the Ministry for Education and Science in February 2008.

1.1 Montenegro - A Brief Profile

On 21st May 2006, Montenegro exercised its right provided in the Constitutional Charter of Serbia and Montenegro to hold a referendum on independence, which proved successful. The "Declaration of Independence" was adopted by the Montenegrin Parliament on 3rd June 2006, stating that the Republic of Montenegro is independent with full legal personality under international law. Recognising legitimacy of the whole process, the EU Council adopted conclusions on 12th June 2006, where it stated that the EU and its Member States will develop further relations with Montenegro as a sovereign, independent state. In the "Declaration of Independence" Montenegro expressed legal continuance regarding the international treaties and agreements to which the State Union of Serbia and Montenegro was a party and which remain relevant for Montenegro (European Commission, 2006). The new Constitution was adopted on 19th October 2007.

Today, Montenegro is a modern parliamentary democracy with a population of approximately 620,000 people (45 per km²). Montenegro is geographically located in the Central Mediterranean or South-East Europe, and has a total land area of 13,812 km².

The main unresolved problems in Montenegro result from the dissolution of the State Union with Serbia. Issues for discussion include the implementation of comprehensive institutional, political and economic reforms within the context of the EU's Stabilisation and Association Process (SAP); the adoption of a new constitution in line with European values and standards and negotiations regarding the accession to international organisations, to which the State Union was a party, and continuation of negotiations regarding future membership in others, for example, the World Trade Organisation (WTO) (European Commission, 2006). The 5th session of negotiations on accession to WTO took place from 26th to 29th February 2008 in Geneva. The official statement was that Montenegro has made immense progress since the previous round of negotiations. It is expected that full membership will be achieved in October 2008 (Knezevic, 2008).

Regarding the economic situation, real GDP in Montenegro rose by 4.1% in 2005, despite the 1.9% fall in industrial production, notably due to problems in the coal mines, the thermoelectric power plant and the steelworks. Tourism and the financial sectors were the most dynamic factors behind economic growth. The budget deficit continued at 2.6% of the GDP, while public debt decreased to 43% of GDP and the external debt reached 30.6% of GDP. The WTO accession process will require further reforms and the establishment of new institutions (European Commission, 2006). In 2006, the real GDP growth rate was 6.5% (U.S. Department of State, 2007). In the first quarter of 2007, real GDP grew by 6.6% year-on-year. The main driver was the solid expansion of the services sector, in particular: tourism, financial intermediation and real estate. In addition, the low inflation environment also facilitated the positive performance of the economy (European Commission, 2007).

Unemployment rate in Montenegro has been declining, in 2005 it was 18.5% and in 2006 already 14.7% (European Commission, 2007). Since the beginning of the year 2007 employment has increased by 8%. Some 12,714 new jobs have been created, of which, 18.6% were seasonal. The major contributor to employment remains the services sector while labour in construction industry is contracting (European Commission, 2007).

1.2 Relations between Montenegro and the EU

Policy development in the Western Balkan countries (WBCs) is often intertwined with the EU accession process. Montenegro started the Stabilisation and Association Process (SAP) on 26th September 2006; the implementation of the required policies and strategies is a necessary prerequisite for creating an innovative knowledge-based economy for the future, helping the countries to withstand competitive pressure in the market economy of the European Union (EU).

The government of Montenegro declared European integration to be one of the strategic priorities for the Republic and also decided to inform the EU of its intention to pursue bilateral relations, notably negotiations on the SAA, starting from the point reached before the referendum (European Commission, 2006).

Due to a decision of the EU Council of Ministries dating from 15th September 2006, regular political dialogue was established on minister's level, when the EU invited Podgorica to coordinate its future policy with the foreign policy of the EU, due to the promotion of full integration of Montenegro in the community of European Nations and its gradual association to EU membership. The first political dialogue between Montenegro and EU was held in Brussels, on 22nd January 2007, when the Minister of Foreign Affairs met with the EU Troika (Djurovic, 2007).

Since 2001, Montenegro has benefited from the EU policy advice provided through the EU-FRY Consultative Task Force, later replaced by the Enhanced Permanent Dialogue. The task of the Enhanced Permanent Dialogue is to encourage and monitor reforms on the basis of the European Partnership adopted by the EU Council in June 2004 and updated in January 2006. Although the current text takes due account of the respective competences and different priorities of Montenegro and of Serbia, it will require an adaptation following the change in status of Montenegro. The structures of the Enhanced Permanent Dialogue will remain in place and continue to provide support for the reforms in Montenegro until formal contractual relations between the EU and Montenegro are established through the Stabilisation and Association Agreement (SAA) in the context of the Stabilisation and Association Process (SAP). On the basis of decisions made at the Thessaloniki Summit in June 2003, and confirmed on several further occasions by the EU, Montenegro is a potential candidate country for the EU accession (European Commission, 2006).

SAA negotiations with the State Union and the two constituent republics were launched in October 2005. Since then, two official and two technical rounds of talks have been conducted and progress has been made in discussion of the text of the future agreement. Following a negative assessment on the state of co-operation between Serbia and Montenegro and Serbia's failure to comply with ICTY (UN International Criminal Tribunal for the former Yugoslavia) obligations, the Commission decided to call off the next round of negotiations on 3rd May 2006. In light of the referendum outcome in Montenegro, the Commission announced its intention to submit a proposal to the Council for a new SAA negotiating mandate for talks with the Montenegro. The SAA is a comprehensive agreement between the European Communities and their Member States on the one hand, and Montenegro on the other and will provide a legal framework for relations between the EU and Montenegro for the entire period prior to possible future accession. However, no further enlargement with a large group of countries is currently envisaged. The Western Balkan countries are at different stages on the road towards EU membership. Future enlargements will move at a pace dictated by each country's performance in meeting the rigorous standards, in order to ensure the smooth absorption of new members (European Commission, 2006).

On 15th March 2007, with positive confirmation of all 27 EU Member States, the Stabilisation and Association Agreement was initialled and that concluded the first and most difficult phase of the integration process. The agreement was signed in October 2007 in Luxemburg (Djurovic, 2007).

EU assistance to the State Union of Serbia and Montenegro, combining the CARDS financial programme, macro-financial and humanitarian assistance, has amounted to more than EUR 2.9 billion between 1991 and 2002 (more than EUR 2 billion of which has been allocated since the fall of the Milošević regime in October 2000). The main focus and objectives of EU assistance have evolved during the 1990s, covering conflict management, post-conflict reconstruction and stabilisation, paving the way for a closer association with the EU. The support provided through CARDS in 2005 (EUR 22 million for Montenegro), focused mainly on the European Partnership priorities, taking account of the political and economic situation in Montenegro, and the requirements that the republic will have to meet in order to be able to conclude SAA negotiations and implement the agreement. Montenegro has also benefited from the regional CARDS programme, which in 2005 had an overall budget of EUR 40.4 million for supporting actions of interest in terms of infrastructure, institution building and cross-border co-operation, in the Western Balkans region (European Commission, 2006).

The Instrument for Pre-Accession (IPA) replaced CARDS in 2007. The IPA remains focused on institution building and socio-economic development and aims to provide

targeted assistance to candidate countries and potential candidate countries with their EU membership applications and has entirely replaced CARDS and other pre-accession financial instruments. The programming has five components - Transition Assistance and Institution Building; Regional and Cross-Border Co-operation; Regional Development; Human Resource Development and Rural Development - only the first two of which apply to potential candidate countries. The IPA allocates over EUR 11 billion during the 2007-2013 period (see-science, 2006).

For the period 2007-2009, about EUR 100 million are to be allocated through IPA instrument to Montenegro. At the moment, the programming for IPA 2009 is in progress. The Ministry of Education and Science, together with the University of Montenegro, submitted five project ideas, dealing with higher education and science. The next step is the national prioritization of project proposals from all sectors, which is expected to be finished by the end of March 2008 (Knezevic, 2008).

Gaining support is mostly in the hands of Western Balkan countries who need to demonstrate certain efforts in formulating and submitting requests to the relevant authorities. The SEE-ERA.NET project, as well as the Steering Platform launched in June 2006, could provide the necessary support behind this process, acting as a forum for the exchange of experiences and best practices among the Western Balkan countries, as well as through focused and co-ordinated interventions targeted at European Commission services and the EU Member States (Bonas, 2006).

As stated in the "Shared Vision" of the *Thessaloniki Agenda for the Western Balkans,* in their effort to adapt to the pervasive knowledge economy and to global competition, the citizens of the Balkan countries need to exploit the high level of motivation for social mobility and their relatively good educational background, as well as combining scientific and technological knowledge with entrepreneurship. This will create higher added value and bestow competitive advantages on the region. In this respect, science, research and technological development are seen as essential tools for future economic stabilisation and growth in the region (CORDIS, 2003b).

Montenegro also acceded to the Partnership for Peace Programme on 15th December 2006. Another significant contribution to the institutionalisation of the relations between all the countries of the region and the EU occurred on 13th April 2007, when the Agreement on Readmission and the Agreement on Visa Facilitation were initialled (Djurovic, 2007). On 18th September 2007 the EU and five West Balkan nations (among them Montenegro) signed nine agreements on visa facilitation and readmission, which will bring the two sides closer in cooperation in migration and movement of persons. The signature of these agreements is an important political decision toward closer cooperation between the EU and the Western Balkan countries in the sensitive areas of migration and movement of persons (see-science.eu, 2007).

2 Contemporary Institutional Landscape

The transition of Serbia and Montenegro's S&T system began in the period following the gradual dissolution of the former Federal Republic of Yugoslavia, the destruction caused by the war and the subsequent brain drain. The institutional landscape has also been altered during the process. The following chapter tries to map the current main stakeholders in the National Innovation Systems, relevant cooperation and the legal framework defining the system.

2.1 Main Stakeholders Involved in Policy Making in Montenegro

During the 1990s, the FRY Government Programme for Technology Development provided the main financial and moral support for the innovation activity in industry. Since sanctions prohibited international technology trade, “in-house” innovative activity was the main source of new technologies and activities (Kutlača, 1998). Even prior to the final dissolution of the State Union, the two entities carried out R&D activities completely independently, and thus needed to be analysed separately. A few institutions belonging to the innovation system have functioned on the State Union level, but the largest part of the R&D system was located in the Republic of Serbia (Kutlača, 2005a).

The Ministry of Education and Science (MoES) is the main research funding body in Montenegro. It follows the long-term Montenegrin requirements for development, transfer and application of scientific and technological achievements, especially from the point of view of greater valorisation of natural and man-made resources of the country. MoES creates the strategy for scientific and technological development, establishing a base for further development of knowledge and creativity. Furthermore, it takes account of the results and problems of science and technology application, the effects of public investments into scientific and technological development, and the quality and use of research infrastructure. It closely monitors status, problems and trends in the development of the research system of the country, especially in the field of scientific research priorities (biotechnology, marine biology, tourism, energy efficiency, telecommunications, computerisation and research on environmental protection, materials-related technologies, health care etc.), as well as speed, range and depth of diffusion of new technologies to the national economy and the obstacles faced in the process (Ministry of Education and Science of Montenegro, 2004).

The priority activities of the Ministry of Education and Science in the field of research are (BIS-RTD, 2007):

1. increasing stability in financing the existing research potential, paying special attention to research at universities
2. professional assessing research groups
3. improving research equipment and other infrastructure
4. increasing international cooperation in science
5. ensuring higher percentage of the population receiving higher education
6. increasing post-graduate education with emphasis on PhD students
7. providing scientific publications and participating in conferences.

The Government established the Council for Scientific-Research Activities in August 2006, which is among other things, responsible for the creation of the Strategy for S&T, for a period of 8 years. The Committee responsible for drafting the proposal of the strategy was appointed in March 2007. The Committee members are representatives of all scientific fields in Montenegro (Knezevic, 2007). The Council consists of nine members, one third from the Government and two thirds are representatives of the research community (Knezevic, 2008).

An additional relevant institution is the Agency for International Scientific, Educational, Cultural and Technical Co-operation of Montenegro. This is an institution of the Government of Montenegro which was established around 30 years ago. Its Department for International Scientific and Technical Co-operation performs the following duties (Government of Montenegro, 2007):

- preparation, co-ordination and implementation of the S&T programs and projects of scientific and technical nature;
- initiation and co-ordination of the establishment of immediate collaboration between Montenegro and foreign institutions and industrial organisations;
- participation in the preparation of multilateral and bilateral programmes on the basis of which RTD projects in Montenegro are being realized;
- professional training abroad within multilateral and bilateral programmes, organisation of international conferences, gatherings and seminars, etc.

The Agency of International Scientific, Educational, Cultural and Technical Cooperation consist of the following organisational units (Government of Montenegro, 2007):

- Department for International Scientific, Educational, Cultural and Technical Cooperation
- Department for General and Financial Issues.

Another important stakeholder in Montenegro is the University of Montenegro. It was founded in 1974 and is the only public university in Montenegro. The University of Montenegro comprises several faculties (17 at the time of writing) (Knezevic, 2008) and is located in 9 towns throughout Montenegro (Podgorica, Nikšić, Cetinje, Kotor, Budva, Bijelo Polje, Berane, Herceg-Novi - Igalo and Bar). Reforms in higher education started in Montenegro in 2000 as a consequence of the transition in society, the need for integration into European and international structures, transition in the economy, the Bologna Process and the employability concept (Ministry of Education and Science of Montenegro, 2004). Since 2004/2005, the regime according to the Bologna Declaration and the principles of the European Credit Transfer System (ECTS) has been applied in all faculties. Full implementation is foreseen by 2008 for undergraduates, 2009 at postgraduate level and 2012 for doctoral studies. The University has several scientific groups with respectable reference lists, but it lacks a proper scientific strategy (Vukcevic, 2007).

All higher education institutions in Montenegro are organised in accordance with Bologna principles, and in accordance with the Law on Higher Education (Koprivica, 2006a).

The Montenegrin Academy of Sciences and Arts (CANU) was established in 1978 and encompasses departments of natural sciences, social sciences and arts, plus the “Njegoš” Institute and other operative bodies. Its activities involve the organisation of scientific research projects, conferences and meetings, as well as enhancing international cooperation and publishing (Montenegrin Academy of Sciences and Arts, 2005). The work of the Academy is regulated by a special collective agreement (Knezevic, 2008).

In June 2005, the government of Montenegro established the National MREN (Montenegro Research and Education Electronic Network) for collaboration with EU institutions.

Regarding innovation and technology centres and cooperation, Montenegro is still in the policy elaboration phase, but has started to implement pilot projects (Machacova, 2007).

Table 2.1: Main S&T Stakeholders of Montenegro (Ministry of Education and Science of Montenegro, 2004; Knezevic, 2008)

Main ministry in Montenegro competent for S&T	- Ministry of Education and Science
Other ministries with importance to the S&T sector	- Ministry of Economical Development - Ministry of Foreign Affairs - Ministry of Health - Ministry of Agriculture, Forestry and Water Management - Ministry of Maritime Affairs and Transportation - Ministry of Tourism and Environmental Protection
Other important stakeholders	- Council for Scientific Research Activities, nominated by the Government of Montenegro - Montenegrin Academy of Sciences and Arts (CANU) - ZAMTES (Republic Agency for International Scientific, Educational, Cultural and Technical Co-operation of Montenegro) - Centre of Information System - Council for Higher Education (within the Ministry of Education and Science)
Main university / research institutions	- University of Montenegro - Private Mediterranean University - Institute for Biotechnology - Institute for History - Institute for Maritime Biology - Institute for Foreign Languages - Institute for Geology - Institute for Steel Production - Institute for Aluminium - Institute for Strategic Studies and Prognoses(ISSP) - Institute for Health Care - Agency for Eco-toxicological Investigations - Centre for Meteorology and Seismology

Higher education may be provided by universities and higher education institutions, as long as it is licensed and accredited in accordance with the Law on Higher Education. The Ministry of Education and Science issues licenses to the institutions and is also responsible for administering changes and divesting institutions of a license. Based on this law, the first private Faculty of Tourism and Hotel Management opened in September 2004 in Bar, Montenegro, enrolling 50 students. There is one private university in Montenegro, the Mediterranean University and five individual private faculties accommodating about 2,500 students. One other private university is preparing the documentation for opening (Skuletic, 2006; Knezevic, 2008).

There is almost no communication between main RTD stakeholders and the general public, in both directions. Practically speaking, the key RTD stakeholders are not visible and do not present themselves in media (BIS-RTD, 2007).

2.2 International Cooperation

The research community in Montenegro is small, thus it is of vital importance to preserve it and promote links with other international researchers, in order to establish a platform for the creation of knowledge-based society. The RTD strategy in Montenegro is oriented towards improving research capacities in the thematic priority domains of the Framework Programmes (FP) by reinforcing their S&T potential, by supporting and mobilising human and material resources, by disseminating scientific information and research results, by facilitating communication, by alleviating brain drain and by improving responses to the socio-economic needs of the country. Montenegro's bilateral and multilateral cooperation programmes should allow the possibility to create links inside the RTD market and facilitate stronger participation in European research endeavours, thus enhancing research perspectives in bilateral and multilateral activities (Ministry of Education and Science of Montenegro, 2004).

Countries of the Western Balkans have seen a constant renewal of international cooperation and support, especially in the last years. Montenegro has, since its independence, put into procedure bilateral agreements with 20 countries from the region and beyond. These agreements will provide additional support for strengthening existing and establishing new partnerships for other, multilateral and regional initiatives and programmes (Knezevic, 2008). This cooperation was substantially supported by many international organisations as well as by individual countries through bilateral and multilateral programmes (also providing significant benefits to the R&D sector). The largest part of financial support in this respect came from the funds of the Stabilisation and Association Process, the CARDS programme, the Stability Pact for Southeast Europe (now transferred to the Regional Cooperation Council (RCC)), the European Investment Bank, the European Bank for Reconstruction and Development, HP DAAD, etc. The European Union's Tempus programme has been important in the area of higher education, while the inclusion of the Western Balkan countries into the 6th Framework Programme (FP6) for R&D (Montenegro participated in FP6 as a partner in the project consortia), and their gradual integration into the European Research Area (ERA), has also been of particular importance. Inclusion of these countries into the European Investment Bank's Innovation 2000 Initiative ought to prove useful as well. Regarding multilateral cooperation in the area of science and research, the Western Balkan countries have closely co-operated with many specialised United Nations (UN) agencies, such as UNESCO, UNIDO, UNDP and UNECE[1]. Some other international organisations, such as the World Bank and USAID, have also been important donors and have helped in the area of R&D (Uvalic, 2006). USAID has adopted a "Strategy Statement" for Montenegro (2006-2011), which addresses Montenegro's development needs in line with the U.S. government's foreign policy objectives. In 2006, USAID administered approximately USD 12 million to Montenegro in support of the mission's strategic objectives - namely, democratic governance, enterprise growth and political stability (USAID, 2005).

On 25th January 2008, the Memorandum of Understanding (MoU) was signed between Montenegro and the EC in Brussels, giving Montenegro full association to FP7. For 2008, the participation fee has been provided from the national funds. It is planned that the funds for subsequent years will be provided from both, national and IPA funds (in 50-50 ratio). The nomination procedure for Montenegrin representatives in the FP7 Programme Committees

[1] Please see the List of Acronyms, chapter 8.

was initiated in February 2008. These members will have observer status in the respective committees (Knezevic, 2008).

A network of National Contact Points (NCPs) has been established and has already carried out several info days for the research community, raising awareness on FP7. The Ministry of Education and Science, which coordinates the network, has registered approximately 40 teams involved in project proposals in the first year of the programme (Knezevic, 2008). As one of the measures for stimulating participation in FP7, the Ministry offers financial incentive for each positively evaluated proposal (Knezevic, 2007). During 2008 the amounts will be graded in accordance with the type of involvement in proposals, that is, if a participant is involved as a project partner or as a coordinator (Knezevic, 2008).

Many regional projects have been launched with the objective of promoting regional cooperation in South Eastern Europe. Regional scientific cooperation within the Western Balkans is currently being promoted by several regional organisations: the Central European Initiative (CEI), the Alps-Adriatic Task Force, the Stability Pact for Southeast Europe, etc. Montenegro has also filed an application for membership to the International Atomic Energy Agency (IAEA)[2].

On 7th December 2007, Montenegro signed the Memorandum of joining CERN (European Organization for Nuclear Research). The country has the status of the observer in this organization, which means that its researchers have right to take part in the joint research activities under this initiative, but there is no decision-making right for the country (Knezevic, 2008).

As of 5th March 2008, Montenegro has joined one of the Competitiveness and Innovation Framework Programme (CIP) components, namely the Entrepreneurship and Innovation Programme (EIP), aimed at projects supporting competitiveness and innovative capacities, especially in the field of small and medium-sized entrepreneurship. Association to this component also provides access to participation in other CIP programmes, which will contribute to further development of research activities in the country (Knezevic, 2008).

Regional networks also include initiatives to aid the participation of Western Balkan countries in the EU Framework Programmes for R&D, as defined by the EU-Balkan countries Action Plan on Science & Technology adopted at the Ministerial Conference in Thessaloniki on 26th-27th June 2003. The “Action Plan”, along with the “Shared Vision”, defined the priorities of the research cooperation and provided a detailed examination of all possible sources of funding, thus contributing to the economic growth of Balkan countries and aiding their integration into the European Research and Innovation Area (CORDIS, 2003a).

Montenegro also collaborates with the Joint Research Centre (JRC) which is a Directorate-General providing independent scientific and technological support for EU policy-making. Knowledge and information is gathered using specific application/issue-oriented research within the seven JRC Institutes as well as through close cooperation with over 1,000 public and private organisations in 150 networks within Member States and applicant countries. The JRC aims to contribute to the goals of the European Research Area and provide S&T support to EU policies. Its efforts in the ERA focus on five activities: developing scientific reference systems, networking, training and mobility, accessing and using its infrastructures, and a dedicated effort to support enlargement (European Commission, 2004). The government of Montenegro believes that the collaboration with the JRC could be of vital importance in

[2] In June 2006, IAEA membership of Serbia and Montenegro was continued by the Republic of Serbia. Subsequently, the Republic of Montenegro applied for membership to the IAEA (14th June 2006), a process that is pending completion.

preventing further brain drain, especially in encouraging talented students to stay and work in Montenegro, by making university and research careers more attractive (Ministry of Education and Science of Montenegro, 2004). After association to FP7 in January 2008, Montenegro was invited in February 2008 to nominate a representative for the JRC Board of Governors. The nomination procedure is ongoing (Knezevic, 2008).

The Ministry of Education and Science and the University of Montenegro supported mobility of junior and senior researchers with individual mobility grants. There have also been foreign researchers working in Montenegro in the fields of bio-technical, technical-technological and medical science, most coming from Russia, Italy, France, Slovenia and Germany (Uvalic, 2006).

Current bilateral S&T cooperation has also been used as a starting point for identifying partners for FP7, COST and EUREKA. The new state of Montenegro is not yet a member of COST (Co-operation in Science and Technology), which has developed into one of the largest frameworks for research cooperation in Europe and is a valuable mechanism for co-ordinating national research activity. According to the latest reports, COST has around 200 actions and involves nearly 30,000 scientists from 34 European member countries and more than 80 participating institutions from 11 non-member countries and non-governmental organisations. Ease of access for institutions from non-member countries also makes COST a very interesting and successful tool for tackling topics of a global nature.

In December 2006, thanks to an international endeavour, MoES published the 'Pilot Joint Call' (PJC) for the SEE-ERA.NET project along with thirteen other countries. The main goal of this project is to explore and utilise the synergies of bilateral scientific-technological agreements of partner countries. However, this call is only the introduction to a bigger, "Real Joint Call", which will be announced after the conclusion of the PJC. The idea behind this call is to connect scientists, who can apply for funding for cooperation through multilateral research projects, thematic networks or connection of scientific teams or institutions, but not individually. Projects in the following three fields will receive funding: "Environmental Protection", "ICT" and "Food, Agriculture and Biotechnology" (Ministry of Education and Science of Montenegro, 2006). The PJC can be considered as a success for all the participants, and therefore for Montenegro as well. Out of 321 positively evaluated proposals, Montenegrin research teams participated in 50 proposals and 6 are approved for funding (Knezevic, 2008).

Projects based on bilateral inter-governmental agreements have been numerous, while further integration is expected in line with the activities of the Southeast European ERA-NET (SEE-ERA.NET) (Uvalic, 2006).

The project ERA-WESTBALKAN aims at integrating the Western Balkan countries into the European Research Area. Over the course of two years, the National Contact Points in BiH, Serbia, Montenegro and FYR of Macedonia were established, trained and supported. From January 2007, the project is being continued and enlarged as ERAWESTBALKAN+. The focus is on the integration of scientists from the region into the European Research Area and specifically the Framework Programmes. It provides support to Montenegrin researchers through the project partner ZAMTES (The Republic Agency for International Scientific, Educational, Cultural and Technical Co-operation of Montenegro), an institution belonging to the government of Montenegro, established around 30 years ago.

Montenegro has also been included in the two ongoing projects, SEE-GRID 2 and SEEREN2, dealing with South Eastern European research and education e-infrastructure and networking (Skuletic, 2006). As a means of sustaining the work of the SEE-GRID 2 project, the SEE-

GRID-SCI project has been approved for funding (Knezevic, 2008).

Montenegro held the FP6/INCO partner country status under the EU-WB Countries Action Plan in S&T and participated in two FP6 projects. Furthermore, participation was reported for two UNESCO projects, 12 other multilateral projects (financed by UNDP, CERN, NATO, IAEA and COST) and other bilateral projects, mainly realised with partners from Greece, Slovenia and France. Within the Tempus programme, Montenegro contracted 22 projects and 31 individual mobility grants up until the end of 2007 and expects further proposals in the currently open call. The Individual mobility grant scheme has ceased, following the launch of the ERASMUS MUNDUS and ERASMUS MUNDUS External Cooperation Window programmes (Skuletic, 2006; Knezevic, 2008).

WUS (World University Service) Austria, a non-profit making organisation established in Graz in 1983, has developed a regional focus on South Eastern Europe since 1994. Since its shift of focus towards the Western Balkans, it has successfully carried out various projects; for example, CEP (Centre of Excellence Projects), NIP (Networking Infrastructure Projects), Training Courses on Project Management and International Co-operation, Internet and Computer Training Programme etc. Montenegro also benefits from the ongoing World University Service (WUS) projects - Course Development Programme Plus, Brain Gain Programme, Counselling and Information Centres, the Balkan Case Challenge project and others (WUS Austria, 2006; Knezevic, 2008).

Montenegro has also been a member of the Union of Mediterranean Universities since its establishment in 1983. The Union is active in promoting further development of science and cultural cooperation between its members - 175 universities and various research centres and organisations from 20 Mediterranean countries. Furthermore, Montenegro is also active as a hosting country of the Summer Academy, organised under the auspices of the Stability Pact for South Eastern Europe and German Institute for Academic Mobility (DAAD). For the past eight years, the Summer Academy has been welcoming top senior technical and computer science students from Southeast Europe and Germany(Prosvjetni rad, 2006). Other regional networks include the Inter-Balkan Forum on IST and the Balkan Physical Union.

Montenegro has also become a member of the ENIC (European Network of Information Centres) and has its own National Information Centre. National Information Centre should alleviate access to precise information about the system and qualification of higher education in Montenegro and in other countries - ENIC members (Ministry of Education and Science of Montenegro, 2007). The new Law on Recognition of Educational Certificates was approved on 28th December 2007, which more precisely defines the recognition procedures as well as responsibilities of the ENIC centre (Knezevic, 2008)

Montenegro also takes part in the Bologna Process. Implementation of the Bologna Process is overseen by a National Team of Bologna Promoters. This consists of Working Groups aimed at providing counselling to higher education institutions on the three Bologna priorities as defined by Ministers in Berlin; quality assurance; the three cycle system; recognition (ECTS, Diploma Supplement, Europass and the Lisbon Recognition Convention) (Koprivica, 2006a).

3 The Input Side of the National Innovation Systems

The current economic situation in the Western Balkan countries still poses significant constraints on national R&D policies. Most countries in the region are at less than 30% of the EU-25 GDP per capita average, hardly reaching 60-80% of their 1989 GDP. The restrictive fiscal and monetary policies, necessary for attaining macroeconomic stabilisation,

allow limited public expenditure and have generally contributed to the low investment rates, including those experienced in the R&D sector. Although financial assistance received from abroad is significant, it is not always provided on a continuous basis or with the best interests (Uvalic, 2006).

Regarding the input indicators for the S&T system, some questions (for example, the amount spent in terms of the gross domestic product (GDP), volumes, growth rates etc.) need to be addressed. Here a distinction is made between private and public investment. R&D investment can be considered as an indirect measure of a country's innovation capacity (Fischer, 2006).

The sources which reports on R&D expenditures provide some conflicting figures for the different categories, for example, (Uvalic, 2006) and (Kutlača, 2005b).

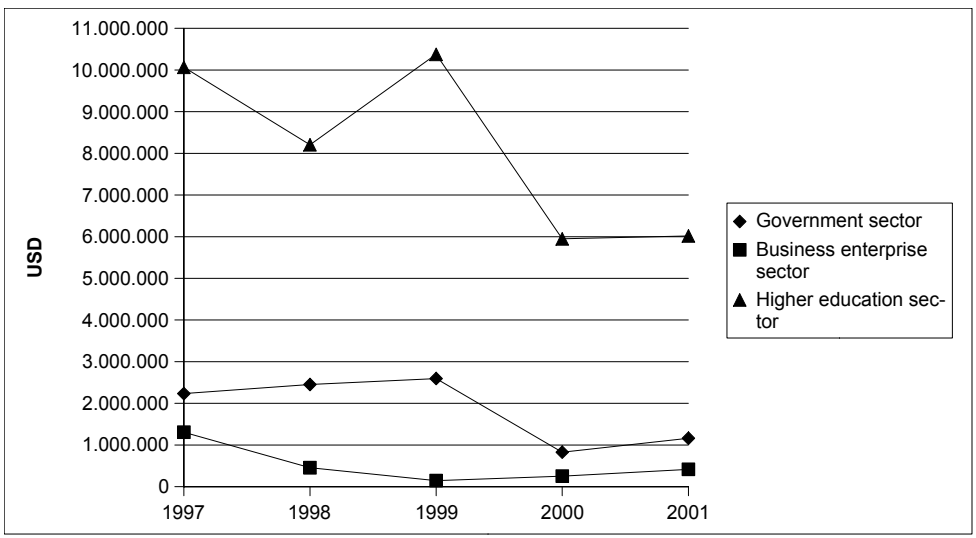
In Montenegro 80% of the RTD budget is spent on salaries and overheads for the projects, which leaves 20% for human resource development, equipping of laboratories, international cooperation and information system building (Koprivica, 2006b).

3.1 Development of Financial Resources Allocated to R&D

Generally, the dynamics of expenditure can be used as an important indicator of knowledge creation and absorption.

In Montenegro, the higher education sector is the sector with the highest expenditure on research and development, and as in other countries in the WB region, the business sector provides almost negligible investment. The downward trend of government expenditure was especially noticeable between the years 1999 and 2000.

Figure 3.1: Dynamics of Expenditure for R&D per Sector [3]



[3] Source: State Statistical Office according to Kutlača, 2005b

3.2 Government Sector Expenditure on R&D

As already stated above, a dramatic downward trend in government expenditure was registered in Montenegro between 1999 and 2000 (following the NATO intervention in the State Union in 1999). After 2000, a slight but steady upward trend in GOVERD can be observed, although the share of the government expenditure on R&D is still well below the requirement.

Table 3.1: Government Expenditure on R&D (GOVERD)[4]

	1997	1998	1999	2000	2001
R&D expenditure in total (in USD)	2,233,671	2,451,944	2,595,711	827,626	1,162,139
R&D expenditure as % of GDP	0.25	0.32	0.23	0.16	0.11

Table 3.2: Government Expenditure on R&D (GOVERD) (Skuletic, 2006)

	2002	2003	2004	2005	2006
R&D expenditure in total (in EUR)	1,301,000	1,433,000	1,535,000	1,644,000	1,759,000
R&D expenditure as % of GDP	0.14	0.09	0.19	0.21	0.24

In an interview with the monthly scientific bulletin, “Prosvjetni rad”, Sreten Škuletić, president of the Commission for Scientific Activity and International Cooperation at the Montenegrin Ministry of Education and Science, gave a critical overview of the current situation in the S&T sector in Montenegro. Škuletić expressed satisfaction with the financial sources allocated from the budget to the Ministry in 2005 - these sources were sufficient to cover all requirements, thus fulfilling the criteria for financing. According to Škuletić, the MoES allocated EUR 722,000 in 2005, financing 56 projects which received a positive review from the Ministry (out of 81 projects submitted). The projects were approved for two-year financing, and the MoES allocated EUR 383,500 during the first year. However, the expected increase in financial sources in 2006 failed to occur and the Commission has expressed its disappointment with the situation, questioning the further existence and development of scientific activities in Montenegro. In keeping with the financial responsibilities of the previous year, the Ministry was unable to open any new contests for scientific projects, MSc or PhD theses, or scientific newspaper publications. Škuletić has revealed that the government is planning to increase R&D expenditure to 0.75% of the GDP by 2007 (this percentage is currently significantly lower, see figures above). Montenegro has also signed the Lisbon declaration which aims to increase this percentage to 3% of the GDP by 2010. According to Škuletić’s overall assessment, science and research in Montenegro is not receiving nearly enough attention and support from the state; furthermore, the financial sources allocated to the Ministry in 2006 were 47% lower compared to those received in 2004. In view of such conditions, little optimism regarding future improvements is possible (Prosvjetni rad, 2006).

The Ministry’s expenditure by scientific field (1996-2006) focused on Biotechnology and Medicine (45%) and Natural Sciences and Engineering (40%). The remaining 15% of the budget funds research in the social sciences and humanities (Skuletic, 2006).

[4] Source: State Statistical Office according to Kutlača, 2005b

3.3 Business Sector Expenditure on R&D

R&D investments in the business enterprise sector are evaluated by looking at the level and dynamics of business sector R&D expenditure at the aggregate country level. These activities are particularly essential for the innovative output and competitive dynamics of a country (Fischer, 2006).

The relative importance of the business sector's R&D efforts is indicated by the level of business expenditure on R&D (BERD) as a share of GDP. The relative importance of BERD in the total economic activity of South Eastern Europe (0.24% in 2003 as calculated by Fischer (2006), who includes Bulgaria and Romania but not BiH and Albania, due to the lack of data), lags considerably behind that of the EU-15 (1.26% in the year 2000). In Montenegro, the level of BERD expenditure as a percentage of GDP was 0.15% in 1997, only 0.01% in 1999 (the lowest percentage of all the years measured) and 0.05% in 2001.

The input of the business sector in R&D activities in comparison to overall R&D activities reveals the relative importance of profit-oriented knowledge creation and absorption. Nevertheless, thorough examination of the business sector's share of total R&D expenditure shows considerable variation within the Western Balkan region (only in Romania was business sector research responsible for more than 50% of total R&D, which is on a par with the EU-15 average of 65.5% in the year 2000). In Montenegro, a very low proportion of total R&D (5.5% in 2001, according to statistical data obtained by Kutlača, 2005) was spent on business research, thus reflecting a relatively low level of business sector knowledge investment in comparison with knowledge invested by the government and higher education sectors (Fischer, 2006).

The desolate state of the business and industry sectors, which have deteriorated in the past 15 years, explains the low level of business sector investment, although exact data is hardly available (Prosvjetni rad, 2006).

3.4 Higher Education Sector Expenditure on R&D

University research represents one of the key activities within the higher education sector regarding the national innovation systems, and providing scientific and technological knowledge to be disseminated and utilised in the economy. However, as primary suppliers of fundamental research, universities do not only contribute to the economy through the direct provision of applicable results, but also through the diffusion and adoption of skills and techniques and through professional networks and other forms of communication channels created by academic research (Fischer, 2006).

According to statistical data obtained from the State Statistical Office by Đuro Kutlača, the expenditure in the higher education sector, research institutes and other organisations with research units in 2001 was USD 6 million[5], which represented 0.76% of the 2001 GDP. Although, as regards Montenegro this data is regarded unreliable, and official data on the budget of the University of Montenegro, the only public university in the country, is published in the Bulletin of the University of Montenegro (No. 211, from 15.11.2006) (Prosvjetni rad, 2006; University of Montenegro, 2006)

[5] EUR 6.7 million on 31.12.2001, http://www.oanda.com/convert/classic

Table 3.3: Budget of the University of Montenegro for 2007 (Knezevic, 2008)

Amount dedicated to the faculties	EUR 12,279,767
Amount dedicated to the institutes	EUR 1,615,569
Amount dedicated to other units, organisations, inside expenses, student activities etc.	EUR 2,504,664
Total amount obtained from the government	EUR 16,400,000

3.5 R&D Infrastructure

In her survey on the National Systems of Research and Development in the Western Balkan Countries (compiled for the purposes of the SEE-ERA.NET Consortium), author Milica Uvalić established that the existing scientific infrastructure in Montenegro has a number of weaknesses - amongst them, large differences in the development of research units, a lack of adequate premises for laboratories and libraries, poor financial standing of research projects, a lack of interest for studies where experimental research is obligatory, such as engineering, and old and inadequate equipment (or lack thereof). Significant investment is required in printing and electronic equipment, which would help enhance research and learning resources, as well as providing new equipment, facilities and services. Thus, a clear strategy for R&D ought to be established, embracing all research institutes (Uvalic, 2006).

In October 2007, for the first time in 15 years, the Ministry of Education and Science was in the position to publish a call for financing the scientific-research infrastructure. While the interest in this call was not as high as expected, many of the eligible institutions submitted their proposals. As a result, an amount of EUR 363,538 was approved, which covered about 40% of the total requested funds. It is expected that a similar call will be opened during 2008 (Knezevic, 2008).

R&D infrastructure was much better and more modern prior to 1990 than it is at present. A lack of financial resources, as well as the presence of international sanctions, prevented an update of technical equipment and made foreign imports impossible, therefore preventing further development.

According to statistical data the number of Science and Research (S&R) organisations has been raised (see the table below).

Table 3.4: Structure of S&R institutions (Bacovic, 2007)

Year	S&R Institutions	Experimental development units	Faculties	S&R organisations **TOTAL**
2002	4	4	13	21
2003	4	3	14	21
2004	4	3	15	22
2005	4	3	16	23

Regarding the ICT (Information and Communication Technology) sector - there were over 16,000 internet hosts per 100,000 inhabitants and 100 PCs per 1,000 inhabitants in 2006. Internet penetration in Montenegro increased to 29% in 2007 (Knezevic, 2008). This share still does not compare to the EU average of 52% (or about 240 million internet users in 2006, according to the Internet World Stats) (Internet World Stats, 2007). In order to demonstrate an awareness of the importance of ICT in educational process and a readiness to improve

the existing situation, in 2004 the government adopted a document called “Strategy for Development of Information Society - the way to knowledge-based society”. This strategic document comprises several strategic lines; one is ICT and Education, which covers all levels of education. It is based on the “Strategy of Introducing ICT into the Education System of Montenegro - Up to the University Level” (2003)[6].

Among the first tasks of the Ministry of Education and Science was to decrease the number of students per computer (currently around 50 students per computer, which is discouraging compared to the European average of about 14 students per computer).

The Montenegrin Research and Education Network (MREN) was established in June 2005. It encompasses all networking services and facilities, which support the communication and information requirements of the education and research community in Montenegro. MREN aims to create, promote, offer, participate in, and preserve the necessary bases for effective use of modern telecommunication technologies in the fields of education and research in Montenegro. The main goal is to connect MREN to GEANT (a pan-European multi-gigabit data communications network), which is reserved specifically for research and educational use, via a high speed fibre optic connection. MREN’s target is to support the substantial use of the Pan-European and world research networks by Montenegrin researchers, scientists, lecturers and students, as well as to facilitate the integration of Montenegrin educational, research and cultural resources in the international information space (Uvalic, 2006). The link, connecting MREN to the GEANT was operating at 4Mbps in 2006, and has been upgraded to 34 Mbps in 2007. The development and operation of MREN is co-financed by the European Commission through the SEEREN2 project (FP6) and the Ministry of Education and Science. MREN is also member of TERENA (Trans European Research and Education Network Association) (Koprivica, 2006b).

The libraries and the information and communication technology (ICT) services should be rationalised to provide more effective services, as existing technical equipment and informatisation do not meet international standards. Since May 2006, the University of Montenegro is subscribed to electronic databases THOMSON and EBSCO, which provide access to a significant number of articles from the most renowned scientific magazines and publications in the fields of Technology, Medicine, Economics, Sport etc. A new system of mutual categorisation among the Montenegrin libraries was established in December 2001 using the COBISS system, as well as a mutual bibliographic base (COBISS-CG), combining the local University Library, and the Central National Library of Montenegro. Some of the faculty libraries have local systems for computerized documentation, so their databases cannot be reached through the internet. The University of Montenegro possesses an academic computer network, maintained and developed by the Centre of Information System (CIS), which provides internet connectivity. However, the CIS equipment ought to be improved; presently, the communication infrastructure between the CIS server and the units is based on an optical fibre with low speed communication through copper twisted pairs. There is only one 4Mb link with Belgrade, which should have been upgraded to 34 MB link by the end of 2006, and a 34 Mb link with Greece (through Serbia) using the SEEREN-SENSE project foundation. The research units’ communication equipment is generally satisfactory, apart from the lack of multimedia lecture halls (Uvalic, 2006).

The development of a strong and visible ICT sector in Montenegro is still more of a promise, than an easily traceable action. Like in many other target countries, statistics here must be taken with caution. Montenegro is very good at raising visibility and expectations, by organising international events, conferences and specialised seminars for students, scholars,

[6] More details in chapter 5.2

ICT professionals, ICT companies and other various participants. These events are useful as they bring communities of ICT knowledge together, and promote innovation and collaboration through open peer networks. Depending on tangible outcomes of such initiatives, they could help reverse the brain drain and create more domestic opportunities for young generations and investors. Such events also mobilize public representatives in thinking and acting towards improving education levels for the rest of the population as well as the administration- in learning how to use new technologies.

Some great opportunities have occurred for Montenegro in the recent past: the University of Montenegro and several private companies successfully managed to open the Cisco Academy in Montenegro; Microsoft's donation of EUR 2 million worth of free education software to the Electro-technical Faculty had a major impact on the quality of IT training and support to research activities; positive regional ICT-IST trends and a potential for a 'spillover', innovation and experimentation through peer networks and open communities of knowledge (SBRA- Great-IST, 2007).

3.6 Human Resources in R&D

The mass emigration of young, educated people in highly sought-after fields of expertise (brain drain) has been one of the most alarming phenomena that the countries in the Western Balkans region have had to face since the devastating war and break-up of the former Yugoslavia. This loss of talent has led to an impoverishment of national capacities at a crucial time for reconstruction and development.

The number of scientists in R&D in Montenegro is reported to be low. The most recent data (from the Report on the external evaluation of higher education institutions in Montenegro (December 2007)) shows that for the University of Montenegro alone, 367 teachers/ researchers (with a PhD), 346 assistants (PhD, MSc/MA), 77 professional associates and 398 people in administration and technical services are employed in full-time positions. The part-time staff add up to 242 teachers/researchers with an academic title (PhD), 98 teaching assistants (PhD, MSc/MA), 20 professional associates and 10-15 people in administration and technical services. In addition, the Medical Faculty, which has a special status within the University of Montenegro, employs 32 teachers/researchers with academic title (PhD), 59 teaching assistants (PhD, MSc/MA) and 27 professional associates (Knezevic, 2008).

These figures do not differ greatly from those provided in the Bulletin of the University of Montenegro in 2006, whereby the university employed 394 scientists with a PhD degree and 319 scientists with a MSc degree, as full-time engaged, and 242 scientists with a PhD and 98 scientists with a MSc degree as part-time engaged (Prosvjetni rad, 2006; University of Montenegro, 2006).

4250 students enrolled in the academic year 2007/08, which makes the current total number of students at the University of Montenegro 18,199. The number of new students slightly decreased compared to the previous year (when 4,442 new students enrolled), which is due to the fact of increased number of private faculties, that enrol about 2,500 students at the moment (Knezevic, 2008). Even so, these numbers are still important when one considers that in the previous 10 to 15 years, the number enrolled hardly exceeded 1,500. The percentages for 2007 have not changed significantly on the figures for the previous year, when 58% of students enrolled in Humanity Studies (including Business, Financial Management and Law), 40% in Engineering Studies, Natural Sciences etc. and 2% in Arts (Prosvjetni rad, 2006).

Table 3.5: S&R organisations (Bacovic, 2007)

Year	S&R organisations	No. of Employees	Scientists/ researchers	Scientists/researchers as % of total population
2002	21	1,185	605	0.00097
2003	21	1,127	602	0.00096
2004	22	1,200	597	0.00096
2005	23	1,246	633	0.001

The breakdown of researchers by scientific field shows that the largest concentration work in the field of Social Sciences and Humanities, followed by Engineering and Technology (Ministry of Education and Science of Montenegro, 2004).

Table 3.6: Relative structure of Researchers by scientific fields (Knezevic, 2008; Ministry of Education and Science of Montenegro, December 2007)

Natural and Mathematical sciences	13.4 %
Biotechnology	5.7 %
Engineering and Technology	22.2 %
Medicine	10.5 %
Social sciences and Humanities	48.2 %

There are, however a disproportionate number of researchers in the field of Social Sciences and Humanities (48%) compared to the budget that the Ministry of Education and Science allocates to this scientific field (15%). This is probably due to the constant increase in the humanities student population. The actual number of first-year students in the Faculty of Economics is about 700, while in the faculty of Metallurgy and Technology, the number of students hardly exceeds 50 (Uvalic, 2006).

The Ministry of Education and Science adopted a Human Resource Development Programme in 2004, the main instruments of which were 90 scholarships for master studies at home and 15 scholarships for master studies abroad; financial support of 30 PhD students working on basic or applied projects at home, as well as 26 PhD researchers abroad (for 2 to 6 months). Additionally, the Ministry financed 91 participations in scientific conferences including travel and registration costs (Ministry of Education and Science of Montenegro, 2004; Skuletic, 2006). By 2007, the number of master study scholarships at home, unfortunately, was reduced to 60. The number of financed participations in scientific conferences doubled to 198. Also, support was given to 28 PhD students for work on their doctoral thesis (Knezevic, 2008).

One of the human-resources development support measures in 2007 was employment of young researchers through scientific projects by publishing a call for these types of projects. Nine of these projects for a total number of 10 new employees was approved (total amount allocated is EUR 156,000) (Knezevic, 2008).

Human resources play a key role when it comes to knowledge production and, subsequent, economic and technological development. Availability and quality of human resources (being both producers and diffusers of knowledge) in S&T, forms a crucial element on the path towards a knowledge society (Fischer, 2006). It is quite obvious though that the recent trend regarding human resources in countries of the Western Balkans has been extremely variable. In some countries, the number of researchers and scientists has been increasing (for example, in Albania and Croatia), while in others (for example, in the FYR of Macedonia, Montenegro and Serbia) it has been stagnating or declining (Uvalic, 2006). In 2003, Serbia and Montenegro reported 3.5 researchers per 1,000 labour force, which was on a par with some of the EU-15

countries (for example, Greece and Portugal), but still well below the EU-15 average (5.4 researchers per 1,000 labour force) (Fischer, 2006). There is, however, no precise data on how many of these researchers actually came from Montenegro (as compared to Serbia).

According to the national statistics reported by Kutlača (Kutlača, 2005c), the total number of researchers in Montenegro in the last decade has been more or less constant. There were about 642 researchers in the year 2000, almost 100 more compared to 1990. However, after the year 2000, a slight downward trend was registered, with 626 researchers reported in 2001 (Kutlača, 2005c).

Table 3.7: R&D Personnel in Total, FTE and HC (Kutlača, 2005c)

	1990	1999	2000	2001
R&D personnel (fulltime equivalence, FTE)	852	775	806	768
R&D personnel (headcounts, HC)	1,082	1,128	1,217	1,223

Of total R&D personnel in 2001, 57.7% were engaged in the higher education sector, 35.5% in the government sector and 6.8% in the business sector (Kutlača, 2005c) as illustrated in the table below.

Table 3.8: R&D Personnel, Distribution by Sectors, in absolute numbers - FTE (Kutlača, 2005c)

	1990	1999	2000	2001
Government sector	374	302	265	273
Business sector	193	23	60	52
Higher education sector	285	450	481	443

Human resource potentials in S&T can also be increased by producing Science and Engineering (S&E) graduates. Degrees in S&E fields of study formally qualify their holders for employment as researchers, scientists and engineers. In this respect, the State Union of Serbia and Montenegro demonstrated a positive trend, having the highest proportion of students enrolled in S&E within the region. However, the exact proportion of S&T students solely in Montenegro was uncertain. Furthermore, a negative growth rate of 1.2% has been registered in the period between 1997-2001 (Fischer, 2006).

In order to improve the alarming situation in the country, UNESCO (in cooperation with Hewlett-Packard) has devised project to alleviate the brain drain in the Western Balkans region. The project's general aims for Montenegro were laid out under the following objectives (UNESCO & Hewlett Packard, 2003):

- promoting successful mechanisms to alleviate brain drain
- attempting to stop mass emigration of young intellectuals
- strengthening intellectual and scientific capacities
- establishing a website to identify young scientists who have left Montenegro in last 10 to 15 years
- creating a database of experts in the identified disciplines who have left the country and have expressed an interest in contributing to the project
- maintaining effective two-way communication between young professional people who have left Montenegro and their colleagues who have remained in the country
- developing mechanisms to promote contacts and offer opportunities for shorter and longer-term positions for returning experts as well as for their "virtual presence" and continued contribution to cultural, scientific and economic life

- opening visiting positions, organising meetings and fostering possibilities for experts within the Diaspora to serve as mentors for advanced home students in corresponding fields, as well as organising multidisciplinary master class courses, distance education, an alumni organisation network, etc.
- creating a network of highly qualified experts in specific fields world-wide, creating opportunities for them to take part in shorter-term or longer-term assignments in their countries of origin
- creating virtual links with experts outside the country
- publishing joint scientific and technical papers and reports
- carrying out common work on scientific and technical projects etc.

The project was divided into two sub-projects, according to areas of expertise: (1) Electrical Engineering and Information Technology and (2) Physics. Phase III of the project was due to finish in December 2004 (the University of Montenegro's proposed budget for that year was EUR 15,000). Sreten Škuletić, president of the Montenegrin Commission for Scientific Activity and International Co-operation at the Ministry of Education and Science and the coordinator of this project in Montenegro, has considered the project as very successful. Many foreign professors and eminent scientists have been involved in the project, along with intellectuals of Montenegrin origin living and working abroad. The project itself was responsible for the creation of a database which re-established the connection between the scientific diaspora and the University of Montenegro. Škuletić expressed great satisfaction with the response received, stating that all contacted scientists proved ready to participate in future projects. Although established merely as a pilot-project for the duration of one year, the overall assessment was very positive, leaving the University of Montenegro with valuable computer and communication equipment and a functioning database to help maintain, broaden and deepen the connections with the scientific community abroad (Prosvjetni rad, 2006). This project and its achievements were also regarded as very successful by both UNESCO and HP representatives.

According to Fischer, the results obtained in his survey suggest that the future outlook is optimistic, especially with respect to the fact that a greater percentage of young people are becoming more highly qualified, offering potential relief to the shortages created by the transition to a knowledge-based economy. However, the author fears that investment in R&D is not the only prerequisite for achieving these goals. Rather, there are multiple components to investment (such as productivity, good performance in science and technology, efficient use of information infrastructure and an effective education system (Fischer, 2006)), all of which need to produce successful results in order to achieve a smooth transition to a knowledge-based economy (Fischer, 2006).

It is important to help Montenegrin researchers in networking and joining their capacities at both national and international levels, as well as connecting different sectors. The concept of mobility of researchers needs to be examined and enhanced through adequate policies and organisational structures. Montenegrin researchers are under great pressure. In addition to their teaching and research commitments, they try to successfully cope with poor funding and lack of human resources, keep abreast of participation in international projects etc. They need strong support and more favourable environment to be able to fully contribute to the development of Montenegrin and European societies (Knezevic, 2007).

4 The Output Side of the National Innovation Systems

The output of an innovation system is manifested through the new knowledge, new products and processes which are produced. Whereas indicators such as the Gross Expenditure on

Research and Development and the number of researchers involved provide a measure of the resources potentially allocated to innovation, this chapter focuses on the results of the innovation processes and their output indicators (Uvalic, 2006).

4.1 Patenting Activities in Montenegro

Among other approaches, innovative output can also be measured by patent data, the most important advantage of which is the wealth of the information supplied. A patent file granted by the European Patent Office (EPO) provides data on the invention, which is protected by the patent through the title, abstract and technological classification. Furthermore, patent data provide the only output measure available for almost all countries in the world, including the Western Balkan countries (Hörlesberger, 2006).

European inventors today have a choice between two alternatives when seeking patent protection for their inventions: the European Patent Office (EPO) and national patent offices. The EPO was set up to provide patent protection through a single procedure, defining the granting of patents in some or all of the contracting states of the European Patent Convention (EPC). The procedure for obtaining a patent at the EPO consists of two phases and sometimes a third phase dealing with possible objections. In contrast to national patents that are valid in only one country, a European patent gives its proprietor equivalent rights to a national patent in each member state. Moreover, European patents may also be effective in some countries, including Montenegro, that have not yet acceded to the EPC. Serbia and Montenegro have held a so-called 'extension state' status at the EPO since 1st November 2004. This means that although the State Union recognised European patents, it was not formally a member of the organisation (European Patent Office, 2006).

A second barrier to patenting is the cost associated with a patent application. Studies estimate that the cost of an application and the 10-year maintenance of a patent at the EPO is approximately EUR 32,000 (Roland Berger Market Research, 2004). In contrast, applications to national patent offices may be less expensive (applications to local patent offices in the Western Balkans in particular can be expected to incur a considerably lower cost than an application to the EPO) (Hörlesberger, 2006).

The situation regarding Intellectual Property (IP) protection in Montenegro has been quite difficult to comprehend, even prior to the separation from the State Union of Serbia and Montenegro. According to Kathryn Szymczyk, director of the Montenegrin branch of an international legal office specialising in IP protection, both states had their own legislatures and, to some extent, different laws and institutions. In 2005, Montenegro adopted its own "Law on the Enforcement of Intellectual Property Rights" (Official Gazette of Montenegro No.45/2005), but nevertheless continued to enforce the same laws as Serbia with respect to IP rights generally (SD Petosevic, 2006). After its separation from Serbia in June 2006, the Montenegrin Ministry of International Economic Relations and European Integrations took the stance that applicable laws that were in force in the union of Serbia and Montenegro would retain legal continuance until suitable laws are passed in the Montenegro. According to legal experts, this means that until a new Patents and Trademarks Office (PTO) is established, all IP rights validly registered in Serbia, both before and after the dissolution of the Union, will also be enforceable in Montenegro. Furthermore, a likely outcome is that once a Montenegrin PTO is established, a revalidation period will be permitted whereby holders of IP rights in Serbia will have 6 to 12 months to revalidate their existing IP rights in Montenegro. It must be stressed, however, that the Republic of Montenegro does have its own Law on Enforcement of the Legislation that Regulates Intellectual Property Rights which gives various government agencies, such as Customs and Market Inspectorate, the authority to detain and seize

infringing goods. This means that applications for the enforcement of IP rights must still be made separately for Montenegro, even though such applications will have to be based on IP rights registered in Serbia (SD Petosevic, 2006).

The Montenegro Government has recently adopted a Decree which provides for the establishment of a national IP Office. The Decree came into force on 19th May 2007 (8 days after it was published in the Official Gazette No. 25/2007), and stipulates that the IP Office would start operating within the following 60 days (IMPACT, 2007). It is also going to act as the national Patent Office.

Patent applications originating from Montenegro have so far been submitted to the Federal Institute for Patents in Belgrade, which was in charge of patents in the State Union. Until the national IP office becomes fully operational, the patent applications are still going to be submitted in Belgrade (Knezevic, 2008)

The number of patents administered in Montenegro, as reported by the Federal Institute for Patents, has been relatively low in recent years: 4 in 2002, and 1 in 2003 (Uvalic, 2006). As for patents granted by the EPO, it is obvious that even Croatia, the best performing country in the Western Balkan region (with 15 patents in 2003), plays a very limited role as an applicant country for EPO patents. In 2003, a total of 62,873 patents were granted by the EPO, of which, 31,027 were granted to EU countries, and only 4 to Serbia and Montenegro (Hörlesberger, 2006).

As of 4th December 2006, Montenegro is a member of the World Intellectual Property Rights Organization (WIPO), and since then, all conventions and protocols from the field of intellectual property that the State Union was a signatory of, are being enforced by Montenegro. In addition, a regulation on the recognition of Intellectual Property Rights (IPR), as adopted by the Patent office of the State Union has been adopted. This regulation also refers to the status of applications and approved IPR given by the Belgrade office before national IP Office starts with work (Knezevic, 2008).

4.2 Publication Activity in Montenegro

Publishing activities in Montenegro are difficult to estimate due to the absence of a mutual categorisation system among libraries. This results in a lack of categorisation of scientific publications (except for Masters and Doctoral theses and some monographs). Most monographs are in the field of humanities, with around 95% of all published monographs in the disciplines of Economics, Law and National History, while less than 5% of catalogued publications are in the fields of Engineering and Natural Sciences. However, although the engineering faculties are among the oldest in Montenegro, a large number of their publications are not catalogued for the reasons mentioned above.

The VIRTUALNA BIBLIOTEKA CRNE GORE (VBCG, Virtual Library of Montenegro) project has been introduced as a means of joining Montenegrin libraries in a uniform information system, with the ultimate aim of enabling library users to access, in an organised and rational way, online information and documents, created in the autonomous system of Montenegro, or the COBIB union catalogue database, or specialised information in many internet databases. Montenegrin libraries are relatively small, with inadequate technological equipment (obsolete, or even no computer and communications equipment), inadequate staff structure, insufficient specialised knowledge, etc (COBISS.CG, 2008).

The VBCG development is limited by the non-existence of the VBCG Centre (Centar VBCG)

as the centre's objectives should be to: represent the system and all its participants active in the realisation of the VBCG project; carry out legal, administrative and similar activities for the realisation of the VBCG project; plan system development and extension, realise the agreements, and co-operate with the software provider; technically maintain the functions of the VBCG Centre, including system and data protection; maintain the online union catalogue and the function of the system; define professional, technical, information and financial conditions for the integration into the system, extend the system and sign agreements on the participation with new members; ensure recurrent training for the work in the system; carry out administration, statistical coverage and supervision of the system and co-operate with other compatible shared cataloguing systems in the region, in Europe and elsewhere (COBISS.CG, 2008).

Recently, a new measure of providing financial incentives to researchers that publish in international scientific papers and journals has been introduced at the University of Montenegro. This measure will provide significant input for creation of a database of all the scientific publications.

Table 4.1: Scientific Output - Number of Books and Brochures in Montenegro, 2001 (MONSTAT according to Uvalic, 2006, p. 77)

	Books	**Brochures**
General	3	-
Philosophy, Psychology	1	-
Religion, Theology	1	-
Social Science	38	9
Mathematics, Natural Science	2	-
Applied Science, Medicine, Techniques	4	2
Arts	9	1
Literature	38	2
Geography, Biography, History	17	1
Total	**113**	**15**

5 National R&D Strategy and Legal Framework

Most S&T policies in the Western Balkans region are characterised by their encouragement of sustainable support for basic research at universities and research institutes, for the development of human resources, and for cooperation within the framework of the European Union's programmes for RTD and joint research programmes with the European Science Foundation and bilateral agreements (Dall, 2006). In technology policy, emphasis is placed on linking research institutions as sources of knowledge with industry and SMEs, and encouraging the establishment and functioning of intermediary institutions - although the practical success of such institutions is still being questioned (Kobal, 2005).

This chapter discusses the legal framework for national R&D strategies, presents the main documents reflecting these strategies, and highlights the main fields for intervention and the research priorities in Montenegro.

5.1 Legal Framework for the National R&D Strategy

A legal framework is indispensable in the organisation of R&D institutes, innovation infrastructure and programmes that provide grants to research organisations and innovative companies. Most commonly, as is the case in Montenegro, S&T and higher education laws are prepared separately, for example, the Montenegrin Law on Higher Education was adopted in October 2003 and the Law on Scientific Research Activities in November 2005 (Dall, 2006).

The Law on Scientific Research Activities has following goals (Koprivica, 2006b):

- Integration into European Research Area and EU Framework Programmes
- Sustainable development of the country
- Introduction of international quality standards
- More investments into scientific and research activities
- Connecting researchers at national and international level.

According to the Law on Scientific Research Activities, the Government should prepare strategy of creation the society based on knowledge, and to define annual budgetary increase as a percentage of GDP, allocated to R&D until 2010. Regulation on Scientific Activities Finance (1995) has been innovated regarding appointment of independent experts, evaluation criteria, detailed description of proposal evaluation and finalization of the evaluation according to the practice in EU countries (BIS-RTD, 2007).

The Law on Higher Education was adopted with objectives of eliminating rigidity from university structure, preventing brain drain, complying with EU standards and enabling full participation in mobility schemes (Dall, 2006). This law was adopted on the basis of the government's Strategic Plan of Education Reform implemented in January 2003, in line with the objectives of the Bologna process. Subsequently, the government announced that it will prepare a strategy to define the annual budgetary increase allocated to R&D up until 2010. The main strategic aim of this statute was to create a legal basis for the future creation of a knowledge-based society and a gradual increase in the R&D budget.

The overall goal of the law is to give higher education institutions in Montenegro maximal autonomy in their activities, particularly in the academic field. Mediation from the state shall be kept to a minimum, except when requested for the purpose of protecting public interest. A further aim is to enable the university to educate young people in compliance with the new European standards, to be citizens in a democratic society and to be a qualified workforce in the European labour market.

The law also prescribed the adoption of a University Statute within a maximum of three months after adoption the law; this was successfully carried out in January 2004. The Statute, contrary to the law, needs to clarify, and specify more thoroughly the organization of the university, the structure of the Board and the Senate etc. The new Statute and other by-laws and regulations have already been approved (Skuletic, 2006).

According to the law, the Ministry of Education and Science is, at the time of writing this report, preparing a draft on the regulation of HE financing. Current discussions are oriented towards the inclusion of a social dimension with regard to tuition fees (Skuletic, 2006).

Table 5.1: Important Laws in the Legal S&T Framework of Montenegro (Dall, 2006)

Law on Scientific Research Activities	This new law was adopted in November 2005 and replaced the one adopted in 1992.
Law on Higher Education	This law was reformed in 2003 in order to eliminate rigidity from the university structure, prevent brain drain, comply with EU standards and enable full participation in mobility schemes.
Laws on IP Protection: Law on Enforcement of IP Rights, Patents Law, Copyrights and Related Rights Law, Trademark Law, Law on the Legal Protection of Designs and Law on the Protection of Integrated Circuit Topographies	Montenegro adopted its own law on the enforcement of IP Rights in 2005. However, applicable laws that were in force in the Union of Serbia and Montenegro have legal continuance until suitable laws are passed in the Republic of Montenegro. This means that until a new PTO is established, all IP rights validly registered in Serbia, both before and after the dissolution of the Union, will also be enforceable in Montenegro.

Progress has also been made in Montenegro's intellectual property legislation. As mentioned in chapter 5.1, the situation regarding IP protection in Montenegro has been quite difficult to comprehend, as the country has been using in parallel, both its own law (Law on Enforcement of Intellectual Property Rights adopted in 2005), as well as the laws adopted on the federal level, through the Assembly of Serbia and Montenegro (Patents Law, Copyrights and Related Rights Law, Trademark Law, Law on the Legal Protection of Designs and Law on the Protection of Integrated Circuit Topographies, all December 2004). These laws were adopted in order to fully harmonise regulations with the requirements of the World Trade Organisation (WTO) and the TRIPS Agreement (Trade Related Aspects of Intellectual Property Rights), as well as in accordance with related EU regulations. Currently, the laws in question maintain legal continuance in Montenegro until the country adopts its own laws in this field, according to a decision made by the Montenegrin Ministry of International Economic Relations and European Integrations (SD Petosevic, 2006).

Despite the obvious efforts being made, it must be stressed that enforcement of laws dealing with intellectual property is causing many difficulties in practice. Due to disharmony, limited competence and inadequate coordination between the authorities responsible for the enforcement of laws (for example, courts, public prosecutors, police, customs and market inspectors), the protection of intellectual property rights is not efficient enough at present (Yusurvey, 2006).

5.2 Main Documents Reflecting National Strategies for Research, Development and Innovation

Underdevelopment of S&T governance in Montenegro still represents an important structural problem. There is a certain dynamic present in the government's undertakings, allowing a variety of formal and informal institutions, mechanisms and procedures for managing S&T infrastructure, designing, delivering, selecting and evaluating S&T policy programmes, and specifying and implementing standards. However, differences between the functions described in the laws and the actual implementation can often be found; some institutions do not function properly or merely exist 'on paper'. Innovation should not be limited only to higher education, as is often the case in the Western Balkans region; instead it should penetrate

other relevant policies, such as competition, enterprise, research, finance and taxation policy. Such a shift in focus from science, to a more comprehensive innovation system perspective is still lacking in the country under study, and corresponds to the general situation in the region (Dall, 2006).

The Ministry of Education and Science of Montenegro started the reform on higher education in 2000 as a consequence of various, equally important, factors influencing significant policy changes in society and economy. In 2003, the government of Montenegro adopted the Law on Higher Education, in line with the objectives laid out in the Strategy Plan for Educational Reform. The new Strategy Plan for Educational Reform in Montenegro for the period 2005-2009 was adopted by the Government of Montenegro in 2005. Among other goals, the Strategy Plan envisages the development of educational infrastructure, the introduction of ICT into the education system, curricula modification etc. (Government of the Republic of Montenegro, 2005). Furthermore, in 2003 the Government of Montenegro adopted a strategy for introducing ICT into Montenegro's education system (Ministry of Education and Science of Montenegro, 2003). It is reasonable to expect further adoption of government strategy plans in the near future in order to keep up with the positive dynamics of the work being done so far.

A notable document is also the "Montenegro 2006 Economic and Fiscal Programme", which is the first official document in the recently initiated economic dialogue between the EU and Montenegro, submitted on 1st December 2006. The Economic and Fiscal Programme reflects the overall goal of the Republic of Montenegro planned for the period 2006-08, which is to maintain macroeconomic stability as a prerequisite to faster economic growth and development (Djurovic, 2007).

A new Strategy for S&T is also expected to be completed during the first half of 2008. This Strategy will define the priorities of further S&T development (where participation in all European scientific programmes is the top priority), define feasible mechanisms for increasing annual budgetary allocations for science, which are currently at a very poor level. The draft strategy should be put to public discussion and Government adoption (Knezevic, 2007).

In the Information Society Technology (IST) field, the Montenegro Strategy for Information Society 2004-2007 focuses more on infrastructure development in order to aid poor economic conditions for the country and alleviate the technological gap with the rest of the EU, so only a small part is devoted to IST RTD (INA - Great-IST, 2007).

Under the responsibility of the Secretariat for Development, the "National Strategy for Development of Information Society - the way to knowledge-based society" (on the basis of the common guidelines prepared by the Working Group of the Stability Pact Electronic South Eastern Europe Initiative (eSEE Initiative (Stability Pact for South Eastern Europe, 2003)) was adopted on 17th June 2004. (Secretariat for Development, 2004) This document contains several strategic issues, one of them is `ICT and Education`, which covers all levels of education (including HE) (Knezevic, 2008).

It is based on the "Strategy of Introducing ICT into the Education System of Montenegro – Up to the University Level", which was published by the Ministry of Education and Science in 2003. The general aims of this document were to modernize the entire education system in Montenegro and improve the quality of the education provided so that all pupils of primary and secondary school get fully involved in the information society through achieving computer and information literacy; that all schoolteachers of primary and secondary level, teacher trainers at teacher faculties (Faculty of Philosophy - Nikšić, Faculty of Science - Podgorica and Academies) should develop their skills and the use of ICT for teaching and learning; to provide

Management and Quality Assurance in the Education System of Montenegro and to introduce a Management and Information system based on EU experiences (Ministry of Education and Science of the Republic of Montenegro, 2003).

A couple of other strategic documents deserve to be mentioned, since they all include research and research needs, and they all demonstrate the intention of establishing basis (each in its respective field) for building society based on knowledge. Those are the National Strategy for Sustainable Development (Ministry of Tourism and Environmental Protection of the Republic of Montenegro, 2007), the Strategy for the Development of SMEs (Directorate of Development of Small and Medium-Sized Enterprise, 2007) and draft National Spatial Plan until 2020 (Ministry of Environmental Protection and Physical Planning Republic of Montenegro, 2007; Knezevic, 2008).

5.3 Main Fields of Intervention and Research Priorities

A key challenge for all Western Balkan countries is the process of the transition to a market economy is to create stable and favourable conditions for economic growth. Against this background, innovation policy has to enlarge its scope from the focus on research to a broad productivity agenda (Dall, 2006). As stated by Slavo Radošević, innovation policy as such has only recently re-emerged in the Western Balkans, after having been reduced to a secondary role during the transition process. "*In order to be effective, innovation policies in the CEECs should recognise the structural weaknesses of their individual innovation systems. This will require a search for country-specific solutions, as opposed to the rather imitative mode that has so far prevailed"* (Radosevic, 2005). Investments in R&D and high-tech orientation are regarded as the dominant paradigm in innovation policy.

Serious long-term structural problems that affect the S&T sector need to be discussed in order to assure further development. Amongst these structural problems are budgetary constraints and public debt, a generally low level of development, widespread unemployment, poverty and massive migrations, pointing to the need for industrial restructuring in largely agricultural-based, de-industrialised economies (Uvalic, 2005). Due to the overall lack of resources, prioritisation is of the utmost importance and research orientation has to be steered towards the economic and social needs of the present in order to make provision for the future. International programmes need to support foresight studies and the process of prioritisation, as simply focusing on the RTD Framework Programme or imitating the strategies of other countries will not bring the desired results (Uvalic, 2006).

Priority setting in the S&T sector is intended to facilitate the efficient performance of certain identified S&T fields through a predictable allocation of critical-size funds. The need to define thematic S&T disciplines and fields has been recognised by all countries. Research priorities in general are principally Information and Communication Technologies, Life Sciences, research on Agribusiness and Biotechnology, Genomic research, Environmental and Materials research, and research on renewable energies and sustainable development as well as water management, transport, aerospace research, humanities and social sciences, and research in SMEs. The level of specification varies from country to country. A great deal has been achieved in terms of institution and strategy development. However, some papers remain generally superficial, and many statements have more to do with paying lip service than real policy implementation and related operations. The level of aggregation seems too broad and thus, goal-oriented interventions will be difficult to identify and are unlikely to generate the expected benefit. Much remains to be done, including the implementation of national foresight studies in order to support the prioritisation process. It would also be worth considering a complementary regional comparative foresight exercise to assist the diverse

national attempts (Uvalic, 2006).

According to the SBRA-Great-IST Report, in Montenegro the key steps to be taken simultaneously in the IST field are first to improve the coordination of legislation for IST related research and development. Secondly, a truly meaningful policy and normative work requires recognition and greater collaboration between all actors and stakeholders, starting with SMEs and research organisations, but also reaching out towards civil society (including various professional associations).

The Ministry of Education and Science needs to continue the development of the Montenegrin Education Information System as a basic component for strengthening of ICT in education and research. The Government should also continue the eGovernment project it has started, which aims to connect governments at all levels into a single secure broadband internet based network, to connect educational and health institutions to the internet and to create public access points in all towns and villages with more than 500 citizens by 2008. Additionally, the government needs to deal with the lack of ICT leaders and strategic institutional organisations, even though the country has a significant human potential. The government should also create a realistic strategy to raise internet penetration, especially to the general. The majority of internet users are still dial-up, broadband infrastructure needs to be developed - especially outside of the capital (SBRA-Great-IST, 2007).

The SBRA-Great-IST Report has stated some weaknesses and threats for Montenegro, especially in the IST field: poverty of business climate in the ICT sector; lowering share of RTD funding as percentage of government budget, very modest participation in FP6 (no project were won in the IST area); insufficient broadband infrastructure and access; lack of official statistics on IT and IST RTD; dominance of tycoons over smaller entrepreneurs and the continuous lack of resources and state assistance (and interest) to build the capacity in these sectors (SBRA-Great-IST, 2007).

In Montenegro, the main orientation of R&D policy is supporting basic scientific research and applied research. The priority tasks of the Ministry of Education and Science in the field of research are (Ministry of Education and Science of Montenegro, 2004):

- increasing stability in financing the existing research potential, paying special attention to research at higher education institutions (universities)
- professional assessing research groups
- modernising research equipment and other infrastructure
- increasing international cooperation in science
- ensuring that a higher percentage of the population receive higher education
- increasing post-graduate education of junior researchers with emphasis on PhD students
- providing scientific publications and participating in conferences

The Ministry of Education and Science uses two main programmes: the Human Resource Development Programme and the Scientific Research Programme. The main priorities of the Scientific Research Programme include biotechnology, marine biology, tourism, energy efficiency, telecommunications, computerisation and research on environmental protection, materials-related technologies and health care (Uvalic, 2006). Due to its position as the dominant institution, the University of Montenegro is the prime target of the reform process. However, the stimulation of enterprises and the creation of favourable environments for industry and SMEs are also considered to be crucial. In order to steer the changes in a synergetic way, a system of priorities, supported by adequate and sound economic policy measures, needs to be developed (Ministry of Education and Science of Montenegro, 2005).

Thematic Priorities in Montenegro according to the Ministry of Education and Science of Montenegro, 2005 (Dall, 2006):

General research priorities focus on:

- improvement of the quality of life and communication infrastructure,
- Information and Communication Technologies (ICT),
- environmental technologies and water management,
- materials research,
- research on agribusiness and biotechnology.

In addition, it would be recommendable for the country to develop a sustainable strategy, also taking into account regional and European dimensions. Although the last document related to R&D strategy adopted by the government dates back to 1995 and is no longer effective, the new Law on Scientific-Research Activities (2005) does envisage the preparation of an R&D strategy regarding the creation of a knowledge-based society (Uvalic, 2006). Furthermore, foresight and the identification of innovation capacities will help to develop policies and a long-term strategy in a regional context. Continuously increasing awareness among the public and politicians about the relevance of RTD is also important, and a dialogue between the economy, academia and the administration will provide the basis for developing a science policy that is in line with economic policies and priorities. Benchmarking and evaluation can also help to improve the performance of research institutions and to concentrate capacities in priority areas in coherence with regional development and European integration. A close dialogue with important foreign stakeholders with shared experiences is inevitable, but since there are no ready-made solutions, simply imitating policy approaches is unlikely to produce the desired results (Dall, 2006).

6 Summary and Draft Conclusions

After the dissolution of the Socialist Federal Republic of Yugoslavia (SFRY), Montenegro faced a turbulent political decade, followed by a long period of international sanctions and isolation, which prevented any significant progress in the country. Finally, on 3rd June 2006, Montenegro decided to hold a referendum of independence from the State Union of Serbia and Montenegro, taking on responsibility for its future status and reputation in the international political arena. The European Union recognised the legitimacy of the whole process and instantly commenced a procedure to continue separate negotiations with Montenegro on the Stabilisation and Association Agreement, which were temporarily terminated in the previous year.

There is a general conviction that in the 1990s, the SFRY had a more favourable starting position in terms of matching Western European standards than the former state socialist countries under communist hegemony in Central and Southeast Europe. The scientific and technological trajectories of the former SFRY seemed close to Western European developments and interaction between these two politically contrasting regions continued, both in terms of personal mobility and institutional cooperation. Unfortunately, the collapse of the SFRY and the resulting armed and civil conflicts hindered the necessary modernisation of S&T in the countries of the former SFRY (with the exception of Slovenia) in 1990s. All of these complex reasons have contributed to the loss of comparative advantage of the new countries (successors of the SFRY), which have missed the opportunity to carry out necessary adaptations and fine-tuning. The current situation can be described as critical, which is unequivocally demonstrated by the input and output figures of the national innovation systems. R&D was one element of the system which was most negatively affected during the transition and crisis period of the last 15 years. The research budgets in some of the

countries in the region (including Montenegro) are below critical threshold or have decreased significantly. Modernisation of the institutional and structural set-up of the national innovation system is long overdue, although a number of attempts have been initiated since the turn of the millennium. Links to other subsystems, such as education, the regional economy, and the financial and banking system, are generally still underdeveloped (Schuch, 2006).

International cooperation has been of tremendous importance and value to Montenegro. Serious efforts by the European Commission, Austria, France, Germany, Greece, Slovenia and others have been initiated to overcome the critical situation caused by the decade of isolation and underdevelopment. In this respect we can highlight the EU's "Balkan Countries Action Plan in S&T", formulated under the Greek EU Presidency in 2003, the establishment of the Southeast European ERA.NET initiated by Austria in 2004, and the implementation of a 'Steering Platform' for the Western Balkan countries under Austria's Presidency of the EU in 2006, as projects with the highest relevancy in the recovery of the RTD sector in the region, including Montenegro (Schuch, 2006).

One of the positive features in the countries of the Western Balkans, in comparison with some other developing regions, is a fairly sound human capital base, with an absorptive capacity central for learning, assimilating and using knowledge developed elsewhere. At the same time, however, the relative loss in quality at all levels of the education system is worrying. Development and higher education cooperation policies have recognised this threat and contributed material and immaterial resources to safeguard this vital source of economic and social development. Smaller countries, like Montenegro, are particularly dependent on technological and organisational knowledge and know-how generated abroad, however they can only access it using internationally up-to-date expertise which enables them not only to acquire, but also to generate and apply the knowledge and know-how themselves. Innovation is thus a process that involves more than just capable individuals. Bridging activities between companies and organisations of different sub-sectors of the innovation systems (such as education, regional development policy, S&T, and financial and regulatory systems) are of the utmost importance, as are bridging activities between more developed and less developed regions of knowledge. Interaction and interdependence are the most fundamental characteristics of this approach (Schuch, 2006).

Although the general assessment shows that the research system in Montenegro has substantial potential, it is still troubled by the inappropriate treatment of the research institutions, an unfavourable structure, weak interaction with the business sector and insufficient linkages with the education and research systems of other countries. Over the course of time, science, scientists and scientific research have been marginalised, while R&D has not been among the key priorities and a clear longer-term strategy in this area is still absent. According to Milica Uvalić, the links between business enterprises, universities and research institutes need to be improved and efforts should be made to accelerate the implementation of laws and related measures (Uvalic, 2006).

In addressing these complex issues, the government will have to face the challenge of finding the right balance between restrictive economic policy, which is clearly necessary for macroeconomic stabilisation purposes, and other types of policies with long-term effects, which can contribute to raising economic competitiveness, for example, through increased investment in human capital, and increased spending on R&D and on education. It would also be desirable to address the issue of a longer-term strategy of R&D for all Western Balkan countries in a regional context. Furthermore, there is a need to attract more Foreign Direct Investment (FDI) by further improving the business environment and thus decreasing the risk associated with investment, which also ought to facilitate the transfer of modern technologies

and know-how (Uvalic, 2006).

Sreten Škuletić, president of the Commission for scientific-research activities and international cooperation at the Montenegrin Ministry of Education and Science has assessed the overall situation in the country regarding RTD as a reflection of the general situation in society at this moment. The current economic situation, accompanied by severe under-financing of science gives little hope for any significant improvements in the near future. Allocated financial sources are hardly sufficient to cover basic survival needs, let alone create a platform for further development. Nevertheless, he believes that the situation could gradually improve by pursuing continuous efforts and investments in the RTD sector, accompanied by reforms in the field of higher education in line with the Bologna objectives and following processes (Prosvjetni rad, 2006). This is also a general assessment by the Montenegrin scientific Diaspora, who wants to see the positive changes in the country continue with an accelerated pace, but also reminds us that the most significant change required, is a change in the way science is viewed by society, in particular, the need for a greater awareness of the importance of science for the existence and development of society as a whole.

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8 List of Acronyms

BERD	Business Sector Expenditure on R&D
CARDS	Community Assistance for Reconstruction, Development and Stabilisation
CANU	Montenegrin Academy of Sciences and Arts
CEEC	Central and Eastern European Countries
CEI	Central European Initiative
CERN	European Organisation for Nuclear Research
CEP	Centre of Excellence Projects
CG	*Crna Gora* - Montenegro
CIP	Competitiveness and Innovation Framework Programme
CIS	Centre of Information System
COBISS	Co-operative Online Bibliographic System & Services
CORDIS	Community Research & Development Information Service
COST	Co-operation in Science and Technology
DAAD	German Institute for Academic Mobility
DG	Directorate General (in the European Commission)
EC	European Commission
ECTS	European Credit Transfer System
EIP	Entrepreneurship and Innovation Programme
ERA	European Research Area
ERA-NET	European Research Area Network
EU	European Union
FP	Framework Programmes
FP6	Sixth EU Framework Programme for R&D
FP7	Seventh EU Framework Programme for R&D
FTE	Full Time Equivalent
EPC	European Patent Convention
EPO	European Patent Office
FDI	Foreign Direct Investment
FRY	Federal Republic of Yugoslavia

GEANT	multi-gigabit pan-European data communications network
GERD	General Expenditure on R&D
GDP	Gross Domestic Product
GOVERD	Government Sector Expenditure on R&D
HC	Head-Count
HE	Higher Education
HERD	Higher Education Sector Expenditure on R&D
HP	Hewlett Packard
IAEA	International Atomic Energy Agency
ICT	Information and Communication Technology
ICTY	United Nations International Criminal Tribunal for the former Yugoslavia
INCO	International S&T cooperation of the European Union
IP	Intellectual Property
IPA	Instrument for Pre-Accession Assistance
ISSP	Institute for Strategic Studies and Prognoses
IS2WEB	FP6 project “Extending Information Society Networks to the Western Balkan Region”
IST	Information Society Technologies (Sub-Programme in FP6)
JRC	Joint Research Centre
MEIS	Montenegrin Educational Information System
MoES	Ministry of Education and Science
MONSTAT	Statistical Office of the Republic of Montenegro
MREN	Montenegrin Research and Education Network
NATO	North Atlantic Treaty Organisation
NIP	Networking Infrastructure Projects
PJC	Pilot Joint Call of the SEE-ERA.NET project
PTO	Patents and Trademarks Office
R&D	Research and Development
RTD	Research and Technological Development
SAA	Stabilisation and Association Agreement
SAP	Stabilisation and Association Process
S&E	Science and Engineering
SEE	South East Europe
SEE-ERA.NET	FP6 project “Southeast European Era-Net”
SEE-INNOVATION	FP6 project “Facilitating Innovation for ICT SMEs in South Eastern Europe”
SEE-SCIENCE.EU	FP6 project “Information Office of the Steering Platform on Research for Western Balkan Countries”
SEEREN	FP6 project “South Eastern European research and education networking”
SFRY	Socialist Federal Republic of Yugoslavia
SME	Small and Medium Size Enterprise
S&T	Science and Technology
TEMPUS	Trans-European Mobility Scheme for University Studies
TRIPS	Trade Related Aspects of Intellectual Property Rights
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNIDO	United Nations Industrial Development Organisation
USAID	United States Aid

UoM	University of Montenegro
WB	Western Balkans
WBC	Western Balkan country/countries
WTO	World Trade Organisation
WUS	World University Service
ZAMTES	Republic Agency for International Scientific, Educational, Cultural and Technical Co-operation of Montenegro
ZSI	Zentrum für Soziale Innovation (Centre for Social Innovation)

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Science and Technology Country Report

SERBIA

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1 Introduction

This country report is produced by the "Information Office of the Steering Platform on Research for Western Balkan Countries" and reviews the situation of Science and Technology (S&T) in Serbia.

The report summarises main papers published by the United Nations Educational, Scientific and Cultural Organisation (UNESCO), the South-East European ERA-NET (SEE-ERA.NET), the Austrian "Gesellschaft zur Förderung der Forschung", and several independent scholars on the issue of S&T in Serbia. For the complete table of references please see References in chapter 7, starting on page 263 of this report.

The objective of this study is to enhance our understanding of the national innovation system in Serbia. An overview of the situation in S&T regarding the main stakeholders, input and output indicators, national strategies and priorities and main documents and laws in the field is given below.

The 'system of innovation' approach was taken into account when compiling this report, and covers important factors influencing the development, diffusion and use of innovations, as well as the relations between these factors. It does not place emphasis on individual firms or research organisations, but rather on innovation as an interactive and interdependent process.

Relevant organisations in this respect are firms, higher education institutions, government agencies, etc. interacting to create knowledge and innovation. The macro-level of the system is analysed using indicators such as R&D personnel ratios, R&D expenditure, patent application intensity rates, etc.

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1.1 Serbia - A Brief Profile

Unlike the transitional changes in Central and Eastern European Countries, Serbia has undergone a period of economic and political isolation and escalated conflict. The wars, which only ended in 1999, destroyed the country's infrastructure and devastated the environment and the economy, leaving the majority of the population demoralised and impoverished.

Serbia, with a population of 7,463,157 in 2004 (not including data for Kosovo and Metohija), had a total number of 2,068,964 employed persons compared to 895,697 unemployed in 2005 (Statistical Office of the Republic of Serbia, 2006a).

After the fall of president Milošević in 2000 and the re-introduction of a democratic regime in the Federal Republic of Yugoslavia (FRY), the country's suspension from the UN was lifted. Kosovo has been governed by the UN Interim Administration Mission (UNMIK) since June

1999 and in 2003, lawmakers reconstructed the FRY into a loose federation of two republics called Serbia and Montenegro. The constitution of this union included provision allowing each of the republics to hold a referendum on independence after three years. In spring 2006, Montenegro exercised this right and voted for independence enabling it to secede on 3rd June 2006. Subsequently, Serbia declared itself the successor state of the union of Serbia and Montenegro (European Commission, 2006b).

Following discussions, the European Council adopted a conclusion recognising the Republic of Serbia as a legal successor of the state union on 12th June 2006. As a result of strong gains in trade, transportation, financial services and construction, Serbian gross domestic product (GDP), at EUR 2,506 per capita, grew by 6.5% in 2005 (European Commission, 2006b). Major growth drivers were retail trade, telecommunications and transport with the respective rates of 32.9%, 22% and 6.7%. The calculation of GDP and other macroeconomic indicators for the period from 1997 to 2004 was revised by the Statistical Office of the Republic of Serbia. However, according to international standards[1], GDP per capita in 2005 was calculated at EUR 2,836.8; EUR 21,107.9 million using current prices in 2005 (estimates). In 2006, it was estimated that total economic activity, measured by GDP at constant 2002 prices, increased by 5.8% in comparison to the previous year. The greatest increase was noted in the sectors of transport, financial intermediation and construction.

Industrial production grew at a modest 1.3%, while inflation remained in double-digits throughout the year and stood at 17.5% in December 2005, mainly driven by the strong domestic demand, increases in administration costs, the rising cost of fuel imports and the on/off effect of the value-added tax (VAT) introduced in January 2005 (Statistical Office of the Republic of Serbia, 2006a).

In the first quarter of 2007, GDP grew by 8.7% in comparison to the corresponding period of the previous year. Regarding the commercial activities, the growth is noted as follows: the trade sector - 24.1%, the transport sector - 19.4%, the financial intermediation sector - 18.7%, the construction sector - 16.2% and the manufacturing sector - 8.8%. The electricity, gas and water supply sector shows a fall of 5.6%, real estate, renting and business services fall by 1.4% (Statistical Office of the Republic of Serbia, 2007a).

The unemployment rate in Serbia has been increasing in 2004, it was 19.5%, in 2005 reached 21.8% and in 2006, it declined slightly to 21.6%. Labour market conditions in 2007 remained difficult and employment declined by 1.6% year-on-year during the first quarter of 2007. This trend continued during April and May, when employment continued to decline by 1.5% and 1.4% year-on-year, respectively. The official registered unemployment rate remained at a relatively high 19.0% in November 2007, although this rate was shown to be gradually falling (European Commission, 2007a).

According to EU expertise, further reforms in the country are required in order to comply with WTO accession conditions - such reforms include the privatisation of large public enterprises and changes in the foreign trade regime through for example, the adjustment of import rules regulating technical standards and quality and sanitary control of goods entering Serbian territory.

After renewing its membership with the International Monetary Fund (IMF) in December 2000, the former FRY continued to reintegrate into the international community by rejoining the World Bank and the European Bank for Reconstruction and Development (EBRD) in 2001.

[1] In compliance with new international standards and recommendations - the methodology of the System of National Accounts (SNA 93) and the European system of national accounts (ESA 95).

In order to enhance fiscal sustainability and economic growth in Serbia, the World Bank has been active in the Transitional Support Strategy for Serbia and Montenegro. The EBRD has also provided significant support to the country, approving more than 20 new projects and providing major infrastructural loans and investments in support of SMEs. In 2001, an agreement was concluded, rescheduling the country's USD 4.5 billion Paris Club government debt - 66% of the debt was written off - while the London Club of private creditors forgave an additional USD 2.8 billion of debt, 62% of the total owed (European Commission, 2006b).

The European Bank for Reconstruction & Development ranked Serbia top reformer in Central and Eastern Europe for its implementation of structural reforms making investment in Serbia more straightforward. The Government of Serbia is continuing to update and upgrade the business climate and gives full support to international companies realizing their investment ambitions in Serbia (SIEPA, 2006).

The final status of the Serbian province of Kosovo represents another important issue that remains to be resolved. Several thousand peacekeepers from the UN Administration Mission in Kosovo (UNMIK) have administered the region since 1999 and as soon as the required conditions are established, the international community has agreed to begin the process to determine the final status of Kosovo. Under the current regime, UNMIK/Kosovo has an independent institutional structure for science and higher education.

At the time of writing, Kosovo's provisional political institutions have declared Kosovo to be independent from Serbia, a move which has been recognised by a number of foreign states, for example, many EU member states, the US and Japan. It is not possible at this moment to foresee the effect this declaration will have on the S&T processes within Serbia or Kosovo, so the report will continue to give an overview of the situation up to February 2008.

1.2 Relations between Serbia and the EU

The government of Serbia officially declared European integration to be one of the strategic priorities for the country. The European Commission report states that since 2001, Serbia has benefited from the EU policy advice provided through the EU-FRY Consultative Task Force (CTF), later replaced by the Enhanced Permanent Dialogue (EPD), the task of which is to encourage and monitor the reforms based on the European Partnership (adopted by the EU Council in June 2004 and updated in January 2006). EPD structures will remain in place and continue to support the reforms in Serbia until formal contractual relations between Serbia and the EU are established through the Stabilisation and Association Agreement (SAA), which will provide a legal framework for relations during the entire period prior to the possible future accession (European Commission, 2006b).

This process has been prolonged through the European Commission's decision on 3rd May 2006 to block SAA negotiations with Serbia until its obligation to cooperate fully with the International Criminal Tribunal for the former Yugoslavia (ICTY) is fulfilled. Top EU officials held a meeting with the Serbian Prime Minister, Vojislav Koštunica, on 16th October 2006, in order to evaluate the current state of affairs regarding the country's attempts to fulfil the obligations of the ICTY. Following the negative assessment on cooperation given by The Hague's chief prosecutor, Carla del Ponte, the EU decided not to resume SAA negotiations with Serbia.[2] However, the Commission continued to stress its readiness to resume negotiations as soon as full cooperation with the ICTY is achieved. The Council supported the Commission's decision. Following a clear commitment by the country to achieve full cooperation with the

[2] Some changes could occur after parliamentary elections in January 2007.

ICTY, and concrete actions undertaken by the country that have matched this commitment, SAA negotiations with Serbia resumed on 13th June 2007 (FOCUS Information Agency, 2006; European Commission, 2007b).

The SAA should also promote economic and trade relations, with the aim of establishing WTO-compatible free trade after a transitional period. The two agreements will include commitments by Montenegro and by Serbia respectively to progressively align their legislation with that of the Community.

Negotiations for visa facilitation and readmission agreements with Serbia were opened in November 2006. On 18th September 2007 the European Union (EU) and five West Balkan nations (among them Serbia) signed nine agreements on visa facilitation and readmission, which will bring the two sides closer in cooperation in migration and movement of persons. The signature of the agreements is an important political decision toward closer cooperation between the EU and the Western Balkan countries in the sensitive areas of migration and movement of persons (see-science.eu, 2007c).

The EU provides substantial financial assistance to the Western Balkan countries through CARDS (Community Assistance for Reconstruction, Development and Stabilisation), which was replaced by the new Instrument for Pre-Accession Assistance (IPA), starting from January 2007. EU assistance (combining CARDS/IPA, macro-financial and humanitarian assistance) to the whole Serbia and Montenegro has amounted to more than EUR 2.9 billion between 1991 and 2002. A major part of this assistance has been allocated to conflict management, post-conflict reconstruction and stabilisation, paving the way for a closer association with the EU (European Commission, 2006b).

The IPA aims to provide targeted assistance to candidate countries and potential candidate countries with their EU membership application, and entirely replaces CARDS and other pre-accession financial instruments. The programming has five components - Transition Assistance and Institution Building; Regional and Cross-Border Co-operation; Regional Development; Human Resource Development and Rural Development - only the first two of which will apply to potential candidate countries (including Serbia). The IPA will allocate over EUR 11 billion across the 2007-2013 period (see-science.eu, 2006).

Even though science is not among the main objectives of the IPA, support of S&T infra-structure and related activities is envisaged. This significant change is mainly the result of the following dynamics: on the one hand, Serbia's formal request to CARDS for funding S&T related activities, which was supported by EU Member States, and on the other hand the SEE-ERA.NET project, which drew particular attention to the issue of S&T support and pushed the matter to specific contacts with EU officials. Hence, gaining support is mostly in the hands of the West Balkan countries (WBC), which need to demonstrate certain efforts in formulating and submitting requests to the relevant authorities. The SEE-ERA.NET project and especially the Steering Platform, could provide the necessary support in this process, acting as a forum for the exchange of experiences and best practices among the WBCs, as well as through focused and coordinated interventions in respect to the European Commission services and the EU Member States (Bonas, 2006). The European Commission also pledged to support the region in finding synergies between IPA and science in its Communication on the Western Balkans (European Commission, 2008).

2 Contemporary Institutional Landscape

The transition of Serbia and Montenegro's S&T system started following the gradual dissolution of the former FRY, the destruction caused by the war and the subsequent brain drain. The institutional landscape has also been altered during the process. The following chapter tries to map the current main stakeholders in the national innovation system, relevant cooperation and the legal framework defining the system.

2.1 Main S&T Stakeholders Involved in Policy Making in Serbia

The main ministry in Serbia with responsibility for S&T policy and the management, planning and financing of public R&D activities is the Ministry of Science (MSCI)[3]. It also has core and full responsibility for international R&D cooperation[4]. Serbia has no funds or agencies responsible for financing R&D activities - complete financial schemes, payment procedures and the control of infrastructure comes under the responsibility of the MSCI, while higher education policy is managed under the authority of the Ministry of Education. Scientific issues are held under the authority of the Ministry of Science[5]. Following its primary task of co-ordinating science development, based on the knowledge and activation of the existing development potentials and resources in Serbia, the MSCI is also engaged in the realisation of research in the sector of technological development. The aim of this research is to use Serbia's scientific-research potential to solve development problems in various institutions and organisations in the fields of information technology, chemical technology, engineering and software industry, traffic and construction, biotechnology and energy technologies. Realisation of such research should allow direct input of knowledge, helping to achieve faster development within individual economic sectors, as well as creating highly innovative, market-attractive products, improving product quality and competitiveness in international markets, and development of infrastructure (Ministry of Science and Environmental Protection of the Republic of Serbia, 2006).

The formation of the new Serbian government in 2007 created a new division and definition of responsibilities of ministries. According to the new Law on ministries, adopted on 15th May 2007, the new Ministry of Science (now distinct from the Ministry of Environmental Protection) is responsible for:

- System, development and advancement of scientific research activities to support scientific, technological and economic development;
- Definition and implementation of the policy and strategy of S&T development;
- Definition and implementation of the programmes of scientific, technological and developmental research;
- Training and development of researchers;
- Definition and implementation of innovation policy;
- Stimulating entrepreneurship, transferring knowledge and technologies into the industry, development and advancement of the system of innovation;

[3] In the previous government, from 2001 to 2004, it was the Ministry for Science, Technology and Development and from 2004 to 2007 Ministry of Science and Environmental Protection.
[4] Responsibilities for International R&D Cooperation: negotiation with partners and national S&T institutions; contracting the framework for international bilateral and multilateral S&T cooperation; financing of international bilateral and multilateral S&T activities, which are selected and approved by the Ministry (JISA, 2006).
[5] Ministry of Science is divided into 4 departments: Department for Basic Researchers; Department for Technological Development, Transfer of Technologies and Innovation System; Department for International Scientific and Technological Cooperation; Department for Human Resources Development in Sciences.

- Development of the system of S&T information and the programme of S&T infrastructure;
- Research in the field of nuclear energy, security of nuclear objects, etc. (Sipka, 2008)

Other responsibilities in this area are delegated to the Ministry of Telecommunications and Information Society, which is responsible for:

- Definition and implementation of the policy and strategy of building an information society;
- Applying information sciences and Internet;
- Development and functioning of the academic computer network of Serbia

The fact that both the Ministry of Science and the Ministry of Telecommunications and Information Society have closely related responsibilities should be taken into consideration, in order to encourage cooperation rather than overlapping policies (Sipka, 2008).

Respecting the fact that higher education institutions are both educational and scientific institutions, there is also the Council for the Development of University Level Education, responsible for the provision of high-quality education, the implementation of scientific work programmes at higher education institutions and the development of higher education policy (Ministry of Science and Environmental Protection of the Republic of Serbia, 2006). The Council elected the members of the Accreditation and Quality Assurance Commission. The Council and the Commission, the two bodies independent and separate from the executive authorities, started drafting, immediately after their establishment, the norms and standards, to enable the soonest possible accreditation of higher education institutions and curricula according to the Bologna process (Stankovic, 2006).

According to the constitution adopted in 2005, autonomous rights are given to the province of Vojvodina, regarding the definition, finance and management of R&D activities in the province. A Provincial Secretariat for Science and Technological Development has been established which also supports international cooperation, R&D potential and infrastructure and cooperation with industry (Provincial Secretariat for Science and Technological Development Vojvodina).

In Kosovo/UNMIK, the Ministry of Education, Science and Technology in Prishtina supposedly develops both scientific research and the higher education system, as well as promoting a market for innovation and technological development, although no research fund exists (Dall, 2006). The ministry is also responsible for the formulation of an overall strategy for the development of education, science and technology in Kosovo and the promotion of a single, unified, non-discriminatory and inclusive education system. In 2003, the budget allocation for the Higher Education Department amounted to EUR 11.6 million, or 62.4% of the budget of the ministry (MEST Kosovo, 2002).[6]

A Department of Higher Education and Science is in operation within the Ministry of Education, Science and Technology. Its primary goal is planning the development of higher education and science. To achieve this goal it works on plans and documentations of policy, standards and procedures, which provide systematic solutions to the challenges arising in the fields of higher education and scientific research (MEST Kosovo, 2007).

[6] The web page of the Ministry of Education, Science and Technology of Kosovo/UNMIK is http://www.ks-gov.net/masht/DefaultPC.aspx?CaseID=10&LangID=SR&ModID=60

The thematic report for the Information Office by Klaus Schuch (Schuch, 2008) covers the situation in Kosovo/UNMIK in more detail.

Although the Serbian Law on Higher Education states that universities are independent higher institutions, while faculties must be units of a university, the reality is that faculties still enjoy high levels of legal, functional and academic autonomy and because of that it is extremely difficult to introduce coherent reforms even in one university, let alone across a national system (Crosier, 2007). Private faculties are also established as laid out in the Law on Higher Education, on an equal basis with the faculties founded by the Republic of Serbia as regards their rights and their obligations (Stankovic, 2006). Serbia has a much higher proportion of private universities/faculties than the other countries in the region.

An issue has been raised regarding the lack of improvement made in the field of education. While the reforms required by the Bologna Process have begun, more sustainable efforts are needed, in particular to ensure quality and to link the university with the labour market and economic needs. Some progress was made in the endorsement of framework policy documents on vocational education and training (VET). However, further action is needed to implement policies and to strengthen coordination between VET, the other education sectors and the labour market. The development and adoption of a national qualification framework for VET has not advanced. Limited administrative capacities, inadequate definition of competencies and lack of coordination among the responsible institutions are a source of concern, as well as the absence of a clear programme under the new ministry (Sipka, 2008).

Overall, Serbia is relatively advanced in the development of a legislative framework for education and research. However, substantial efforts are still needed to develop the two sectors and to link them to the economic context. The pace of reform of the education sector has been slow. An improved institutional framework and a better-defined programme are needed to ensure further progress.

As regards the main institutions, the University of Belgrade has to be highlighted, as it is the biggest and most important university in Serbia. It incorporates over 30 faculties and 8 institutes, which cover the fields of Physics, Chemistry, Technology, Metallurgy, Molecular Genetics, Genetic Engineering, Applied Nuclear Energy etc. Apart from their research projects, the university personnel carries out, or takes part in, the realisation of a considerable number of projects from the republic's "Programme of Scientific Research" and the "Programme of Technological Development". The scientific research units of the university are currently carrying out quite a number of projects in the fields of general and applied research, as well as some development projects. The university also intensively publishes scientific research results in nearly 300 doctoral theses per annum (University of Belgrade, 2006b).

The Serbian system of higher education incorporates universities founded by the state (the University of Belgrade, the University of Arts Belgrade, the University of Novi Sad, the University of Kragujevac, the University Niš, the University of Novi Pazar, and in Kosovo/UNMIK, the University of Prishtina and the University of Mitrovica[7]), various private universities (the University Braća Karić, the European University, Megatrend University, University Singidunum and University Union, all located in Belgrade; the University of Novi Pazar, located in Novi Pazar; and the University Privredna akademija, located in Novi Sad), as well as some additional faculties (Ministry of Science and Environmental Protection of the Republic of Serbia, 2006; Ministry of Education and Sports of the Republic of Serbia, 2007). In addition, a few more faculties have entered the licensing process. It remains to be seen if

[7] Some Serbs refer to the University of Mitrovica as the University of Prishtina, which in the international context is just used for the Kosovo/UNMIK supervised Albanian-teaching university located in Prishtina (and some affiliated institutes in the countryside).

all these institutions can successfully pass the accreditation procedure, which is in due course at the time of publishing of this report.

Serbia also takes part in the Bologna Process, which has been perceived as a key driver for rebuilding and reinvigorating higher education system, burdened with a heritage from a Yugoslav past. However, the programme implementation is rather slow and difficult to sustain, mainly because of the legacy of Yugoslav self-management and its embodiment in the notion of faculty independence. Despite the efforts that have been put into the reform, the fundamental step of integrating universities into coherent and manageable structures has only been achieved in very few cases (Crosier, 2007).

The Serbian Academy of Sciences and Arts (SASA) was founded in 1886. With its eight departments, it represents the most eminent scientific and art institution in Serbia. In 2005, the Scientific Research Fund of SASA provided and allocated the funds for scientific research, publishing, inter-academic and international cooperation, as well as for the participation of SASA members in scientific meetings, for the acquisition of scientific literature and for other SASA scientific research needs. About 180 projects were conducted and 34 publications, with over 360 participating authors, were published in the SASA editions that same year (SASA, 2006).

A number of Technical Incubators have already been established in Serbia, in spite of the initial delay in the development of Serbian innovation centres. They are (see-science.eu, 2007e):

(a) Technology / Innovation Centres:

- Technology Transfer Centre at the University of Novi Sad (TTC)
- Innovation Centre of Mechanical Faculty at the University of Belgrade
- Novi Sad Innovation Centre (NOSIC)

(b) Technological and Science Parks:

- “Mihajlo Pupin” Institute - S&T Park
- S&T Park Nis
- S&T Park Novi Sad
- Institute Vinca, Belgrade

(c) Business-start-up Centres / Technology Incubators:

- Business Start-up Centre Kragujevac
- ENTRANSE Business Incubator Niš (BIC Niš)
- Business Incubator Knjazevac
- Business Incubator Zrenjanin
- Business Incubator Subotica
- Business Incubator Bor
- Business and Technology Incubator of the Technical Faculties of the University of Belgrade

In Kosovo/UNMIK, the only public higher education institution is the University of Prishtina. It comprises about 2,200 employees (over 360 full-time professors with a Ph.D., and over 220 with a Masters degree, according to statistical data) and 20,000 students studying at 14 faculties and 7 higher education institutions located in various regions. The University

of Prishtina is now a member of the European University Association, as well as other international university cooperation bodies. The university is deficient in science equipment, laboratory materials, books and journals and only functions within the Albanian language stream, except for some particular departments, where other languages are taught (MEST Kosovo, 2002). There has been a strong tendency to establish a higher education institution within the Serbian language stream in northern Kosovo. Currently, there are two separate institutions, both using the name "University of Prishtina", one of which is conducting education in the Serbian language and is backed by the government of Serbia. In 2004, UNMIK decided to suspend the license of the University of Kosovska Mitrovica and demanded the annulment of Professor Radivoje Papović's appointment as rector of the university. Subsequently, the EUA called upon its members to discontinue cooperation with the University of Kosovska Mitrovica until the institution is legally reintegrated into the higher education system of Kosovo (EUA, 2004).

Figure 2.1: Relevant intermediary institutions and research performers of the Serbian STI-system (Kutlaca, 2007b)

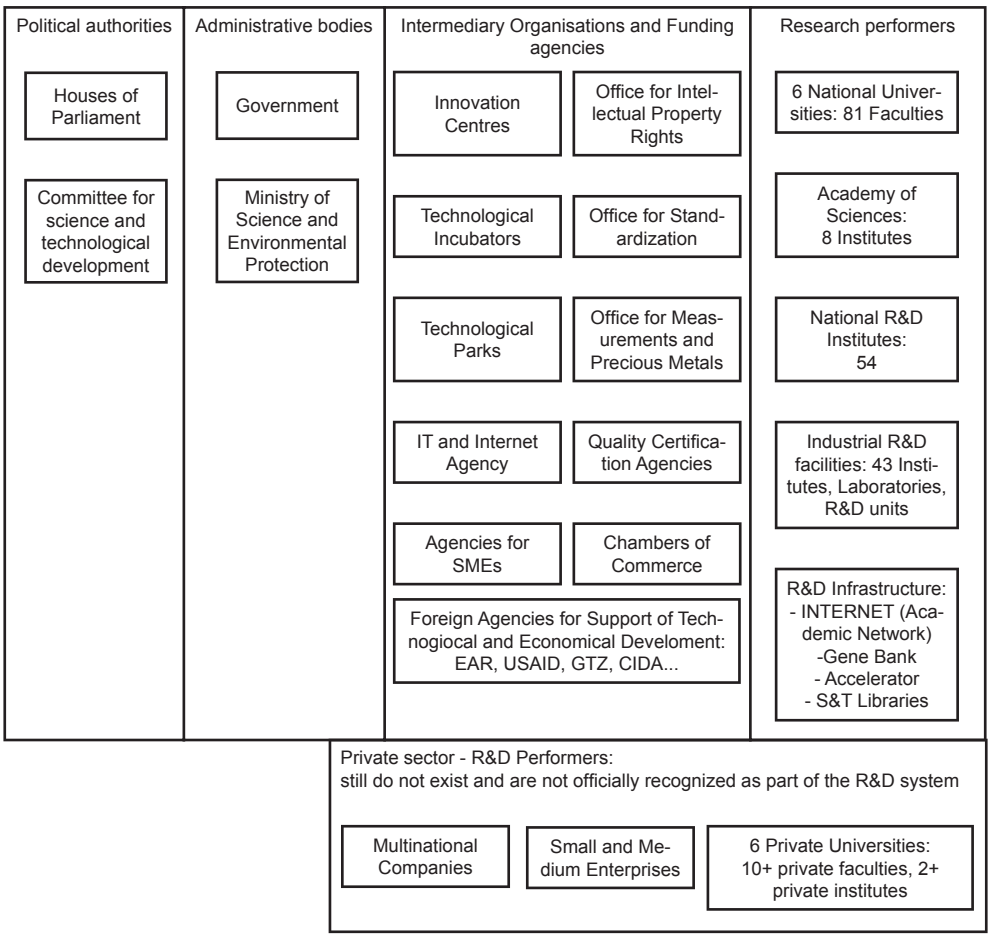


Table 2.1: Main S&T Stakeholders in Serbia (Dall, 2006)[8]

Main ministry in Serbia competent for S&T	- Ministry of Science (MSCI)
Other ministries with importance to the S&T sector	- Ministry of Education - Ministry of Economy and Regional Development - Ministry of Telecommunications and Information Society - Ministry of Health - Ministry of Agriculture, Forestry and Water Management - Ministry of Foreign Affairs - Ministry of Energy and Mining
Other important stakeholders:	- Intellectual Property Office - Council for the Development of University Level Education - Rectors Conference - National Council for RTD
Main research institutions / universities	For a list of research institutions see Annex I - Main R&D institutes in Serbia
	- Serbian Academy of Sciences and Arts (SASA), with 8 departments - University of Belgrade - University of Arts, Belgrade - University of Novi Sad - University of Kragujevac - University of Niš - University of Novi Pazar - Private Universities (University “Braća Karić”, European University, “Megatrend” University, University “Singidunum”, University “Union”, all Belgrade; and University of Novi Pazar, University “Privredna akademija” Novi Sad, University of Novi Pazar etc.) - University of Prishtina (Kosovo/UNMIK) - University of Mitrovica (Kosovo/UNMIK)

2.2 International Cooperation

Serbia has been experiencing constant renewal of international cooperation and support, especially in the last five years. This cooperation has been substantially supported by many international organisations, as well as through the assistance of developed countries in bilateral programmes (also providing significant benefits to the R&D sector). The vast majority of financial support in this respect came from the funds of the Stabilisation and Association Process, the CARDS programme, the Stability Pact for South Eastern Europe, the European Investment Bank, and the European Bank for Reconstruction and Development. The European Union’s Tempus programme has been important in the area of higher education, while Serbia’s participation in the EU Framework Programmes for R&D has also been of particular importance. Concerning multilateral cooperation in the area of science and research, Serbia has closely cooperated with many specialised UN agencies, such as

[8] Adapted by Dall (2006)

UNESCO, UNIDO, UNDP, UNECE[9], while some other international organisations, such as the World Bank and national organisations, such as the USAID, GTZ (Germany), and SIDA (Sweden), etc. have also been important donors and have helped in the area of R&D and innovation (Uvalic, 2006).

Many regional projects have been launched with the objective of promoting regional cooperation in South Eastern Europe. Regional scientific cooperation in Serbia is currently being promoted within several regional organisations: the Central European Initiative, the Adriatic-Ionian Initiative, the Black-Sea Economic Co-operation, the International Centre for Genetic Engineering and Biotechnology and the Stability Pact for South Eastern Europe. Since 27th February 2008, the Stability Pact has been transferred into the new regionally owned cooperation framework, the Regional Cooperation Council. From March 2008, the Council intends to play a key role in consolidating achievements of the Stability Pact to date and in making further progress in the different areas of co-operation. It will also continue to provide a platform for supporting further Euro-Atlantic integration of South Eastern Europe (Stability Pact for South Eastern Europe, 2008).

Serbia is also maintaining active cooperation with the International Atomic Energy Agency (IAEA) and the Joint Research Centre (JRC). The JRC is a department (Directorate-General, DG) of the European Commission providing independent scientific and technological support for EU policy-making. Knowledge and information is gathered using specific application/issue-oriented research within the seven JRC institutes, as well as through close cooperation with over 1,000 public and private organisations in 150 networks within the Member States and applicant countries. The JRC aims to contribute to the goals of the European Research Area and to provide S&T support to EU policies. Its efforts in the ERA focus on five activities: developing scientific reference systems, networking, training and mobility, accessing and using infrastructures, and a dedicated effort to support enlargement (European Commission, 2004).

Regional networks also include initiatives to assist the Western Balkans countries to participate in the EU Framework Programmes for R&D and to integrate in the European Research Area, as defined by the EU-Balkan countries' Action Plan on Science & Technology adopted at the Ministerial Conference in Thessaloniki on 26th-27th June 2003. The "Action Plan", along with the "Shared Vision", defined the priorities of the research cooperation and provided a detailed examination of all possible sources of funding, thus contributing to the economic growth of Balkan countries and aiding their integration into the European Research and Innovation Area (CORDIS, 2003). In June 2004, the Serbian government decided to invest EUR 9 million in R&D infrastructure and the development of technological parks. This was the first time that the significance of RTD as a tool for fostering a knowledge-based economy has been recognised by the highest level of authority in a Western Balkan country (Videnovic, 2006).

Serbia participated in the Sixth Framework Programme (FP6) as an 'INCO country' with co-financing of projects provided by the Ministry for Science and Environmental Protection. In FP6, implemented in the period 2002–2006, scientific workers and researchers took part in a total of 86 projects and received EUR 12 million, as well as access to research that led to projects worth over EUR 170 million (see-science.eu, 2007d). The increased activity and involvement of Serbia in FP6, as well as the current negotiation of Serbian association to the Euratom Programme, does not hide the fact that the country has not yet managed to define an integrated research policy.

[9] Please see the List of Acronyms (chapter 8).

Following the signature of a Memorandum of Understanding, on 13th June 2007 Serbia joined the EU Seventh Framework Programme (FP7) for research and technological development, which will help it participate in EU scientific and research initiatives on equal footing with the Member States. The total programme budget (2007-2013) stands at over EUR 50 billion and participation in the programme enables international scientific cooperation and research, as well as implementation of projects from scientific and technical sciences and humanities (see-science.eu, 2007b).

Positive examples of regional networks include the Inter-Balkan Forum on IST (Information Society Technologies) and the Balkan Physical Union. Various projects based on bilateral inter-governmental agreements have been particularly numerous and further integration is expected as a result of the activities of the South Eastern European ERA-NET (Ministry of Science and Environmental Protection of the Republic of Serbia, 2006; Uvalic, 2006).

ERA-WESTBALKAN is another project focusing on the integration of Western Balkan scientists into the European Research Area, and specifically the Framework Programmes. The project partner is the Ministry for Science. Some other examples of relevant support actions are IS2WEB, SEE-INNOVATION, BAFN, EU-Balkan-FABNET and SCORE, among others.[10]

COST (Co-operation in the field of Scientific and Technical Research) has developed into one of the largest frameworks for research cooperation in Europe and is a valuable mechanism co-ordinating national research activity. According to the latest reports, COST has around 200 actions and involves nearly 30,000 scientists from 34 European member countries and more than 80 participating institutions from 11 non-member countries and non-governmental organisations. Ease of access for institutions from non-member countries also makes COST a very interesting and successful tool for tackling topics of a global nature.

In addition the EUREKA programme has been active in Serbia since 2003 and has since realised 30 projects, with a total value of over RSD 54 million[11] (Zarkovic, 2006). Among the main objectives of EUREKA are to increase productivity, to support cooperation between industry, SMEs, universities and institutes, as well as to develop market-oriented technologies, services and products. Only 30% of the specific project value should come from the budget, while the rest should be contributed by the RTD institutes and private companies.

Higher education institutions maintain bilateral connections with a number of foreign university associations, support participation in TEMPUS and the CEEPUS (Central European Exchange Programme for University Studies). There are also programmes and various international competitions that award funds to scientific research, the development of the education system and the acquisition of material resources for the advancement of the higher education teaching process. Furthermore, higher education institutions, particularly the University of Belgrade, have regular contacts and cooperate with trade associations, as well as student exchange associations, for the purpose of studying and participating in summer practice programmes (University of Belgrade, 2006a). Serbian academic institutions are also continuing to maintain strong international cooperation by signing bilateral agreements with a number of foreign universities, covering every continent and joining the European Universities Association (EUA), the Balkan Universities Network, the Danube Rectors' Conference (DRC), the Network of Universities and Research Centres of the Adriatic-Ionian Region (UNIADRION), the Agency of the Francophonic Universities, the Educational Committee of the Council of Europe, UNESCO and other organisations that contribute to the development of education, science and culture (University of Belgrade, 2006a).

[10] Information on the Serbian partners, including Ministries, involved in these projects can be found on their websites.
[11] Around EUR 700,000 (www.oanda.com/convert/classic).

The Organisation for Black Sea Economic Cooperation (BSEC) initiative and the Regional Co-operation Council (RCC) are further opportunities to build partnerships and cooperation. The BSEC signed a Declaration on Cooperation in Higher Education and University Research in September 2005, to exchange and share examples of good practice and experiences in this field (Fila, 2005). One of the key activities of the Stability Pact for South Eastern Europe that will hopefully be adopted and supported by its successor, the RCC, is the area of "Fostering and Building Human Capital" (i.e. the field of education and research). Since May 2007, a Memorandum of Understanding (MoU) was signed between the Ministers responsible for Education, Science and Research in South Eastern Europe, acknowledging the importance of education, higher education, science and research for the future of this region. However, to date, Serbia is the only country that has not signed this MoU. The intentions of this MoU and a subsequent Declaration of Intent (DoI) to strengthen and deepen Cooperation in Education, Science and Research (signing in August 2007) have contributed to the Proposal for the establishment of a Task Force Fostering and Building Human Capital (to be authorised by April 2008 (Cvijic, 2008)).

Current bilateral S&T cooperation in Serbia and in the other South Eastern European countries owes a great deal to the Central European Initiative (CEI). The initiative was set up in 1990, and has gradually extended to incorporate 18 members from Central, Eastern and South Eastern Europe, bringing them closer together and assisting in their transition to stable democracies and market economies as well as in their preparation for EU membership. The priorities of the CEI are divided into three principal areas: economic, human and institutional development (CEI, 2006). As a result, the progress made in S&T cooperation has been used as a starting point for identifying partners for FP6, FP7, COST (Co-operation in the field of Scientific and Technical Research) and EUREKA (the Pan-European network for market-oriented, industrial R&D). Bilateral agreements are signed between Serbia and France, Germany, Greece, Hungary, Romania, Slovak Republic, Slovenia, Norway and Switzerland. With several other countries, protocols are existing or agreements under negotiation: Belgium, Bulgaria, Czech Republic, Italy, Israel and Turkey (see-science.eu, 2007a).

Serbia also participates in the Swiss SCOPES Programme for Eastern Europe by Swiss National Science Foundation (SNSF). On 12th February 2007, Serbia and Switzerland signed the Memorandum of Understanding (MoU) on the Technical Cooperation in the field of sciences - SCOPES today. The MoU allows the realisation of 15 new joint research projects in the scientific cooperation between Switzerland and Serbia, in a total amount of almost half a million CHF. This shall enable scientists from the two countries to undertake together original research of high quality. The projects refer on nuclear physics, ecology, health, geology, chemistry, etc. This cooperation implies knowledge and expertise transfer between a host of reputed Swiss scientific institutions and Serbian counterparts. These will in turn strengthen international networking of Serbian research teams and increase the attractiveness and competitiveness of Serbia's scientific institutions (Swiss Cooperation Office in Serbia, 2007).

USAID adopted a "Strategy Statement" for Serbia (2006-2011) in December 2005. The strategy guides its programmes and activities, addressing Serbia's development needs in line with US government foreign policy objectives. The main strategic objectives are to ensure democratic governance of the market economy, to encourage enterprise growth in high potential sectors and to reduce political risk (USAID, 2005).

The WUS (World University Service) of Austria, a non-profit making organisation established in Graz in 1983, has developed a regional focus on South Eastern Europe since 1994. In the Western Balkans, it has successfully realised various projects; for example, CEP (Centre of Excellence Projects), NIP (Networking Infrastructure Projects), Training Courses on Project

Management and International Cooperation, Internet and Computer Training Programme. Serbia also benefits from ongoing World University Service (WUS) projects - Course Development Programme Plus, Brain Gain Programme, Counselling and Information Centres, and others (WUS Austria, 2006).

3 The Input Side of the National Innovation Systems

Regarding the input indicators for the S&T system, some questions (for example, the amount spent in terms of the gross domestic product (GDP), volumes and growth rates) need to be addressed. Here a distinction is made between private and public investment. R&D investment can be considered as an indirect measure of a country's innovation capacity (Fischer, 2006).

The current economic situation in the Western Balkan countries still poses significant constraints on national policies in R&D. Most countries of the region are at less than 30% of the EU-25 GDP per capita average, hardly reaching 60-80% of their 1989 GDP. Restrictive fiscal and monetary policies, necessary for attaining macroeconomic stabilisation, allow for limited public expenditure and have generally contributed to low investment rates, also experienced in the R&D sector. Financial assistance received from abroad is significant but not always provided on a continuous basis (Uvalic, 2006).

In order to provide an understandable, accurate and least conflicting statistical insight, some particularities need to be explained. There are strong inconsistencies between statistics released by the Ministry of Science and Environmental Protection (which has been renamed to Ministry of Science) and the Statistical Office of the Republic of Serbia. Statistics on Serbian R&D activities calculated by the MSEP/MSCI are mostly based on data from organisations supported and financed by the ministry, while statistics on R&D activities in Serbia built by the Statistical Office of the Republic of Serbia are calculated using the collection and interpretation methodology and statistical practice inherited from the previous regime (during the 1980s and 1990s). Under this methodology, R&D data is collected from all organisations registered under the Science Law and from all other organisations, which are willing to supply their data concerning R&D activities. However, it must be stressed that neither of these two methodologies is based on the Frascati manual nor on the OECD/EU based statistical methodologies and practices concerning R&D activities in one country. Therefore, researchers within the Science and Technology Policy Research Centre of the Mihajlo Pupin Institute have organised their own R&D statistics based on official data, collected and published by the Statistical Office of the Republic of Serbia, and than re-calculated, using the methodology proposed in the Frascati manual. Nevertheless, a significant proportion of R&D data is still absent from the official statistics, particularly in the private sector (for example, the software industry). This problem has not been resolved by the new Science Law, but could be overcome with the Innovation Law if both private, and state companies, would register their activities under this law (this is a precondition for the application of R&D activities which could be co-financed by the Ministry of Science and Environmental Protection - now Ministry of Science). Still, major changes in R&D statistics are expected to be announced by the Statistical Office of the Republic of Serbia, within the framework of the national innovation system, and under full cooperation and understanding between officials and professionals from this office and responsible ministries (Kutlača, 2007a).

The latest official source (Statistical Office of the Republic of Serbia, 2006c) published in 2006, contains R&D data for 2004, which as described above, was re-calculated by the Science and Technology Policy Research Centre of the Mihajlo Pupin Institute. The results are given in the tables below (Kutlača, 2007a).

3.1 Development of Financial Resources Allocated to R&D

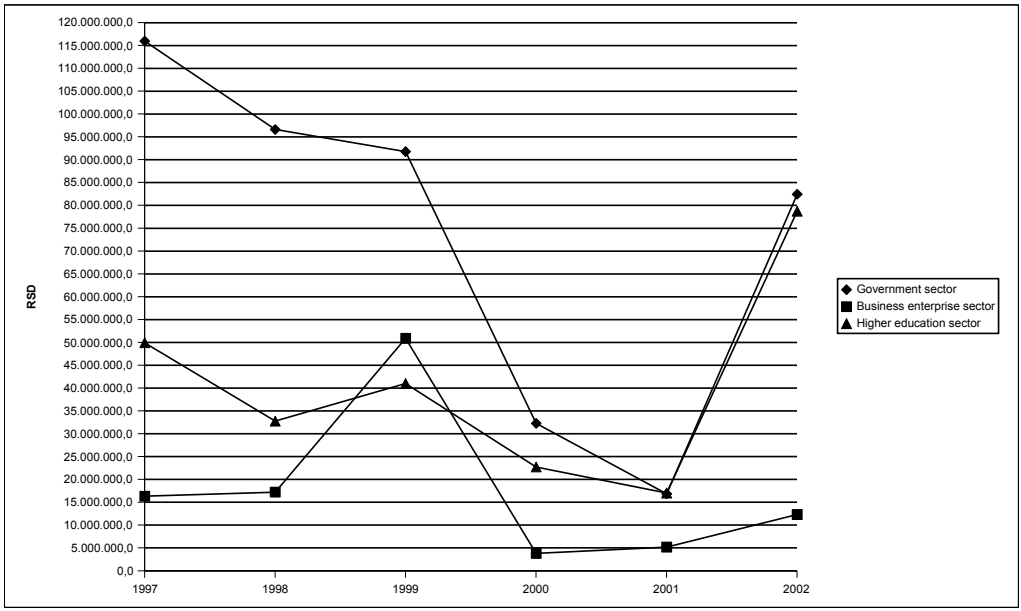
In general, the dynamics of expenditure provide an important indicator of knowledge creation and absorption, of which there are very special characteristics to be observed in Serbia. However, it is important to bear in mind the aforementioned problems concerning these statistics.

Table 3.1: General Expenditure on R&D (Kutlača, 2007a)[12]

	1997	2000	2001	2002	2003	2004
GERD (in thousands, RSD)	1,081,991	3,710,114	2,636,486	10,198,181	6,361,680	4,418,784
as % of GDP	1.27	1.18	0.48	1.45	0.79	0.50

In line with expectations, whereupon Central and Eastern European countries have registered a general cut in science expenditures in the early stages of the transition process, the Serbian level of investments in R&D has decreased rather than increased in recent years. However, these numbers still call for the alert and rapid coordinated policy action towards affirmation of local talent and support of national innovation, which is a normal response for countries in this stage of transition.

Figure 3.1: Dynamics of Expenditure for R&D per sector



[12] Source: State Statistical Office according to Kutlača

3.2 Government Sector Expenditure on R&D

In Serbia, government expenditure on R&D in 2005 represented only 0.32% of the GDP, but this figure is a remarkable increase compared to only a few years before, having more than tripled since 2000 (Zarkovic, 2006). According to the Statistical Yearbooks of Serbia, the government allocated in total USD 58.7 million[13] in 2000, USD 39.9 million[14] in 2001 and USD 173.4 million[15] in 2002 (Kutlača, 2005b).

Political determination to improve the situation was expressed by the former Serbian Minister of Science and Environmental Protection, Aleksandar Popović. Minister Popović explained the objectives of the "National Investment Plan" and the criteria for defining investment priorities regarding scientific research[16]: according to Popović, although the MSEP was extremely dissatisfied with the 0.4% of GDP that the government was allocating to science and research, it also displayed significant improvements in this respect. Following the objectives laid out in the "National Investment Plan" and the increased budget outside the investment plan, the budget for science and research should soon reach 0.6% of GDP, which would represent a significant increase compared to the 0.2% of GDP allocated in 2001, when the government was starting the sector reform (Popović, 2006). Inside the EU-27, the aim is to achieve an investment rate of 3% GDP for science and research by the year 2010 (1% of which is supposed to come from the budget and the other 2% from private funding and donations).

Table 3.2: Government Expenditure on R&D (GOVERD) (Kutlača, 2007a)[17]

	1997	2000	2001	2002	2003	2004
GOVERD (in thousands, RSD)	685,254	2,037,133	1,137,447	4,846,908	3,834,326	2,207,892
as % of GDP	0.80	0.65	0.21	0.69	0.47	0.25

The Serbian Ministry for Science and Environmental Protection dedicated the largest part of its budget to R&D programmes, more than 84% of the total in 2004. Regarding the distribution of funds among the different programmes, in 2004 more than 50% of Serbian R&D budget was allocated to the Basic Research Programme, 30% to the Technology Development Programme, and another 8% to the R&D Facility and Infrastructure Upgrade Programme. The remaining programmes received a much smaller relative share of the budget (Uvalic, 2006).

3.3 Business Sector Expenditure on R&D

The contribution of the business enterprise sector is evaluated by looking at the level and dynamics of the business sector's R&D expenditure at the aggregate country level. R&D activities in the business enterprise sector are particularly essential for the innovative output and competitive dynamics of a country.

During the 1990s, the government "Programme for Technology Development" provided the main financial and moral support for innovative activity in industry. Since sanctions prohibited international technology trade, the "in-house" innovative activity was the main source of new technologies and activities (Kutlača, 1998b).

[13] EUR 62.3 million (31.12.2000, www.oanda.com/converter/classic)
[14] EUR 44 million (31.12.2001, www.oanda.com/converter/classic)
[15] EUR 165.4 million (31.12.2002, www.oanda.com/converter/classic)
[16] 04.08.2006, Interview in daily newspaper "DANAS".
[17] Source: State Statistical Office according to Kutlača

The relative importance of the business sector's R&D efforts is indicated by the level of business expenditure on R&D (BERD) as a share of GDP. The relative importance of BERD in total economic activity in the region of South Eastern Europe (0.24% in 2003 as calculated by Fischer (2006), which includes Bulgaria and Romania, but not BiH and Albania, due to the lack of data), lags considerably behind that of the EU-15 (1.26% in the year 2000). In Serbia, the level of BERD expenditure as a percentage of GDP was only 0.06% in 2001, 0.10% in 2002, declining again in 2004 to 0.07%.

The input of the business sector in R&D activities in comparison to overall R&D activities reveals the relative importance of profit-oriented knowledge creation and absorption. In Serbia, a very low proportion of total R&D (around 7% in 2002) was spent on business research, thus reflecting a relatively low level of business sector knowledge investment in comparison with the knowledge invested by the government and higher education sectors (Fischer, 2006). In 1999, the Statistical Office of the Republic of Serbia recorded a particular increase in expenditure that then sharply declined in 2000 and only slowly recovered. Thus, data for 1999 is also given in the following table.

Table 3.3: Business Sector Expenditure on R&D (BERD) (Kutlača, 2007a)[18]

	1997	1999	2000	2001	2002	2003	2004
BERD (in thousands, RSD)	96,384	593,114	238,728	348,730	723,535	884,922	643,309
as % of GDP	0.11	0.39	0.08	0.06	0.10	0.11	0.07

Compared to the EU-15 (4.3%, 1995-2000), BERD increased relatively slowly in South Eastern Europe[19] (growth rate 2.3%, 1997-2003). Figures for Serbia demonstrate negative dynamics, with a low level of business R&D activity, resulting in sub-optimal absorptive capacities preventing firms from taking advantage of the R&D activities undertaken elsewhere (Fischer, 2006).

3.4 Higher Education Sector Expenditure on R&D

Higher education institutions research represents one of the key activities within the higher education sector affecting national innovation systems, providing scientific and technological knowledge that is disseminated in and utilised by the economy. However, as primary suppliers of fundamental research, universities do not only contribute to the economy through the direct provision of applicable results, but also through the diffusion and adoption of skills and techniques and through professional networks and other forms of communication channels created by academic research (Fischer, 2006).

According to statistical data compiled by Đuro Kutlača, the expenditure in the higher education sector, research institutes and other organisations with research units in 2002 was USD 78.9 million[20] (more than triple the expenditure 2000), which represented 0.66% of GDP in 2002.

[18] Source: State Statistical Office according to Kutlača
[19] Fischer has included Bulgaria and Romania in this calculation but not Albania and BiH - due to the lack of data.
[20] Around EUR 77 million (31.12.2002, www.oanda.com/converter/classic).

Table 3.4: Higher Education Sector Expenditure on R&D (HERD)[21]

	1997	2000	2001	2002	2003	2004
HERD (in thousands, RSD)	294,905	1,434,253	1,150,309	4,627,738	1,642,432	1,567,583
as % of GDP	0.35	0.45	0.21	0.66	0.20	0.18

3.5 R&D Infrastructure

In her survey on the National Systems of Research and Development in the Western Balkan Countries (compiled for the purposes of the SEE-ERA.NET Consortium), Milica Uvalić established that the research infrastructure in Serbia severely deteriorated during the 1990s, as very little investment was made in modernising existing technical equipment in research institutions. The only exception was in the information technology sector where individual computer use increased, but the degree of information networking does not qualify as sufficient. Although the recovery of the R&D sector started in 2001, the severe consequences of neglecting the sector throughout the 1990s are still evident. Within the Ministry of Telecommunications and Information Society, the Department for Information Society co-ordinates and encourages activities concerning e-management and the internet. Various initiatives, including the preparation of a policy and strategy for the creation and development of the Information Society (the strategy was adopted in October 2006, Official Gazette RS, No.87/06) have been launched in order to involve Serbia in the e-Society and e-Europe initiatives and programmes. In addition, some regulations in the process of informatisation, the internet, and the Electronic Business Law have been adopted and contracts between the government and ICT companies have been implemented.

Even more recently, in the area of information society services, the new Ministry of Telecommunications and Information Society has attached priority to accelerating the legislative agenda. Serbia still has to adopt new laws on information society covering e-government, e-commerce, and protection of personal data. The role of IT in the government's communication and services to citizens (e-government) is currently limited. Serbia is moderately advanced in this area (Sipka, 2008).

An important body in this field was the Information Technology and Internet Development Agency (ITIDA). The ITIDA has been founded in 2001 because the Serbian government placed a strategic orientation on Information and Communication Technology (ICT) in order to overcome the existing gap in and to unite all the authorities in the field of IT and the internet in one coordinated body. It consisted of a working body of about ten ICT experts, as well as assisting technical staff. The Agency was the fundamental source of contact and work coordination between international and local donors, Serbian government and final beneficiaries of ITIDA's programmes. ITIDA planned very ambitious programmes, which have been realised just in parts. Because of conflicts in jurisdiction between ITIDA and then existing Ministry of Science, Technology and Development, ITIDA activities are practically suspended since 2003 (JISA, 2006).

Before dividing into two separate entities, the MSEP had already signed contracts with Microsoft and Oracle, and the Academic Network of Serbia has become a constituent part of the GEANT Network, a pan-European research and education network which provides high-bandwidth data connectivity between the national research and education networks throughout Europe, now also providing connections between all educational and research

[21] Source: State Statistical Office according to Kutlača

institutions in the 18 cities in Serbia (Uvalic, 2006). The infrastructure in Serbian faculties and research institutions comprises several local computer networks and special-purpose computer purchases. Since the Optical Academic Network has been formed, the MSEP/MSCI is planning to finance local computer networking and Optical Academic Network connectivity, and to purchase special-purpose computers for research institutions (Uvalic, 2006).

In 2007, the Statistical Office of the Republic of Serbia conducted the survey "Use of ICTs by businesses, by companies, households and individuals in Serbia" (no data for Kosovo and Metohija is available), using EUROSTAT methodology and covering statistically national representative samples (1000 companies, 2000 households, 2000 individuals, organized in three sub samples: Belgrade, Central Serbia, Vojvodina). The main findings were (Statistical Office of the Republic of Serbia, 2007b):

- 97.8% of households in Serbia own a TV set, 33.8% own a cable TV;
- 73.6% of households in Serbia own a mobile telephone;
- 34% of households in Serbia own a computer (the rate of PC penetration being the highest in Belgrade, where it reaches 45.4%, followed by Vojvodina with 34.4% and in Central Serbia only 26.3%)
- distribution of PCs in households strongly depends on economic situation - 74.9% of households with an average monthly income higher than 600 EUR own a computer, 54.1% of households with an average monthly income between 300 and 600 EUR own a computer, and only 20.5% of households with an average monthly income less than 300 EUR own a computer;
- 26.3% of households in Serbia have an internet connection (39.1% in Belgrade, 29.2% in Vojvodina, 16.56% in Central Serbia; 35% in urban Serbia and 13.7% in rural Serbia);
- more than 4,400,000 inhabitants in Serbia (76.8% of population) use a mobile telephone;
- more than 1,700,000 inhabitants in Serbia used the internet in the last three months;
- more than 850,000 inhabitants in Serbia used the internet every day;
- more than 230,000 inhabitants used e-government electronic services;
- more than 135,000 inhabitants used the internet last year for e-shopping.

Regarding the informatisation of libraries, the largest part of information acquisition is carried out through *KoBSON* (Consortium for Co-ordinated Acquisition), which comprises representatives from all important scientific libraries in Serbia (the National Library of Serbia; Matica Srpska Library, Novi Sad; University Library of Belgrade Svetozar Marković; University Library of Niš Nikola Tesla; University Library of Kragujevac; Library of SASA - Belgrade; and representatives of the Community of University Libraries and Community of Libraries of Serbia). The main objectives of KoBSON are the acquisition of scientific information, the use of electronic publishing and the promotion of access to electronic information. The overall subscription system is financed by the government. About 111 institutions in Belgrade and an additional 64 in other Serbian towns were registered with access to the KoBSON website in 2005 (Uvalic, 2006).

Any modern information society that supports knowledge-based development needs a contemporary bibliographic information system and a system to provide information about research activities. Since 2003 Serbia has been a member of COBISS (Co-operative on-line bibliographic system and services), established by the Slovenian Institute of Information Sciences (IZUM) in 1991. In January 2006, 380 libraries were using COBISS software for the automation of their activities (293 Slovenian, 44 Serbian, 21 Macedonian, 13 BiH and 9

Montenegrin libraries). IZUM is pursuing the development of the third generation of applicative software (COBISS3), initiated in 1997, using a new technological platform (COBISS.SR, 2006).

Furthermore, the National Library of Serbia (NBS) became a full partner in the project called The European Library, which is carried out under the authorities of the Conference of the European National Librarians and the European Commission. The Commission aims to achieve not just a single database, but rather integrated access to the digitalised material of Europe's cultural institutions through a single multilingual entry point. A recent report by the INASP (International Network for the Availability of Scientific Publications, entitled Accessing and Disseminating Scientific Information in South Eastern Europe), undertaken in 2006 for the purposes of UNESCO-ROSTE, has analysed the existing infrastructure in the Western Balkan countries in detail, particularly the situation regarding connectivity, e-journals, libraries, and e-publishing. The report has confirmed great variety among individual countries in the Western Balkans in each of these areas of scientific information dissemination. According to the INASP findings, researchers in Serbia enjoy good connectivity and wide access to international journals and databases. The INASP suggested various areas for activity, for example, Accessing International Journals, Online Journal Service, Open Access Publishing, Open Access Archiving, Library Strengthening, Regional Co-operation, Communicating Science, which allowed for some significant accomplishments to be achieved in acquiring and publishing national science outputs in full-text format (INASP, 2006).

3.6 Human Resources in R&D

The quality of the science system in Serbia is generally considered much higher than the level of economy would suggest, possibly because of the satisfactory supply of human capital. The education system, although not generally modernised and consequently facing difficulties in providing highly qualified graduates on a large scale, is capable of supplying a large scientific elite to keep up the status of the science sector. However, the continuous brain drain poses a severe threat to science in Serbia. Driving forces behind the brain drain are the deteriorated economic living conditions and the lack of state-of-the-art infrastructure and funds, constituting serious obstacles for research, as well as restrictive visa regulations that hinder scientific exchange and temporary employment abroad.

Human resources play a key role when it comes to knowledge production and, subsequently, economic and technological development. Availability and quality of human resources (being both producers and diffusers of knowledge) in S&T, forms a crucial element on the path towards a knowledge society (Fischer, 2006). It is obvious though that the recent trend regarding the human resources in the Western Balkan countries has been extremely variable. In some countries, the number of researchers and scientists has been increasing (for example, in Albania or Croatia), while in others (for example, in the FYR of Macedonia or Serbia) this number has been stagnating or declining (Uvalic, 2006). In 2003, Serbia[22] reported 3.5 researchers per 1,000 of the labour force, which was on par with some of the EU-15 countries (e.g. Greece or Portugal), but still well below the EU-15 average (5.4 researchers per 1,000 labour force) (Fischer, 2006).

According to the Statistical Office of the Republic of Serbia, the total number of researchers in Serbia since 1990 has been more or less constant. There were about 12,000 researchers in 2004, or 52% of the total number of personnel employed in science and research activities (Statistical Office of the Republic of Serbia, 2006b).

[22] The data is for Serbia and Montenegro.

Table 3.5: R&D Personnel (Kutlača, 2007a)[23]

Year	1999	2000	2001	2002	2003	2004
Total number of employees	24,198	23,117	19,415	21,291	22,054	22, 485
Total number of employees - FTE	17,752	16,595	13,586	14,879	15,558	15,651
Number of researchers	12,163	11,969	10,071	10,855	11,353	11,637
Number of researchers - FTE	6,647	6,406	5,085	5,364	5,642	5,617
Number of Research Organisations	203	189	150	156	165	163
Number of researchers per 1,000 labour force	3.4	3.4	2.8	3.1	3.2	3.2
Researchers (in % of total R&D personnel)	50%	52%	52%	51%	51%	52%
Supporting staff (in % of total R&D personnel)	23%	24%	23%	22%	21%	22%
Others (in % of total R&D personnel)	26%	25%	25%	27%	27%	27%

Of the total R&D personnel in 2002, 35% were engaged in the government sector, 59 % in the higher education sector and 6 % in the business sector. Regarding the distribution by scientific field, most of the R&D personnel work in the engineering and technology sector (32.6 % in 2002); while the rest are more or less evenly distributed amongst other scientific fields (Kutlača, 2005b).

Compared to OECD data, it becomes evident that there are very few researchers in the business enterprise sector and a vast majority in the higher education sector, mostly employed by the main public universities.

Table 3.6: R&D Personnel, (Kutlača, 2007a)[23]

Distribution of researchers by sectors, OECD and Serbia, year 2001			
	Business Enterprise Sector	Government Sector	Higher Education Sector
OECD	64.60	8.80	26.40
Serbia	6.37	18.80	74.83

Data for 2002 presented by official sources and quoted by Uvalic in her study, also confirms that over 80% of researchers in 2002 were employed by the main public universities, around 14% worked at research institutes, mostly (67% of the total) in the field of natural sciences. An almost negligible percentage of researchers were employed in industrial institutes and private research organisations. Regarding the distribution by scientific field, more than 50% of researchers registered by the Ministry of Science and Environmental Protection (now Ministry of Science), work in the Basic Research Programme, around 30% in the National Programme on Energy Efficiency, and about 10% in the National Programme on Biotechnology and Agro-industry. Within the largest sector, the Basic Research Programme, the greatest percentage of researchers work in the area of Medicine, followed by the Social Sciences and Chemistry (Uvalic, 2006).

Human resource potentials in the S&T sector can also be increased by producing more Science and Engineering (S&E) graduates. Degrees in the S&E fields of study formally qualify their holders for employment as researchers, scientists and engineers. Serbia[24] has the highest proportion of students in S&E within the region (43.2%). However, a negative growth rate of 1.2% has been recorded in the period between 1997 and 2001 (Fischer, 2006).

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[23] OECD - MSTI, provided by Kutlača
[24] The data is for Serbia and Montenegro.

Fischer concluded that the results from his survey suggest that the future outlook is optimistic, especially due to the fact that a greater percentage of young people are becoming more highly qualified, offering a potential relief to the shortages created by the transition towards a knowledge-based economy (Fischer, 2006).

As regards the brain drain problem, Serbia has established a Ministry of Diaspora, which runs initiatives directed at scientists living abroad. In 2007, the Ministry initiated a project aimed at the creation of a database of all researchers working outside Serbia, with 5000 researchers expected to be on the list. If this database succeeds, it will provide great potential and resources in this area. As regards brain-drain, Serbia also established a Ministry of Diaspora which sets initiatives towards the scientists living abroad.

A joint UNESCO/Hewlett Packard (HP) project on piloting solutions for alleviating regional brain drain was implemented in 2003 in several Southeast European countries. By providing resources, including technological and financial facilities, to various universities, the initiative has enabled young scientists from the region to work within the framework of joint research projects with their fellow-nationals living abroad. The project has provided grid technology to various universities from Albania, BiH, Croatia, FYR of Macedonia, Serbia and Montenegro. At the University of Belgrade, for example, several young engineers remained in the country to develop experiments using the grid computing technology. Moreover, at the regional level, regular project meetings have also acted as a stimulus for transcending boundaries. Not only has the project strengthened scientific and educational capacities at the national level, it has re-established dialogue among young researchers from the region after years of broken communication. The networks created with UNSECO/HP support function autonomously, with the objective of sharing innovative experiences to help researchers from the region consolidate local capacities and undertake research beyond borders, without leaving their home countries permanently (Preda, 2007).

4 The Output Side of the National Innovation Systems

The output of an innovation system is manifested through the new knowledge, new products and processes that are produced. Whereas indicators such as the Gross Expenditure on Research and Development (GERD) and the number of researchers provide a measure of the resources potentially allocated to innovation, this chapter focuses on the results of the innovation processes and their output indicators such as patents and scientific papers.

4.1 Patenting Activities in Serbia

Among other approaches, innovative output can also be measured by patent data, the most important advantage of which is the wealth of the information supplied. A patent file granted by the European Patent Office (EPO) provides data on the invention, which is protected by the patent through the title, abstract and technological classification. Furthermore, patent data provide the only output measure available for almost all countries in the world, including the Western Balkans countries (Hörlesberger, 2006).

European inventors today have a choice between two alternatives when seeking patent protection for their inventions: the European Patent Office (EPO) and national patent offices. The EPO was set up to provide patent protection through a single procedure, defining the granting of patents in some or all of the contracting states of the European Patent Convention (EPC). The procedure for obtaining a patent at the EPO consists of two phases and sometimes a third phase dealing with possible objections. In contrast to national patents that are valid in

only one country, a European patent gives its proprietor equivalent rights to a national patent in each member state (EPO, 2006).

Moreover, European patents may also be effective in some countries that have not yet acceded to the EPC, including Serbia. Serbia and Montenegro have held a so-called "extension state" status at the EPO since 1st November 2004. This means that although the State Union recognises European patents, it is not formally a member of the organisation (EPO, 2006). As the legal successor to the former State Union of Serbia and Montenegro, Serbia retained this status, while the position of the territory of Montenegro has yet to be confirmed. The Patent Cooperation Treaty (PCT) provides a unified procedure for filing patent applications.

A second barrier to patenting is the cost associated with a patent application. Studies estimate that the cost of an application and the 10-year maintenance of a patent at the EPO are approximately EUR 32,000 (Roland Berger Market Research, 2004). Applications to national patent offices, may be comparatively, less expensive (applications to local patent offices in the Western Balkans in particular can be expected to incur a considerably lower cost than an application to the EPO) (Hörlesberger, 2006).

On the other hand, in transition economies, improvements in production and organisation and imitation of technology with minor improvements and adaptations for local use are more important but are not usually sufficient to be patented. Therefore domestic patenting data in these countries does not capture a significant share of relevant domestic technological activities (Da Motta e Albuquerque, 2000). Furthermore, the patenting activity in some countries in the EPO is too small and cannot be used as a proxy for RTDI activity within the country (Kutlača, 2004).

Serbia has its own Intellectual Property Office (IPO). The patent law adopted in 1995 significantly altered the practice of protection of invention in the country: Since then employee inventors have not been allowed to apply for patent rights without their firm's permission. Since 2004, the IP Office has ratified and applied a Cooperation and Extension Agreement with the EPO, which envisaged technical, legal and administrative cooperation for the purpose of infrastructure development for the efficient patent system in the Republic of Serbia (Intellectual Property Office of the Republic of Serbia, 2006a). New patent laws have adopted recommendations by WIPO (World Intellectual Property Organisation) and EPO concerning the protection of pharmaceutical products, which had been the subject of negotiations between former Yugoslavia and these organisations. This patent law is in process of change, adopting new regulations, particularly in the field of protection of software. It is questioned if the IPRO for Serbia has a sufficient number of trained personnel in order to fulfil its substantially changed role, scale and scope of activities (Kutlača, 2004).

In 2003, there were in total 62,873 patents granted by the EPO, 31,027 of which were granted to EU countries. Austria, a country comparable in size to Serbia, was granted 765 patents in 2003, while Serbia registered only 4 granted patents[25] (Hörlesberger, 2006).

For the purposes of her survey, Marianne Hörlesberger used the data on the total number of patents granted between 1996 and 2004 (Hörlesberger, 2006). The six technological fields that are analysed are mechanical engineering, chemicals and pharmaceuticals, process engineering, electricity and electronics, instruments and consumer goods. According to Hörlesberger, the technological specialisation of Serbia[26] is similar to that of Romania. 38% of all patents granted at the EPO were in the field of chemicals and pharmaceuticals, followed

[25] Data refers to the year 2003 and is for Serbia and Montenegro.
[26] The author used data for Serbia and Montenegro.

by mechanical engineering as the second most important field with 18% (this share was significantly lower than it was for the EU-25). Shares of instruments (16%) and consumer goods and civil engineering (11%) were slightly larger than the respective shares for the EU-25. Electronics also had a significant share (10%), but process engineering (5%) lagged behind (Hörlesberger, 2006).

A thorough analysis of the cumulative aspects of technology learning based on national patenting data is given in a survey of national patenting between 1921 and 1995 in Serbia (Kutlača, 1998a). It shows over decades the persistently high share of resident patents in the field of mechanical engineering and agriculture eventually proving the country's competitiveness in these two sectors, as well as the country's technological dependence in the chemical industry, with the highest share of non-resident patents over the entire analysed period (Kutlača, 2004). Patent intensity (ratio of average number of patent applications to the average population size between 1997 and 2003) shows that Serbia, with a ratio of 0.06 lags considerably behind the ratio of the EU-25 (10.39) (Hörlesberger, 2006).

It is indeed disputed whether the use of registered patents is a proper measurement of the country's output activity. Kutlača argues that it is only partly applicable in the case of transition countries, like Serbia. He bases this opinion on the insufficient legal framework regulating the IP sector, which exists in line with international standards, even though it is not fully operational and lacks human resources, computer and technical equipment and the documentation needed for the patent registration process. Thus, the small number of registered patents is mainly due to long procedures caused by the non-existence of the aforementioned conditions. Kutlača argues that it is therefore more reasonable to use the number of patent applications rather than the number of registered patents (see Table 4.1) for the purposes of the survey (Kutlača, 2004).

Table 4.1: Patenting Activity in Serbia 1994-2004, Patent Applications and Registered Patents (Intellectual Property Office of the Republic of Serbia)[27]

Patent Applications	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Residents	574	584	477	372	415	274	324	362	359	381	473
Non-residents	214	230	237	141	203	449	524	573	657	658	694
Patent Applications - Total	788	814	714	513	618	723	848	935	1016	1039	1167
Registered patents	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Residents	156	161	96	70	112	59	3	31	73	91	65
Non-residents	518	350	186	133	137	49	0	11	58	93	110
Registered patents - Total	674	511	282	203	249	108	3	42	131	184	175
Ratio: Registered patents / Patent applications %	86%	63%	39%	40%	40%	15%	0%	4%	13%	18%	15%

The number of registered patents in Serbia has considerably varied in recent years. Pre-2000, Serbia had been registering very different results through patenting activity, at times demonstrating a sharp decline with only 3 patents granted in 2000 (Hörlesberger, 2006). It is important to stress that only a small percentage of patent applications are actually granted - in 2004, the 175 patents granted represented only around 15% of the total number of applications (see table above).

4.2 Publication Activity in Serbia

Another possibility for measuring innovative output is in bibliographic data, such as scientific

[27] Provided by Kutlaca (2007a)

publications or new product announcements in technical journals. Information on scientific publications at the country level is readily available through indexes such as the Science Citation Index. However, according to Hörlesberger, publications tell us more about the capabilities of the science system than about the ability of countries to create new products and services (Hörlesberger, 2006).

Uvalić emphasises a number of problems specific to the Western Balkans countries regarding scientific output measured through bibliometric methodologies. During the 1990s, the region was isolated and inward-oriented, thus some of the Western Balkan countries were not covered by major databases during this decade, clearly raising the possibility of under-estimation of their scientific output. Many national scientific journals in these countries are still not included in international databases. Furthermore, scientists have suffered from the lack of opportunity to publish in internationally recognised journals, partly due to limited international contacts and limited participation at international conferences (and not necessarily because of low quality output) (Uvalic, 2006).

Serbia seems to be under-way to surmount these difficulties. Publishing activity in the country has recovered in recent years. As a result, national performance as measured by number of articles published in ISI Web of Science (WoS) citation indexes (SCI, SSCI and A&HCI) were rising steadily from 2000 onwards, recapturing the touch with the performance of neighbouring countries in 2006.

Publishing an article in locally published journals (LPJs) is, however, still the predominant form of communicating results. Due to their hyperinflation during in the period of country isolation, the Ministry of Science, Technology and Development decided in 2003 to submit all periodicals to bibliometric analysis and assessment. This ended with a permanent programme of their monitoring and evaluation performed on a regular basis by the Centre for Evaluation in Education and Science (CEON/CEES). All published journal issues are taken from the newly established Repository of National Library of Serbia, and are thus to be followed up by looking at indicators of their impact and quality. The results are published yearly in the form of an interactive web report, the CEON/CEES Bibliometric Journal Report(CEON/CEES, 2007).The purpose of this programme is to classify journals according to their quality, in order to use the results for evaluation purposes. The purpose is also to improve the general quality of the journals, as well as to select and support the best among them in their efforts to achieve international recognition. Journals that meet a set of predefined criteria are included in SCIndeks, the Serbian Citation Index[28]. SCIndeks refers to approximately 350 LPJs, more than 100 available in full text format (Sipka, 2008).

Occasionally, CEON/CEES performs comparative analyses of publishing activity in the country, based on bibliometric data. Conclusions of the results are advanced to the Ministry of Science for eventual use in (re)shaping national publication policy. In the latest such analysis covering a four-year period of journal monitoring some favourable trends were registered (CEON/CEES, 2007):

- sharp raise in visibility and availability of LPJs in a relatively short period;
- better representation of LPJs in top international databases, with more than a dozen admitted for indexing in WoS in Scopus;
- rise of the international impact of LPJs, as measured by the number of citations in WoS indexes;
- slight reorientation of authors to publishing in international (WoS) journals instead of LPJs;

[28] See www.scindeks.nbs.bg.ac.yu

- internationalisation of LPJs, with more than 3,000 papers published yearly by international authors, coming mostly from the regional countries, including the FYR of Macedonia, Bulgaria and Slovenia.

At the same time, the number of active periodicals was found to be still too large, discovering in many cases redundancy, careless editing, disrespect for international publishing standards, irregular issues publication, etc., calling for more selective approach in journals support by the MSCI (Sipka, 2008).

The revival of publication activity in Serbia can be ascribed in part to a huge improvement in availability of up-to-date international periodical literature. The largest part of the acquisition of foreign S&T information in Serbia is carried out centrally, through KoBSON (Consortium for Coordinated Acquisition). Through KoBSON international databases containing both periodicals and books in electronic form are provided (KoBSON, 2007). This activity led by the Centre for Scientific Information of the National Library (CSI NLS) is fully supported by the Ministry of Science.

Another factor contributing to the transformation of S&T publishing in Serbia is acceptance of Open Access. The model was previously promoted through various activities of CSI NLS and CEON/CEES, the most important being two international conferences/workshops held in Belgrade in 2003 and 2005. The gatherings were well attended by publishers and journal editors, which ended in Open Access to become a dominant model of periodical publishing in Serbia. Only sporadic LPJs publishers turned out not to be willing to join the initiative in 2007.

Publishing in general is a part of S&T sector where, thanks to the new technologies, the largest and most visible changes were introduced in the previous decade. Availability and connectivity of both international and domestic resources of scholarly information reached the international level. Several ongoing projects are expected to bring further developments in this area (Sipka, 2008).

5 National R&D Strategies and Legal Framework

The key challenge for all Western Balkan countries is to carry out the transition to a market economy and to create stable and favourable conditions for economic growth. Against this background, innovation policy has to enlarge its scope from its current focus on research to a broad productivity agenda (Dall, 2006). As stated by Slavo Radošević, innovation policy as such has only recently re-emerged in the Western Balkans, after having been reduced to a secondary role during the transition process. “In order to be effective, innovation policies in the CEECs should recognise the structural weaknesses of their individual innovation systems. This will require a search for country-specific solutions, as opposed to the rather imitative mode that has so far prevailed” (Radosevic, 2005). Investment in R&D and high-tech orientation are regarded as the dominant theme in innovation policy (Dall, 2006).

Analysing the innovation policies applied in Serbia, i.e. the official public documents that influence the policies on technical change, scientific development, innovation support, and so on, is the next step in acquiring knowledge about the existing national strategies and programmes. The legal framework and the strategies adopted will be presented in this chapter. The aim is to learn about the implementation of science policy, taking into account scientific and research priority, the policy aspects of the education system, the development of information and communication technologies, intellectual property protection, tax regimes, etc.

5.1 Legal Framework for the National S&T System

A legal framework is indispensable in the organisation of R&D institutes and the development of innovation infrastructure and programmes that provide grants to research organisations and innovative companies. Most frequently, laws are prepared separately for the areas of S&T and higher education, although legislation in Serbia is still undergoing a process of transition. New laws are under public debate, with ministerial regulations and governmental decisions also playing important roles in their passing. Legislation has profited and will continue to profit from stabilisation and association processes (Dall, 2006).

Table 5.1: Important Laws in the Legal S&T Framework (Dall, 2006)

Law on the Scientific and Research Activity	Defines scientific activity, specifies programmes and regulates the financing and managing of state-owned R&D institutions and possibilities for their privatisation. A newer version has been in place since December 2005.
Law on Higher Education	Adopted in September 2005. Fully implements the Bologna Declaration.
Law on the Innovative Activity	Adopted in 2005, this law defines the innovation activity and regulates its organisation, infra-structural support, programmes, financing, IP rights deriving from such activity etc.
Laws on IP Protection: Patents Law, Copyrights and Related Rights Law, Trademark Law, Legal Protection of Designs Law, Protection of Integrated Circuit Topographies Law, Geographical Indications Law	The Assembly of Serbia and Montenegro adopted these laws in 2004 in order to harmonise regulations with WTO requirements and the TRIPS agreement. The adopted laws are also in line with the international con-ventions joined since the latest major revision of laws dealing with such matters, as well as with the related European Union regulations.

The Law on Scientific-Research Activity defines the scope of scientific activities in Serbia, specifying the definition of state-owned R&D institutions, financing and managing these institutions and possibilities for their privatisation. Furthermore, it specifies the programmes for which the ministry provides grants. The law was adopted in 1993, and reviewed and updated in December 2005.

In accordance with the Bologna Declaration, the Law on Higher Education emphasises the fundamental goals, as follows (Fila, 2005):

- Establishment of the system of comparable and easily understandable academic titles;
- Establishment of credit (points) system - ECTS (European Credit Transfer System);
- The Diploma Supplement;
- Two-step system and recognition of studying period
- Quality assurance through accreditation of faculties, licenses for professors and periodic quality assessment.

The implementation of the Bologna process in Serbia is overseen by the Committee for the Monitoring of Implementation of the Law on Higher Education, which consists of representatives from the state and private universities, as well as by the students' representatives and representatives of the Ministry of Education (Stankovic, 2006).

An important novelty, introduced by both laws (on Science and Higher Education) was the mandatory process of accreditation (for all R&D and higher education institutions). The process had a time limitation and is repetitive (every organisation must be re-accredited after several years, as defined in these two laws). During the process of accreditation, a number of issues are evaluated (personnel, equipment, infrastructure, programmes, references etc.) and compared with pre-defined standards. The accreditation of the research organisations was finished on schedule in 2007 and the procedure for higher education institutions is ending. Before the end of 2008, the number of R&D and higher education institutions which comply with the newly introduced standards and criteria for the qualified performance will be known (Kutlača, 2007a). Now the emphasis has to be put on monitoring and evaluating R&D entities and processes.

A basic Law on Innovative Activity was introduced in December 2005, providing principles, aims and organisational criteria for scientific and technological applicability with the objective of supporting the creation of new and improved products, technologies, processes and services as key elements in the country's future development process. According to the Innovation Activity Law, in force since the beginning of 2006, the Ministry of Science has established a Register of Innovation Activity (SBRA-Great-IST, 2007) .

Further progress has also been made with Serbia's intellectual property legislation. In 2004, the Assembly of Serbia and Montenegro adopted five new laws that deal with intellectual property: the Patents Law (July 2004), the Copyrights and Related Rights Law, the Trademark Law, the Legal Protection of Designs Law and the Protection of Integrated Circuit Topographies Law (all December 2004). These laws were adopted with the aim of fully harmonising with the requirements of the WTO and the Trade Related Aspects of Intellectual Property Rights (TRIPS) agreement, as well as in accordance with related EU regulations. Furthermore, in order to align businesses in the IT sector closer to the standards of the EU and to aid the quick development of the Information Society, the following laws have been adopted: the Electronic Signature Law, the Protection of Personal Data Law, the Protection of Consumers Law, the Access to Information Law, and the Amended Criminal Code (SIEPA, 2006).

The main institution dealing with intellectual property in Serbia is the Intellectual Property Office of Serbia. It deals with matters relating to intellectual property rights (patents, trademarks, industrial models and samples, geographic appellations of origin and integrated circuit topography), copyrights and related rights. From September 1999 up to 31st December 2006, the Intellectual Property Office received 2,748 applications for the depositing of copyright works and related rights works. In 2006, 681 copies of copyright works were deposited, which represents the increase of 35% in comparison to 2005, when 519 copies of works were deposited (Intellectual Property Office of the Republic of Serbia, 2006).

Despite the obvious efforts being made, it must be stressed that the enforcement of the laws dealing with intellectual property is causing many difficulties in practice. Due to disharmony, limited competence and inadequate coordination between the authorities responsible for the enforcement of laws (courts, public prosecutors, police, customs, market inspectors etc.), the protection of intellectual property rights is not efficient enough at present (Yusurvey, 2006).

5.2 Main Documents Reflecting National Strategies for Research, Development and Innovation

Innovation is sometimes a topic subordinated to science or research policy or even to development policy. Most S&T policies in Western Balkan countries encourage sustainable support for basic research at universities and research institutes, for the development of human resources and for cooperation in the framework of the European Union's programmes for RTD and joint research programmes with the European Science Foundation or bilateral agreements. In technology policy, emphasis is placed on linking research institutions as sources of knowledge with industry and SMEs and on encouraging the establishment and functioning of the intermediary institutions, although their success in practice is currently still being questioned (Kobal, 2005).

To date, there is still no S&T policy and strategy in the form of an official, single and comprehensive document (Sipka, 2008). The situation has been alleviated but not completely solved since the government of Serbia adopted its ambitious National Investment Plan, with the objective of improving conditions for scientific research. Bearing in mind the basic starting conditions, the government is nevertheless confident of its success in achieving the objectives stretched out in the National Investment Plan. It intends to allocate financial sources for the procurement of capital equipment for chemical, physical and biological sciences, astronomy and information technology departments. In other cases, instead of purchasing new equipment, the government will finance the upgrades of existing laboratories and equipment. According to the National Investment Plan, the investment is worth millions of euro. The investment projection for the government was made by the Ministry of Science and Environmental Protection (now the Ministry of Science). All procurements will be carried out through public tenders, except in some well-defined cases. In order to reduce the price as much as possible, the Ministry has also announced an intention to try international tenders, whenever the legal groundwork for such possibility exists. The government is also planning to begin building the first stage of the technological park 'Radmilovac', dedicated to agricultural sciences and biosciences. The plan is to start building an infrastructure that could combine scientific theory and its application in one place. The government has chosen agricultural science because the country has not only had scientific success in this area, but also success in the corresponding market. Thus, the ministry is convinced that the agricultural sciences should be particularly encouraged, especially since half of the country's scientific "export" involves this field. The government's optimistic forecast is based on a history of success and skilled staff and experts who can transform scientific results into marketing success (Popović, 2006).

Table 5.2: National Investment Plan (National Investment Plan, 2007)

National Investment Plan - R&D sector			**000 EUR**
Year	**2006**	**2007**	**Total**
Equipment	6,290	10,710	17,000
Support for up to 50 innovations per year	925	1,575	2,500
Innovation infrastructure	962	1,638	2,600
Setting-up centralised R&D databases	2,923	4,977	7,900
Total	**11,100**	**18,900**	**30,000**

In October 2006, the government adopted a Strategy for the Development of the Information Society in Serbia (Official Gazette RS, No.87/06) with the objective of promoting the use and development of information and communication technologies (ICT) in all its upcoming development strategies, especially due to the great impact of ICT on the national economy

and global competitiveness. The strategy will aim to improve the general situation in the ICT sector, define the competences, build a partnership between the private and public sectors, and facilitate the participation of key actors, including NGOs. Furthermore, the strategy will direct the insufficient existing financial sources towards the use of ICT for national priorities and help improve the dynamics for additional investments, promote the changes in society, and provide for local initiative activities. The strategy should also re-direct the national innovation system in order to satisfy fundamental and long-term technological conditions and shed light on the overall co-ordination, providing additional investment for the use of ICT. The strategy is divided into ten chapters, outlining the initiatives, priorities and goals of the strategy, and covering the institutional and legislative framework for the development of an information society with an informational infrastructure, e-administration, e-education and e-health. Furthermore, it encompasses a plan for the development of the business sector in terms of information and communication technologies (Government of the Republic of Serbia, 2005).

Aleksandar Popović, former Minister, has expressed his disappointment regarding the government's failed action called "1,000 Serbian Technologies", which in 2005 aimed to make intelligence Serbia's leading export brand. The action was launched with the objective of promoting and marketing Serbia's scientific and technological achievements through a well-designed uniform database, which would allow the government to access foreign markets with the assistance of Serbian embassies abroad, foreign embassies in Serbia and the Serbian Chamber of Commerce. However, after the government launched the project by setting up a web-portal, the scientists failed to correspond with due activity. With the exception of the Mihajlo Pupin Institute, which demonstrated serious will for cooperation, others did not follow the example and the project was eventually terminated. At the time of writing this report, the government was considering its revival, convinced that the successful completion of such a project could significantly contribute to the export of Serbian S&T achievements to foreign markets (Popović, 2006). The government of Serbia believes that the "National Investment Plan" will considerably change the conditions for practicing science in the country as well as improving the conditions for scientific research.

In 2005, as a further strategy for boosting innovation, the government launched a competition for the best technological innovation. According to the latest data from the Ministry of Science, 346 innovations and 900 participants were registered in the first year, 257 innovations and 919 participants (or 471 teams) were registered in 2006, and 274 innovations in 2007 (Sipka, 2008).

In the field of education, there is a strategy document entitled "The Serbian Higher Education Reform". The document was drafted by the Ministry of Education and Sports in 2001 and deals with the reform of the education sector in Serbia (Ministry of Education and Sports of the Republic of Serbia, 2001). Furthermore, the government adopted a strategy for the development of SMEs and entrepreneurship in the period between 2003-2008, with the objective of increasing the total number of SMEs and creating new jobs. In this document, the Ministry of Economy also recognises the need to develop institutional frameworks and a favourable business and investment climate (Government of the Republic of Serbia, 2003).

Another recent document is the "National Innovation Strategy" - co-ordinated by the Ministry of Science and the Ministry of Economy, and assisted by the Support to the Enterprise and Development Entrepreneurship Programme (EDEP). EDEP is now in the process of promoting and disseminating the National Innovation Strategy and the results of the National Innovation Audit (EDEP, 2007).

In Kosovo/UNMIK, the Ministry of Education, Science and Technology drew up a Strategy for the Development of Higher Education for the period 2005 to 2015. The aim is to develop an efficient higher education system, providing high-quality education and research. In the first phase (2005-2009), the ministry decided to focus on completing the legislative documentation, drafting and implementing the development policies, and increasing support funds. Priorities in the second phase (2010-2015) will revolve around the development of the institutional capacities, intellectual capacities and piloting innovations. Various problems, such as the lack of national policies and programmes and incomplete legislation for scientific research, the lack of defined priorities, the lack of administrative and intellectual capacity as well as the lack of interdisciplinary approaches and standards, the ongoing brain-drain, and the absence of a mechanism for protecting both intellectual property and industrial rights, have been identified and assessed. Performance indicators, such as the provision of a legal package and programmes for scientific development, the number of scientific research projects that contribute to the solving of societal problems, the existence of postgraduate study systems organised in accordance with the objectives of the Bologna Process, the number of publications, the allocation of funds to scientific research and the establishment of an institutional infrastructure for scientific work, have also been defined (MEST Kosovo, 2004).

5.3 Main Fields of Intervention and Research Priorities

Serious long-term structural problems that affect the S&T sector need to be discussed in order to assure further development. Amongst these structural problems are budgetary constraints and public debt, a generally low level of development, widespread unemployment and poverty and massive migrations, pointing to the need for industrial restructuring in largely agricultural-based, de-industrialised economies (Uvalic, 2005). Due to the overall lack of resources, prioritisation is of utmost importance, research orientation needs to be steered towards the economic and social needs of the present in order to make provisions for the future. International programmes need to support foresight studies and the process of prioritisation, as simply focusing on the RTD Framework Programme or imitating the strategies of other countries will not bring the desired results (Uvalic, 2006).

Priority setting in the S&T sector is intended to facilitate the efficient performance of certain identified S&T fields by providing a predictable allocation of critical-size funds. The need to define the thematic S&T disciplines and fields has to be recognised by the official policy makers. The specific research priorities include the Information and Communication Technologies, Life Sciences, Research on Agribusiness and Biotechnology, Genomic research, Environmental and Materials research, and research on renewable energies and sustainable development as well as water management, transport, aerospace research, humanities and social sciences, and research in SMEs (Uvalic, 2006). Significant achievements have been made in terms of institution and strategy development. However, some papers remain generally superficial and many statements have more to do with paying lip service than real policy implementation and related operations and identifying an analysis of real performance aimed at locating competitive advantages in S&T. Furthermore, the level of aggregation often seems too broad and thus, goal-oriented interventions will be difficult to identify and are unlikely to generate the expected benefit. Much remains to be done, including the implementation of national foresight studies in order to support the prioritisation process. It would be worth considering a complementary regional comparative foresight exercise to assist the diverse national attempts (Uvalic, 2006).

The general aim of R&D development activities in Serbia is to provide optimal research conditions and encourage the research community to contribute to the economic growth of

the country (Uvalic, 2006). One of the main priorities of the Ministry of Science is to increase the government's expenditure on R&D (Popović, 2006). Furthermore, the government's aim is to improve the project proposal evaluation (peer review according to international standards), improving the status of researchers, building up R&D infrastructure through provision of research laboratories, academic networks and libraries, and enhancing international cooperation through the increased participation in the European Union's RTD Framework Programmes and by concluding additional bilateral cooperation agreements (Ministry of Science and Environmental Protection of the Republic of Serbia, 2005). In view of this, several measures are being either launched or planned - including the promotion of entrepreneurship in technological development (incubators, start-ups, spin-offs, demonstration/application centres, S&T parks), the support of more market-driven and application-oriented projects and R&D programmes according to the long-term development strategy, the reconstruction and privatisation of the R&D system, evaluation and benchmarking, as well as changing mind-sets and market-orientation, and improving networking and marketing activities (Kutlača, 2005a).

Meanwhile, a noticeable improvement is achieved in international cooperation and provision of new library services. In its evaluation of research, the MSEP opted for assessing and categorising individual researchers instead of project teams, based on criteria stimulating publication performance rather than quality of output. In this context, a programme of benchmarking locally published journals is introduced and made permanent (MEST Kosovo, 2005; Sipka, 2008).

Table 5.3: Thematic priorities in Serbia (Dall, 2006)[30]

Research priorities in the Basic Research Programme are:

- physics, chemistry, mathematics and mechanics, biology, geosciences, medicine
- social sciences (economy, law, philosophy, sociology, psychology)
- humanities (history, archaeology, ethnography, Serbian language and literature)

The Technology Development Programme covers thematic areas such as:

- information technology
- electronics and electrical engineering
- mechanical engineering
- construction industry and civil engineering
- biotechnology

There are also a few specific programmes or sub-programmes that address particular issues:

- Energy Efficiency National Programme
- Biotechnology and Agro Industry National Programme.

6 Summary and Draft Conclusions

In recent years, Serbia has demonstrated serious commitment towards creating a favourable R&D platform for the future. The government has adopted a "National Investment Plan" and committed itself to increasing the budget for S&T, with the objective of gradually meeting the criteria set out in the Lisbon Agreement. Furthermore, a number of laws have been adopted to provide a legal framework in the fields of science, education and research. The Ministry of

[30] According to the Ministry of Science and Environmental Protection of the Republic of Serbia, 2005

Science, the Ministry of Education, and other important stakeholders are all committed to the task of improving the general conditions in the country regarding R&D.

Nevertheless, it must be stressed that Serbia cannot fully benefit from international funds and logistical support until it finally fulfils its obligations with the ICTY. When that prerequisite is fulfilled, the European Commission will resume the SAA negotiations, bringing the country closer to meeting the standards of the European Union, which would promote economic and trade relations, regulate the movement of workers, freedom of establishment, supply of services and movement of capital (European Commission, 2006a).

The countries of the Western Balkans, including Serbia, will have to undertake serious measures in order to improve the unsatisfactory conditions currently present in the R&D sector. Many complex tasks are ahead if the countries wish to prevent an increase in the technological gap vis-à-vis the European Union. The adoption of more appropriate policies is necessary on both the national and the international level. Furthermore, it is of the utmost importance to raise public awareness about the knowledge-based economy, and to enhance the awareness of the key role played by innovation and technological progress in economic growth and development (Uvalic, 2006). Serbia is still in the stage of searching for full political stabilisation: a solution to the Kosovo problem and fulfilling obligations towards the ICTY being the biggest challenges preventing the government from concentrating on the advancement of economy and utilisation of RTD in this process (Sipka, 2008).

Although the research systems in countries of the Balkan region have substantial potential, they are generally troubled by the inappropriate treatment of the research institutions, unfavourable structure, weak interaction with the business sector, and insufficient linkages with the education and research systems of the other countries. Over the course of time, science, scientists and scientific research in the countries under survey have been marginalised. R&D has not been registered among the key priorities and a clear longer-term strategy in this area is still absent. According to Uvalić, the links between business enterprises, universities and research institutes need to be improved and efforts should also be made in accelerating the implementation of laws and related measures (Uvalic, 2006).

In addressing these complex issues, the Serbian government will have to face the challenge of finding the right balance between restrictive economic policy, clearly necessary for macroeconomic stabilisation purposes, and other types of policies with long-term effects, which can contribute to raising economic competitiveness, such as the increased investment in human capital, including increased spending on R&D and on education. It would be desirable to address the issue of a longer-term strategy of R&D for all Western Balkan countries in a regional context. Although some results were achieved during the two previous years (2006-07), there is still much need to attract more Foreign Direct Investment (FDI) by further improving the business environment and decreasing the investment risks in the country, which ought also to facilitate the transfer of modern technologies and know-how (Uvalic, 2006).

In recent years, excellent experiences have been gained with the EC funded projects that supported institution- and capacity-building on a regional level. As most of the researchers and scientists are employed at the universities, the reform of the higher education system was, and still remains crucial, and cannot be regarded as independent from the R&D sector (Uvalic, 2006). Nevertheless, building a national innovation system must be of highest priority and the accreditation of R&D and higher education organisations is part of this process. However, the restructuring of the R&D system also has to be put in practice in the business sector so that R&D is also carried out in industry (Kutlača, 2007a).

Full responsibility for creating incentives for further developments in this direction lies with the government as a whole. In order to build a fertile research-industry relationship, substantial changes in fiscal policy has to be effectuated. There is evidence for the need to launch specific programmes and organisational schemes to invoke the process, such as those used earlier by some EU countries, for example, Slovenia or Portugal.

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8 List of Acronyms

AUF	Agency of the Francophonic Universities
BERD	Business Sector Expenditure on R&D
BOS	Belgrade Open School
BSEC	Black-Sea Economic Co-operation
CARDS	Community Assistance for Reconstruction, Development and Stabilisation
CEEPUS	Central European Exchange Programme for University Studies
CEI	Central European Initiative
CEON/CEES	Centre for Evaluation in Education and Science
COBISS	Co-operative On-line Bibliographic System and Services
CORDIS	Community Research and Development Information Service
COST	Co-operation in Science and Technology
CSI NLS	Centre for Scientific Information of the National Library
CTF	Consultative Task Force
DG	Directorate General
DOI	Digital Object Identifier
DRC	Danube Rectors' Conference
DVON	Departman za visoko obrazovanje i nauku (Department for Higher Education and Science) in the Ministry of Education, Science and Technology Kosovo/UNMIK
EBRD	European Bank for Reconstruction and Development
ECTS	European Credit Transfer System
EDEP	Enterprise and Development Entrepreneurship Programme
EPC	European Patent Convention
EPD	Enhanced Permanent Dialogue
EPO	European Patent Office
ERA	European Research Area
ERA-NET	European Research Area Network
EUA	European University Association
EUREKA	Pan-European Network for market-oriented, industrial R&D
FP	Framework Programme
FP6	Sixth EU Framework Programme for R&D
FP7	Seventh EU Framework Programme for R&D
FRY	Federal Republic of Yugoslavia
FTE	Full Time Equivalent
GÉANT	Multi-Gigabit Pan-European Data Communications Network
GERD	General Expenditure on R&D
GDP	Gross Domestic Product
GOVERD	Government Sector Expenditure on R&D
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
HC	Headcount Equivalent

HE	Higher Education
HERD	Higher Education Sector Expenditure on R&D
HP	Hewlett Packard
IAEA	International Atomic Energy Agency
ICGEB	International Centre for Genetic Engineering and Biotechnology
ICT	Information and Communication Technologies
ICTY	International Criminal Tribunal for the Former Yugoslavia
IMF	International Monetary Fund
INASP	International Network for the Availability of Scientific Publications
INCO	International Cooperation (Acronym for Programme in FP6, part of 'Capacities' in FP7)
IPA	Instrument for Pre-Accession Assistance
IPRO	Intellectual Property Rights Office
IST	Information Society Technologies
ITIDA	Information Technology and Internet Development Agency
IZUM	Slovenian Institute of Information Sciences
JRC	Joint Research Centre
JISA	Union of ICT Societies of Serbia
KFOR	Kosovo Force
KoBSON	Consortium for Coordinated Acquisition (Konzorcijum biblioteka Srbije za objedinjenu nabavku)
LPJ	Locally Published Journal
MEST	Ministry of Education, Science and Technology of Kosovo/UNMIK
MoU	Memorandum of Understanding
MSEP	Ministry of Science and Environmental Protection (till 2007)
MSCI	Ministry of Science
NATO	North Atlantic Treaty Organisation
NBS	Nacionalna Bibilioteka Srbije (National Library of Serbia)
NGO	Non-governmental Organisation
NIP	Networking Infrastructure Project
PCT	Patent Cooperation Treaty
RCC	Regional Co-operation Council
R&D	Research and Development
RTD	Research and Technological Development
SAA	Stabilisation and Association Agreement
SANU	Srpska Akademija Nauka i Umetnosti (Serbian Academy of Sciences and Arts)
SAP	Stabilisation and Association Process
SASA	Serbian Academy of Sciences and Arts
SCOPES	Scientific Cooperation between Eastern Europe and Switzerland
S&E	Science and Engineering
SEE	South-Eastern Europe
SEE-ERA.NET	FP6 project "Southeast European Era-Net"
SIDA	Swedish International Development Cooperation Agency
SIEPA	Serbia Investment and Export Promotion Agency
SME	Small and Medium Size Enterprise
SNSF	Swiss National Science Foundation
S&T	Science and Technology
TEMPUS	Trans-European Mobility Scheme for University Studies
TERENA	Trans European Research and Education Network Association
TRIPS	Trade Related Aspects of Intellectual Property Rights
UN	United Nations

UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNIADRION	Adriatic-Ionian Initiative
UNIDO	United Nations Industrial Development Organisation
UNMIK	UN Interim Administration Mission in Kosovo
USAID	United States Agency for International Development
VAT	Value Added Tax
VET	Vocational Education and Training
WB	Western Balkans
WBC	Western Balkan country/countries
WIPO	World Intellectual Property Organisation
WoS	Web of Science
WTO	World Trade Organisation
WUS	World University Service
ZSI	Zentrum für Soziale Innovation (Centre for Social Innovation, Austria)

Annex I - Main R&D institutes in Serbia

Science and Research institutes founded by Republic of Serbia

Archaeological Institute of the Serbian Academy of Science and Arts Astronomical Observatory
Etnografski institut SANU
Institute of Social Sciences
Institute of Economic Sciences
Institute of Technical Sciences
“Mihajlo Pupin” Institute
Institute of Architecture and Regional & Urban Planning of Serbia
Institute of Biological Research “Siniša Stanković”
Institute of Agricultural Economics
Institute of European Studies
Institute of Philosophy and Social Theory
Institute of Physics
Institute of Chemistry, Technology and Metallurgy “IHTM”
“IMS” – Institute of Material Testing of Serbia
Agricultural Research Institute “Srbija”
Institute of Literature and Arts Institute of Medical Research
Institute of Recent History of Serbia
Institute of Nuclear Sciences “Vinča”
Education Research Institute
Institute of Application of Nuclear Energy “INEP”
Scientific Institute of Medical Plants Research “Dr Josif Pančić”
Crop and Vegetable Scientific Institute
Institute of Contemporary History
Institute for Serbian Culture - Prishtina - Leposavić
Institute of Animal Husbandry
Institute of Forestry
Institute of Technology of Nuclear and Other Mineral Raw Materials
Institute of Plant Protection and Environment
Institute of Soil Sciences
Historical Institute of the Serbian Academy of Science and Arts
Mathematical Institute of the Serbian Academy of Sciences and Arts
Scientific Institute of Veterinary Medicine “Novi Sad”
Scientific Institute of Veterinary Medicine Geoinstitute
Mining Institute
Fruit Research Institute

Science and Research institutes not founded by Republic of Serbia

Centre of Multidisciplinary Studies University of Belgrade
Institute for Economics
Electrical Engineering Institute “Nikola Tesla”
Copper Institute – Rtb-Bor
“IHIS” Holding d.o.o.
Institute of Hygiene and Technology of Meat
Institute of Criminological and Sociological Research
Maize Research Institute “Zemun Polje”
Department of Mathematics and Informatics of Faculty of Sciences, Novi Sad
Institute of International Politics and Economics

Institute of Molecular Genetics and Genetic Engineering
Institute of Oncology and Radiology of Serbia
Institute of General and Physical Chemistry
Institute of Lung Diseases
Institute of Political Studies
Institute of Science Application in Agriculture
Highway Institute
Traffic Institute “CIP”
Institute for Technology of Nuclear and Other Raw Materials
Institute of Comparative Law
Institute for Water Management
“IRITEL”, telecommunications and electronics co.
Research and Development Institute “Kirilo Savić”
Research Institute for Reproduction, Artificial Insemination and Embryo Transfer „Temerin”
Serbian Chemical Society (SCS)
WUS Austria - World University Service

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Thematic Report

SCIENCE AND TECHNOLOGY IN KOSOVO/UNMIK

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1 Preface

No intentional system of innovation can be identified in Kosovo. Moreover, even the elements which such a system would require, such as a sector of education, a research sector, the industrial sector, the infrastructure sector, the financial sector etc. are far from being fully functional in their own shape. The technology base of the economy is extremely weak and major institutional arrangements are still lacking. Also the internal structure of the central relevant institutions depicts a lot of deficits. Research for instance, which is in the focus of this paper, is a marginal undertaking in the university and non-university sector in Kosovo. It takes place, firstly, at a low level of intensity and, secondly, not in strategic sectors (European Commission, 2007e). The Ministry of Education, Science and Technology (MEST) is in a long lasting restructuring phase without adequate capacities to steer research and innovation. The general expenditure on R&D amounts to only 0.1 %. Industrial demand for R&D is close to zero. Bridges between science and society are reduced to teaching and political influences in appointing higher management structures in public knowledge organisations. There is a lack of awareness on the advantages, pitfalls, conditions and complexity of a system of innovation. Finally, in practice there is even no undisputed governance system due to the political instable situation which divides the territory into two discrete zones of influence, most prominently characterised by the position of the University of Mitrovica[1]. According to a report by OSCE quoted in Kostovicova (Kostovicova, 2005) *"there has not been any sign of genuine tolerance or attempts to find a common ground between the Kosovo Albanian and Kosovo Serb communities regarding the consolidation of their educational system."*

Because of the absence of a genuine substantial research structure and research undertakings in Kosovo, which would naturally limit this article to a few pages, it is aimed to provide a broader and more detailed picture on the conditions, structures and major drivers and players which could be relevant for an emerging system of research, not to speak about a system of innovation, in Kosovo in the future. It should, hopefully, also act as a baseline report for future academic investigations on higher education, research and innovation in Kosovo[2].

This analysis is not a political one, but it deals with political issues. This is unavoidable if Kosovo is under scrutiny. The declaration of independence of Kosovar leaders on 17th February 2008 added complexity. Until then, the author could always refer to the expression "The United Nations Interim Administration in Kosovo Acting on behalf of and for the benefit of The Provisional Institutions of Self-Government in Kosovo", abbreviated by the term UNMIK/Kosovo. Since then, however, some states are recognising Kosovo as an independent state, while others do not. Unfortunately, the EU member states, and consequently the EU herself, are split in this regard, which makes it difficult for the author being Austrian and European. Therefore, when the term "Kosovo" is used in this article, it should be entirely up to the distinguished reader if she or he reads it as UNMIK/Kosovo based on UN Security Council Resolution 1244 or as Kosovo as the world's most recent state.

2 Political and Economic Background

In order to understand the complicated situation in Kosovo these days, a very short excursus to history is made: Albanians are considered to be descendants of the Illyrians. The region was conquered by the Greeks around 300 BC and later by the Romans. The region of Kosovo fell to the Serbian state ruled by the Nemanjic dynasty in 11th century. In 1389, during the

[1] We use this term according to international practice, although the University of Mitrovica names herself "University of Prishtina" with temporary residence in Kosovska Mitrovica.

[2] The author is thankful to the following persons who provided opportunities for conducting and information exchange in shaping the contents of this study: Ms. Barbara Weitgruber, Ms. Ingrid Sager, Mr. Hubert Neuwirth, Mr. Georg Wöber and Mr. Johann Günther.

famous battle of Kosovo ("Amselfeld") (Kellerman, 2006), the Serbs and their allies were defeated by the Ottoman Turks, who integrated Kosovo shortly thereafter into the Ottoman Empire (OEZA, 2007). In the first Balkan war of 1912, Kosovo was once again annexed by Serbia. In 1939, during WWII, Kosovo Albanians revolted against the Serbian rule and joined Albania. The region was under the control of the Italians, the Bulgarians, and the Germans. At the end of WWII, Kosovo found itself as part of the Yugoslav state of Tito (OEZA, 2007). The 1974 constitution made Kosovo an autonomous province. In 1988/1989 the Milosevic regime abolished Kosovo's autonomy and the Serbian dominated military took control of the province. In response, in 1991 the Kosovo Albanians adopted their own constitution for their Republic of Kosovo. The passive Albanian resistance (lead by Mr. Rugova) was gradually replaced with violence, and in 1997 the Kosovo Liberation Army was formed. As the civil war heated up in Kosovo, and in order to stop the ethnic cleansing and the killing of Kosovo Albanians, NATO launched air strikes against the Milosevic regime (OEZA, 2007). The so called "parallel institutions system" existed between 1989 and 1999.

Since 1999, NATO has been responsible for the provision of military support and security in Kosovo with its peacekeeping forces known collectively as KFOR. Since June 1999, Kosovo has been under the protectorate of the United Nations, as stipulated in the UN Security Council Resolution 1244 of 10th June 1999, under the auspices of the United Nations Mission in Kosovo (UNMIK) and the Special Representative of the Secretary General (SRSG). The inclusion of Kosovo in the then Republic of Yugoslavia's Constitution remained. This status was not changed when the Federal Republic of Yugoslavia became the State Union of Serbia and Montenegro, and later split into Serbia and Montenegro, respectively (OEZA, 2007). In other words, on basis of UNSCR 1244 Kosovo remained Yugoslav territory, but became de facto an independent construct out of Belgrade's but under international control, with a few exceptions (such as the situation of the University of Mitrovica).

In May 2001, and after municipal elections held in October 2000, UNMIK promulgated a Constitutional Framework that established the Provisional Institutions of Self Government (PISG), including an elected Kosovo Assembly. Although SRSG maintained the overall right to promulgate, change or repeal any laws and decisions (which also happened in the field of higher education and research), over time certain powers and authorities have been transferred to the PISG (OEZA, 2007). While UNMIK is reducing, the EU has extended its involvement in Kosovo. Kosovo plays a crucial role in the EU's overall strategy for the region and is included in the Stabilisation and Association Process (Fischer, 2005).

A "standards before status" strategy was introduced in May 2002, but was in the meantime replaced by a "standards in parallel to status" approach. However, building functioning public services according to European standards is a difficult task for a territory with very limited democratic traditions, a heavily burdened inter-ethnic composition and traditional social structures (OEZA, 2007). Until recently, the Serb Kosovars are largely boycotting Kosovo institutions. Security remains the biggest issue for them. A symbol for the ethnic division of the territory is Mitrovica, a town divided in two by a river and a protected bridge.

After more than a year of unsuccessful negotiations between Prishtina and Belgrade, the Kosovar government and parliament declared independence on 17th February 2008, which was recognised by the USA and most, but not all of the EU member states on one side, and most prominently opposed by Russia and, notably, Serbia on the other side.

At present, approximately 2.07 million people are living in Kosovo on a surface of 10,887 km^2. The population increased during the last few years, not at least because of a high natural growth rate (birth minus deaths per 1000 inhabitants) of an average of 13.325 in the years

2003 to 2006 (European Commission, 2007). The life expectancy at birth is below the average for the region (67 for men and 71 for women). Official languages are Albanian, Serbian and English. In some municipalities also other languages are officially recognised (for example, Turkish). The capital of Kosovo is Prishtina. Around 88% of the population are Kosovo Albanians. Kosovo Serbs count approximately 7% and the remaining 5% are Kosovo Roma, Ashkali and Egyptian (often referred to as RAE) as well as small minorities of Bosniac, Turk, Gorani and other (all data cited from OEZA, 2007).

From an economic point of view, Kosovo is confronted with the challenges of transition from the Yugoslav model of socialistic economy towards a functioning, socially equitable market economy. The situation is characterised by wide-spread poverty, a much retarded rural development and high levels of unemployment hitting especially women, youth and marginalised groups. The overall political uncertainty has negative repercussions on the much needed foreign investment, which up to October 2005 accumulated to a low 1.211 billion USD (OEZA, 2007). At present Kosovo is still a heavily cash-based economy. The economy is severely characterised by a dramatic trend of deindustrialisation and by an increasing subsistence production in agriculture (approximately 60% of the population; 80% have only between 0.5 and 2 hectares) and by an almost exclusive focus on trade and construction in the tertiary sector. Despite its low technological standard, Kosovo's agricultural sector contributes 30% of GDP. In 2005, the employment distribution by sector showed the following pattern: 18.8% in agriculture (compared to 5.5% in 1997), 14.4% in industry (compared to 33% in 1997), 7.9% in construction (compared to 3.4% in 1997), and 58.9% in services ; data in brackets from CEPS 2000).

GDP in 2004 amounted to EUR 18,055 million. GDP per capita (2004) was around EUR 1,900 (European Commission, 2007)[3]. Despite a decrease in foreign assistance (expressed in wages of expatriates, wages of locally employed persons, consumption of goods and services, direct budget allocations etc.), real output grew by an estimated 3.8% in 2006 after a low increase of 0.6% in 2005 (European Commission, 2007). The share of donor-financed investment fell to 11% in 2006, while private investment continued to grow at a brisk pace (European Commission, 2007). Diaspora support in terms of private capital transfers still remains high[4]. It is estimated to constitute 20% of GDP in 2006 (European Commission, 2007). Fischer (2005) assesses the investment readiness of the diaspora as almost unique in the world.

The foreign trade balance is extremely unfavourable and widened further to 53% of GDP in 2006 with a continuing trend during the first half of 2007, reflecting the lack of export capacity and competitiveness (European Commission, 2007). Almost half of the exported goods are base metals and base metal products, but a positive shift in the structure of imports from final consumption goods to investment goods (mainly machinery) could be observed in 2006 (European Commission, 2007). The EU is the main trading partner of Kosovo with a 34% share in imports and exports in 2006, but trade integration with neighbouring countries increased (European Commission, 2007).

The private sector is characterised by a large number of micro and small enterprises as well as outdated technologies resulting in low production quality and productivity. Fischer (2005) reports of approximately 40,000 registered enterprises out of which 36 000 have just between 1 and 4 employees. These small enterprises do not pay VAT, which - among other reasons - results in the absurd situation, that currently almost 75% of all tax revenues are collected at

[3] Data very often varies. Fischer (2005) for instance reports a GDP per capita in 2001 of USD 920, quoting a UNMIK Fact Sheet Kosovo of May 2003.
[4] As regards private transfers, Fischer (2005) points to the danger that the integrated 2nd generation of immigrants in Europe and USA may gradually loose the interest and commitment for Kosovo and its future.

the borders (European Commission, 2007). This situation is comparable to the one of Bulgaria in the mid 1990s.

Despite this negative structural situation, Kosovo showed, starting from a very low level, a fast growing GDP nominal growth rate from 2001 to 2006 (see Table 2.1).

Tab. 2.1: GDP nominal growth rate (estimates) (Fischer, 2005)

Year	2001	2002	2003	2004	2005	2006
GDP nominal growth rate	23.5%	14.0%	8.7%	8.2%	8.1%	~ 4%*

* Estimate, European Commission 2007

The officially registered unemployment rate in 2005 was 27.08% (OEZA, 2007), but estimates about the true, but hidden (for example, youth and female unemployment) unemployment situation, are considerably higher (40% to 60%). 69% of the women are not participating in the labour force (Fischer, 2005). According to the labour force survey, unemployment stood at 44.9% of the active labour force in 2006, but a large number of unemployed may be active in the informal sector (European Commission, 2007). Nevertheless, the unemployment rate is the highest in the Western Balkans.

Living standards in Kosovo are very poor. 50% of the population live under the poverty line. 60% of the population lives in rural area and 48% are still without access to piped water (OEZA, 2007). Large parts of the population rely on remittance payments from relatives living abroad (OEZA, 2007). Corruption is endemic. There are considerable disparities regarding rural and urban areas, especially as income levels are concerned. Brain drain and migration to cities belong to Kosovo's key problems (OEZA, 2007). The smallest ethnic groups, such as the RAE, are dramatically marginalised. They live in separate settlements (so-called Mashallas), are facing segregation, discrimination and dramatic living conditions. The human poverty levels are highest among this group (78% live on less than 2 USD per day) (OEZA, 2007).

Kosovo has an extremely young population. Young men and women under 25 years constitute 52% of the population (OEZA, 2007). One third of the population is under 14 years, which puts enormous pressure on the education sector and the labour market. Young entrants to the labour market are facing an already large pool of people (over half a million) also in search of meaningful participation in the economy (Fischer, 2005).

There is evidence that Kosovo's population is under-educated in comparison with the needs of a modern economy, a fact not at least caused by the parallel underground system of the 1990s. There is urgent need for reforms in the education sector to properly prepare the young generation for the labour market needs of the 21st century. The Kosovar Ministry of Education, Science and Technology (MEST Kosovo, 2004) confirms that the greatest challenge for higher education is to establish the link with the economy and to create a mechanism to track down the employability of its graduate. Enormous differences can be found in education levels between urban and rural areas as well as between ethnic groups. While for instance the average schooling for Kosovo Serbs lasts 10.61 years, the figures for the Kosovo Albanians and the RAE are 9.33 respectively 6.89 years (Fischer, 2005) quoting UNDP Human Development Statistics, 2004). The latter is below the 8 year compulsory schooling.

Around a fifth of the population is enrolled in education, of whom 78% in pre-school and primary education, a low 16% in secondary education and a low 6% in tertiary education (European Commission, 2007). The rate for tertiary education enrolment, however, is almost double as high as in the year 2000, which indicates turbulent dynamics in this sector (data taken from CEPS, 2000). School enrolment in Kosovo, however, remains low with under 90% of the age cohort in the final year of compulsory (lower secondary) education. Only 55% were still enrolled at the 12th grade of upper secondary education (European Commission, 2007). A major concern is the low enrollment rates of the minorities, especially Roma.

Higher education is still perceived elitist and often an arena for political incidents than a field of excellence in education and research. Both public universities (Prishtina and Mitrovica) are striving with great difficulties for a minimum of European standards (OEZA, 2007). On the structural level central institutions and mechanisms are still missing or not yet fully in operation.

3 The Ministry of Education, Science and Technology

The Ministry of Education, Science and Technology (MEST) started as Department of Education soon after UNMIK established the Joint Civil Commission for Education, which intended to include members of the Albanian and Serb speaking Kosovo academic community as well as a UNESCO/UNICEF representative as chairman. It was co-headed by Mr. Daxner, the international administrator of the University of Prishtina. In 2003, UNMIK transferred its educational competences to the local government structures (PISG).

Basically, the MEST consisted in the last years of a Department of Pre-University Education (including a division of general education, a division of vocational education, a division of communities and gender issues and a division for cooperation with municipalities), a Department of Higher Education, a Department of Administration and Finance, a Department of Procurement and a Department of Infrastructure (MEST Kosovo, 2005a). It had and has no specific Department for Science and Technology. The responsibility for research and technology lies with the Department of Higher Education and Science (DHES). DHES bases its work on the Law of Higher Education (2003) and the Law on Scientific Research (2004). In order to upgrade capacities in the MEST, in September 2007 a new division of research and technology was established, which is headed by Mr. Murteza Osdautaj. The responsible officer for technology is Mr. Malush Mjaku and the research agenda is taken care of by Mr. Besim Mustafa.

Based upon the institutional partnership agreement with Austria, the MEST is currently establishing, firstly, a Centre for Innovation and Technology Transfer (CITT) under its roof to support science-industry relations and, secondly, a Centre for International Higher Education, Research and Technology Cooperation (K-CIRT). The latter should support the participation of Kosovar researchers and students in international and European programmes, such as CEEPUS or the 7th European Framework Programme for RTD.

Under the departmental structure of the MEST, several other subunits were established over time, including an Office for International Cooperation based upon UNMIK Administrative Instruction 2004/7. Gradually, MEST extended its international contacts and outreach. On 8th January 2004 an agreement between the MEST and the Ministry of Education and Science of FYR of Macedonia and the Ministry of Education and Technology of Albania on the transfer of Tetovo students was signed and in 2005 an Executive Program on Cooperation in Education and Science between MEST and the Ministry of Education of FYR of Macedonia was prepared. In 2006 an agreement between the Ministry of Education and Science of the

Republic of Albania and UNMIK/MEST was signed, emphasising - inter alia - collaborative scientific activities. The agreement does not indicate any resources to be committed. Also in 2006, an umbrella memorandum between UNMIK/MEST on one hand, and the Federal Minister of Education, Science and Culture and the Federal Minister for Foreign Affairs of the Republic of Austria on the other hand, was signed, in which several RTDI relevant provisions were included, such as support for setting up a Kosovo Centre for International Higher Education, Research and Technology Cooperation, a Council of Research and Technology, a Centre for Innovation and Technology Transfer and support for research projects. This memorandum was soon substantiated by the PAIK project (Schuch, 2006). Doubtlessly, it can be expected, that after the declaration of independence the international outreach of the MEST will soon expand.

As most of the researchers and scientists are employed at the universities, the reform of the higher education system still remains crucial, and cannot be regarded as independent from the R&D sector (Uvalic, 2006). This is especially true in Kosovo, where the non-university R&D sector is extremely limited. It is worthwhile to note, that already since 2003 UNMIK/ Kosovo participated in the Bologna Process Conferences as observer. The Law on Higher Education, promulgated in 2003, refers to the Bologna Declaration and requires all Higher Education Institutions (HEIs) to operate in accordance with this Declaration. In January 2006, Mr. Agim Veliu, former Minister of Education, Science and Technology established the Kosovo Bologna Promoters' Team (KBPT) with the purpose to undertake all measures needed for the promotion of the Process of Bologna and for integration in the European Area of Higher Education (EHEA) in Kosovo (MEST/ Kosovo Bologna Promoters' Team, 2007).

In 2004, the Strategy for the Development of Higher Education for the period 2005-2015 was approved. Its aim is to develop an efficient higher education system, providing high-quality education and research. In the first phase of the strategy (2005-2009), the ministry decided to focus on completing the legislative documentation, drafting and implementing the development policies, and increasing support funds. It was intended, that priorities in the second phase (2010-2015) should revolve around the development of the institutional capacities, intellectual capacities and piloting innovations. In this document various problems were listed, among them some directly, although not exclusively, referring to research, such as the lack of national RTD policies and programmes, an incomplete legislation for scientific research, the lack of defined priorities, the lack of administrative and intellectual capacity, the lack of interdisciplinary approaches and standards, the ongoing brain-drain and the absence of a mechanism for protecting both intellectual property and industrial rights. Performance indicators, such as the provision of a legal package and programmes for scientific development, the number of scientific research projects that contribute to the solving of societal problems, the number of publications, the allocation of funds to scientific research and the establishment of an institutional infrastructure for scientific work, have been identified (MEST, 2004).

Three years later, this strategy is in need to be updated. Some of its elements, especially in terms of legislation, have progressed (for example, the Law on IPR), while other elements, which should have been immediately resolved, such as the establishment of a Kosovo Accreditation Agency, are still under construction. In fact, the main deficiencies in reality are now related to institutionalised capacity building, whose delays are also caused by the troublesome incidents of the University of Mitrovica (UM) and the University of Prishtina (UP) between 2004 and 2006 which consumed a lot of energy (see Chapter 5 on this issue). Although the field of scientific research should be primarily addressed in the second period of the strategy (2010-2015), already in the first phase some fundaments for it should have been laid. Also here the implementation shows little progress. There is a need to review and update the Law on Scientific Research, which seems to narrow to serve societal (and industrial)

needs. The Council of Science, urgently needed to develop pilot RTD programmes, is still not operational. Moreover, there is no earmarked budget in prospect to fuel the still not existing RTD programmes with the necessary incentives provoking a catch-22 situation.

In 2005, the overall budget of the MEST was EUR 29.3 million (MEST Kosovo, 2005a). The budget for public Higher Education Institutions (HEI), which in fact was just allocated to the UP, amounted to around EUR 10 million in 2005. Two-thirds was spent on salaries and the rest on goods and services. Another million was allocated to the students centre. The non-university research institutes had an earmarked budget of EUR 2.1 million in 2005, with almost two-thirds allocated to physical capital (including the renovation of buildings of the Academy of Sciences and the Institute of Albanology). It was assessed that it would be necessary to invest EUR 32 million of public funds per year into higher education in order to reach the level of 1.22% of GDP in Kosovo (Pupovci, 2006). The 2005 budget forecasts for higher education for the years 2006 to 2010 reflected this need (MEST Kosovo, 2005b), but its realisation can be doubted and needs critical assessment.

On 9th January 2008, Mr. Enver Hoxhaj became the new Minister for Education, Science and Technology. Despite his academic background, he confirmed in a meeting with the author that he will mostly devote his energies to the primary and secondary education sector in Kosovo, because there the reform needs are supposedly even higher than the reform needs of the tertiary education sector. As regards the latter, a top priority of his political mandate will be the implementation of a functioning accreditation system in Kosovo in order to regulate the mushrooming of private tertiary education providers.

4 Relevant Laws

Three major laws are supposed to regulate research in Kosovo:

1. The Law No. 2004/42 on Scientific Research Activity (27th September 2004 with a promulgation on 23rd February 2005)
2. The Law No. 2004/19 on Academy of Science and Arts of Kosovo (16th June 2004 with a promulgation on 28th July 2004)
3. The Law No. 2002/3 on the Higher Education in Kosovo (26th September 2002 with a promulgation on 12th May 2003)

A series of other laws is more or less impacting scientific research undertakings, notably

- The Law on Medical Products and Medical Devices (No. 2003/26 from 4th December 2003 with a promulgation on 7th July 2004)
- The Law on Copyrights and Related Rights (No. 2004/45 from 29th June 2006 promulgated on 24th August 2006)
- The Patent Law (No. 2004/49 from 27th September 2004 promulgated on 21st December 2004) and amended by Law 02/L-100 on 18th December 2006 and promulgated on 6th February 2007)
- The Law of Technical Demands for Products and Valuation of Confirmation (No. 02/L-20 from 24th June 2005 promulgated on 21st July 2005)
- The Law for Accreditation (No. 02/L-43 from 21st November 2005 promulgated on 21st April 2006)
- The Law on Metrology (No. 02/L-61 from 19th January 2006 promulgated on 22nd April 2006)
- The Law on Publishing Activities and Books (No. 02/L-51 from 16th March 2006 promulgated on 21st April 2006).

At the time of writing this section (January 2008), some other relevant Laws were not yet adopted, such as the 'Law on Genetically Modified Organisms' with a first reading on 12th July 2007, the 'Law on Environmental Impact Assessment' with a first reading on 27th August 2007 or the 'Law for Final and Matura Exam' with a first reading on 27th September 2007.

In addition there are several relevant administrative instructions issued by the MEST, such as the one on the 'Central Scientific Council' (no. 19/2006, 31st May 2006) and on the 'Appointment of Standards in Science' (no. 20/2006, 31st May 2006).

In both the Law on Scientific Research Activity (Assembly of Kosovo, 2004) and the development strategy for higher education of the MEST (MEST, 2004), the public university sector receives special attention and responsibility for the conduct of research. Among other objectives, the Law on Higher Education postulates the goal to establish, develop, protect, and transmit knowledge trough teaching and scientific work and research (Article 2.1.) (Assembly of Kosovo, 2002). MEST (MEST, 2004) clarifies the vision for higher education for Kosovo, *"where knowledge and scientific research are in function of a sustainable cultural, social, and economic development"* (p. 6). The Statute of the University of Prishtina (UP) reflects this vision by stating that it aims to be a leading centre in the advancement of knowledge, ideas and science in higher education.

Based upon specific requirements (Article 21) also private organisations (including private universities) are entitled to carry out research work and can obtain funding to do this (Assembly of Kosovo, 2002). The Kosovo Council of Science should be in charge of providing an opinion regarding the fulfilment of the standards for organising and developing scientific research in private scientific organisations (Article 21.2) and the MEST gives the license (after a positive opinion) and registers private scientific organisations into the Register of Scientific-Research Institutes (Article 23). They must then attach the mark "with public right" on their name (Article 24). However, although the recruitment of the members of the Council of Science progressed during 2007, the Council is not yet operational.

As public scientific-research entities only three are explicitly listed in the Law on Scientific Research Activity (Assembly of Kosovo, 2004), namely (Article 69.2):

a) the Kosovo Academy of Science and Arts
b) the Albanological Institute and the History Institute as scientific research institutes
c) Universities (specifying in Article 13 that scientific research institutes established within the institutions of higher education [or within faculties of universities, Article 18] are science-research institutions as part of the founding institutions in question).

It is worthwhile to note, that the Law on Scientific Research Activity ceased all other scientific research institutes which were based on previous laws falling under the 'old Yugoslav' regime, for example, the Law Decree of Scientific Research Activity of Kosovo dated 17th April 1998. It should also be noted that the SRSG, Mr. Jessen-Petersen, had to promulgate the Law on Scientific Research Activity on 23rd February 2005 by regulating, that the terms "National", "the country" and "Kosovo", which appeared though the text of the Law adopted by the Assembly of Kosovo, had to be deleted and replaced by the term "Kosovo" (MEST Kosovo, 2005b).

Important issues addressed by the Law on Scientific Research Activity (Assembly of Kosovo, 2004) include a dedicated propensity to use scientific research activities for the development of economic prosperity (Article 2) by addressing all major three differentiation schemes of scientific research, namely fundamental, applicative and developmental research (Article 3). It is noteworthy, that in Article 6, scientific research refers to - among other common issues

such as freedom of scientific research and creativity or international inclusiveness - the principle of public work (with a provision of the researcher's status as civil servant in Article 48), competitive funding (at least partially) and the correlation of scientific research and higher education, which is another clear hint on the assigned importance of universities for delivering scientific research. Article 48 and the corresponding Article 49 manifest in practical terms that scientific personnel can hardly be dismissed, which might be good for the life-planning of the individual but undermines the flexibility of the research organisation. In more ways than this, the Law on Scientific Research Activity gives an overall impression of being written in a rather "old-fashioned" Mode 1 spirit.

The Law also states that up to 0.7% shall be allocated from the budget of Kosovo for the purpose of fulfilling the necessary conditions for scientific research and for providing the means to undertake scientific research. Although this quota is far below European average, it is high above the achieved reality (which is 0.1%). In fact, it is a quite ambitious goal in front of the background of Kosovo's economic and financial situation. In comparison, the public expenditure on R&D (GOVERD) of Bulgaria and Romania, who rank at rear positions in the Innovation Scoreboard of all EU Member States, amounts to around 0.38% in Bulgaria (for the period between 2002-2004) and around 0.22% in Romania (for the period between 2002-2004) (Standke, 2006). The Law demonstrates that GOVERD can not only be used for regular scientific research activities, but also to cover expenses related to knowledge utilisation and knowledge diffusion processes, which characterise comprehensive research systems (Borsi, 2004).

It is also noteworthy, that the Law promotes the advance and training of new R&D personnel (for example, Article 19 and Article 50), which is of utmost importance, due to the lack of up-to-date scientific research capacities. In addition to public funds, scientific research institutes are also entitled to receive finances from funds, foundations and donations, from other legal sources (assuming that enterprises fall under this category) and from other means realised by the scientific research institution (for example, licensing of protected knowledge) (Article 66). In the Law on the Higher Education in Kosovo (Assembly of Kosovo, 2002), it is specified that a public university is in principle also free to take any measure to promote and exploit its research activities commercially for its benefit (Article 21.1). However, where such commercial activity includes, or could potentially include, the exploitation of any significant intellectual property right in any literary, artistic or scientific works, scientific discoveries, designs, inventions, materials, goods or services provided wholly or partially, or directly or indirectly out of public funds, the provider shall seek the prior approval of the Ministry (Article 21.2). Article 23.1 proves that accredited private providers of higher education may also receive funding allocations from the Ministry for teaching or research in the public interest.

It should also be mentioned, that the Law on Higher Education in Kosovo (Assembly of Kosovo, 2002), which was drafted by the Council of Europe and local experts, foresees a strong article on academic freedom and protection from measures (Article 25). There it is stated that every higher education institution shall include in its statute or equivalent constitutional document that academic staff has the freedom within the law to question and test received wisdom and to put forward new ideas and controversial or unpopular opinions, without placing themselves in jeopardy of losing their job or any privileges they may have with the institution (Article 25.1). The right of academic staff of providers of higher education to freedom of speech may only be restricted by law (Article 25.2).

The Law on Scientific Research Activity (Assembly of Kosovo, 2004) provides two articles on the 'Kosovo Scientific Research Programme' (Article 51 and 52) and on the 'Kosovo Council of Science' (Article 53-57). Despite some unclear formulations, it can be interpreted that the

Scientific Research Programme should aim - among other things - to work upon identified research priorities, to establish provisions for infrastructural investments, to enhance participation in international scientific research projects and to elaborate a systematic education programme for researchers. The Scientific Research Programme should be approved for a period of five years by the Kosovo Assembly which also provides the funds for the realisation of the programme as proposed by the government. Until now, the Scientific Research Programme has not been in operation. The Law provides - due to its vague formulation - enough action spaces to run not only classical research funding schemes, but also schemes with more structural orientation or with international dimensions. Article 60 specifies that projects can be presented as (a) projects of scientific research, (b) developing projects and (c) projects of developing the infrastructure. General criteria for the evaluation and acceptance of the proposals are (Article 62):

a) importance for the development of Kosovo
b) scientific value and international measures of the project
c) scientific achievement of the project proposer
d) competence of the applying organisation
e) ecological adequacy of the project.

The major development assistance project in the field of higher education and research, which is currently implemented by Austria in cooperation with the MEST, targets the formulation of a full-fledged RTD programme by addressing the authority and capacity of the Kosovo Council of Science in this respect. The Law, however, foresees that the implementation of the Scientific Research Programme should fall partly under the responsibility of a scientific council respectively counsels (for example, as regards project evaluations; project delivery proposals etc.) established by the government (Article 58 and 59) and under the responsibility of the MEST (for example, responsible for announcement of the competition, the final decision of financing and contracting; see Article 60, Article 63 and Article 65). The Law does not anticipate the establishment of a specialised agency to implement the R&D programme(s).

The goal of the Kosovo Council of Science, which should consist of 15 members, is to maintain the development of scientific-research activity of Kosovo (Article 53). It is institutionalised as a pure advisory committee, which, in addition to its task to develop the Scientific Research Programme, gives opinion on certain issues (for example, on the establishing of scientific research institutes) and reports on the overall state-of-art in the field of S&T. By law, the president of the Kosovo Academy of Science and Arts is also the president of the Council. In our opinion, this fixed legal determination, which manifests a superior role of the Academy, could harm the flexibility and diversity to develop a modern system of research and innovation in Kosovo. It could also burden any future attempts to reform the Academy and contradicts with an open system of governance. The other members of the Council of Science are nominated by Kosovo's Assembly, based on the proposal of the government in charge.

5 Institutions with Potential Research Relevance

According to the MEST, scientific research is to be strongly linked with the university system. There are just a few non-university research organisations with scarce information available and whose impact on scientific research seems to be very limited. In front of this background, our analysis focuses on the university system and hereunder on the two main public universities operating on the territory of Kosovo. In general, the higher education system in Kosovo is pre-Humboldtian by refraining from scientific research. Tahirsvlaj (2004) cites Mustafa et al. (Mustafa, 2004), where it is stated that University of Prishtina professors themselves are very critical about their work. They state that no research is undertaken in almost all faculties, with

professors concentrating on teaching as their main and only activity.

A higher education system in Kosovo began in the 1960s with the foundation of the Faculty of Philosophy in Prishtina, followed by the faculties for Law and Economics, Technical Sciences and Medicine. Until 1969 these faculties were constituents of the Belgrade University (Wöber, 2005b). On basis of these faculties, the University of Prishtina (UP) was founded in November 1969[5]. In the academic year 1969/70 7,712 students were enrolled reflecting then a multi-ethnic history (53.4% in the Albanian and 47.6% in the Serbian language stream) (KEC, 2000). The UP was soon enlarged by additional faculties for Agriculture, Natural Sciences and Mining and Metallurgy (located in Mitrovica) during the 1970s. The Technical Faculty was divided into three individual units (Electrical Engineering, Civil Engineering and Architecture) and the Philosophical Faculty into two units (Philosophy and Philology). In 1993 the Faculty for Teacher Training was founded. Until 1991 the University of Prishtina had organised study courses both in Serbian and Albanian language, in accordance with its foundation law of 1969 (Wöber, 2005b). In the academic year 1990/91 the majority of 68% of the 29,016 enrolled students were studying in the Albanian language stream and only 32% in the Serbian language stream (KEC, 2000). Between 1970 and 1990 the participation of female students increased from 21.4% to 37.1% (KEC, 2000). The political situation around the turn of the decade resulted in the detachment of the Albanian teachers and students into parallel education systems at the beginning of the academic year 1991/92. The University of Prishtina operated as a "Serb" university until 1999. After the armed conflicts of 1999, the Serbian university members were forced to relocate to Northern Kosovo as well as to Serbia. At this point the UP split into two (see details below).

The University of Prishtina

Directly after the war, the Albanian speaking University of Prishtina (UP) emerged from the parallel, underground system of the 1990s, under which it gained the shrine of resistance against the Serbian regime by the Albanian speaking Kosovar population. (Gouda, 2003). From that time a strong interaction of the UP with politics can be traced. Although Bayerl (Bayerl, 2006) reports strong LDK links into the UP, also the AAK and the PDK are firmly rooted in the UP, not at least through student leadership.

Already in 1999/2000 the UP reported a staff of around 1,450 person, of them 358 are professors, 212 are lecturers, 72 are high school professors, 338 are assistants, 103 are collaborators (CEPS, 2000), depicting a student/teacher ratio of 20 (KEC, 2000). The rest was administrative personnel. It is estimated that only around half of the academic full-time staff has a PhD (or equivalent) and that only 10% of the full-time staff are women. According to an audit of gender issues in the Kosovo education system done by the Kosovo Gender Studies Centre published in 2007, all deans and all leaders of the Senate are men and out of 17 members of the Student Assembly, only one is female (ETF, 2007). From the 20,277 students enrolled in 2000/01 around 75% were full-time students. Two-thirds of the students were enrolled in social science studies (including economics) and humanities (KEC, 2001). 24% of the students attended the Higher Schools and 76% the Faculties.

At the beginning of its operations, the University of Prishtina, which is a member of the European University Association (EUA) since 1999, consisted of the following 14 faculties and 7 higher schools (KEC, 2001a) (in rank order of total enrolled students):

- Faculty of Law in Prishtina
- Faculty of Economy in Prishtina

[5] For a historic review see also KEC (2000) with slightly differing dates; OECD (2001); Leutloff, C. and Pichl, E. (1999).

- Higher Pedagogical School in Prishtina (Albanian language and literature, teacher training, mathematics, physics-chemistry, technical education)
- Faculty of Medicine in Prishtina (general medicine, dentistry, pharmacy)
- Faculty of Philosophy (with fields of studies in history, philosophy, sociology and pedagogy)
- Faculty of Philology in Prishtina (Albanian, English, German, French and oriental languages and literature)
- Faculty of Mathematical-Natural Sciences in Prishtina (mathematics, chemistry, physics, biology)
- Faculty of Electronics and Technics in Prishtina (electroenergetics, electronics, telecommunication)
- Faculty of Civil Engineering, Construction and Architecture in Prishtina (construction, hydromechanics, architecture)
- Higher Pedagogical School "Xhevdet Doda" in Prizren (Albanian and English language and literature, teacher training, mathematics, physics-chemistry)
- Faculty of Machinery in Prishtina (engineering, traffic, machinery)
- Higher Pedagogical School "Skenderbeu" in Gjilan (pre-school education, teacher training)
- Higher Pedagogical School "Bajram Curri" in Gjakova (Albanian language and literature, teacher training, mathematics, history-geography, biology-chemistry)
- Higher School of Technics in Mitrovica (machinery, electrical engineering)
- Faculty of Agriculture in Prishtina (agriculture, veterinary)
- Faculty of Physical Education in Prishtina
- Higher School of Economy in Peja (finance, management, circulation of goods)
- Faculty of Arts in Prishtina (music, arts, drama)
- Faculty of Mining and Metallurgy in Mitrovica (mining, metallurgy, technology, geology)
- Faculty of Education in Prishtina (teacher training) and
- Higher School of Technics in Ferizaj (machinery, wood-industry) (no data was given for this Higher School in KEC 2001).

As shown in this list, the University represents a patchwork of faculties, which in other countries would be the nucleus of several independent universities (for example, a separate university of medicine, a distinct university of business administration and economics; a technical university and so). The issue of dividing the UP into several dedicated universities has been under discussion almost since its beginning, but did not yet reach a critical level. Like almost all universities with a past under the former Socialist Yugoslav Republic, also the University of Prishtina could have been characterised as a loose association of highly autonomous faculties which organise their own affairs as they choose. The structure remained highly fragmented, and the university as a manageable institution scarcely existed until the new Statute[6] was approved in 2004.

The university was always confronted with severe operational problems, which are to a certain extend caused by its quick start, the steadily increasing number of students and corresponding demands, the prevailing budget restrictions, the internal governance problems and the necessities to reform along the Bologna process requirements, just to name a few. In fact, the Council of Europe already initiated a reform project during the years 2000-2001, but it lacked sustainability (Modvig and Wöber, 2006) like many attempts afterwards. Under the authority of the temporary administrator from UNMIK, Mr. Daxner, together with the Kosovar Rector, Mr. Kelmendi, the implementation of some of the Bologna Process requirements started already during the academic year 2001/2002 in Kosovo with several efforts to reform the curricula at

[6] In 2001 the University of Prishtina was assigned with its first provisional university statute.

the University of Prishtina. The 3+2+3 structure replacing the old 4+2+3 structure was soon approved and the first bachelor studies implemented.

In 2003 a first draft of a new University Statute was elaborated by the Rectorate of the UP, but critically reviewed both by the MEST and by European experts from Magna Charta, Council of Europe and the EUA. In order to enhance the process, Mr. Georg Wöber was appointed to assist in drafting the new Statute which was approved on 5th July 2004 by the Senate of the UP, issued as an administrative Regulation by the MEST, headed that time by Minister Rexhep Oxmani, on 6th July 2004 and ratified by the Kosovo Assembly on 9th July 2004 (Wöber, 2005b).

In December 2004, full-fledged elections at the UP were conducted which, unfortunately, were not in compliance with the new Statutes. As a result, a new Rectorate, headed by Mr. Arsim Bajrami, came into administrative power, which received limited recognition from the outside world. From 2004 to 2006, a long and painful re-election process had to be negotiated and implemented (Modvig and Wöber, 2006). Until 26th July 2005, a lot of time and energy was lost in interpreting the legal situation of the elections, when the Provisional Government of Kosovo finally completed the UP Steering Board with MEST members and in setting up a transitional management in charge for a new election process by adopting MEST Administrative Instruction no. 37/2005. With a bitter statement, Mr. Bajrami resigned on 29th July 2007, accusing *"people with doubtful moral, intellectual and national criteria"* as being guilty for *"this illegal act"* (University of Prishtina, 2005). The MEST Administrative Instructions no.8/2006 issued on 26th January 2006 and no. 11/2006 issued on 26th April 2006, finally paved the way to proceed with full-scale re-elections to conclude the reinstallation of lawful governance at the UP. As of 29th June 2006 the new elected rector of the UP is Mr. Enver Hasani.

After this period of relative standstill, which also substantially delayed the implementation of the Statute of the UP, the university decided to commence the process of consolidation of curricula and of implementing study programs of the second cycle according to Bologna (MEST/ Kosovo Bologna Promoters' Team, 2007), which in fact started already in the 2004/ 2005 academic year by enrolling the first students of the second cycles in 11 faculties with 45 departments. Three former Higher Schools were transformed into 'Faculties of Applied Sciences' and the former Higher Pedagogical Schools merged in a new Faculty of Education (Tahirsylaj, 2004). In 2007, it was decided that until 2010, study programmes of the 3rd cycle, including other organisations and entities in the development of scientific research, should be implemented. By the decision of Minister Hoxhaj in February 2008, the UP was declared the only HEI in Kosovo to qualify for the award of PhDs.

In 2006/2007 slightly more than 32,000 students were enrolled at the UP, representing 67% of the student population in higher education in Kosovo (MEST/ Kosovo Bologna Promoters' Team, 2007). This is 10,000 students more than 5 years before. However, only less than 1% of the students have a minority background (out of which mostly Bosniaks and Turks and very few RAE).

In Articles 171 to 175 of the Statute of the University of Prishtina, the university's relation to scientific research and scholarship is described. This is a 2 page section in a 74 page document. An obvious directed instrumental character of research for the benefit of teaching and training is postulated. It says in Article 171 that the university shall conduct scientific research and artistic work with the objectives to further develop educational processes, to introduce students into scientific research and artistic work, to develop scientific and artistic young professionals, to establish an international network of researchers and artists and to prepare and perform interdisciplinary oriented competitive research and arts projects (University of Prishtina, 2004).

In Article 171 it further refers to basic research without immediate practical use und applied research in close connection with public interest and needs, both either funded through public funds provided by the university or through private funds from individual contracts with third persons. In Article 172 the university obliges herself to provide appropriate conditions for scientific research to achieve competitive results on the international level, but it also demands the academic staff to perform scientific research and that the individual performance regarding scientific research shall be taken into account for professional assessment and career development. In compliance with modern university statutes it is confirmed in Article 173 that scientific research shall be performed within the facilities of the university and that the Rector may give permission to academic staff to perform research in defined locations outside the university and to participate in cooperative projects with other institutions (University of Prishtina, 2004). The latter is especially relevant for participation in the European Framework Programmes for RTD and in other international R&D programmes. Article 174 deals with performance reporting on scientific research and Article 175 with sabbatical leave.

Although the UP refers to scientific research several times in its mission statement and, thus, attributing high value to it in theory, the reality is far from the vision. With support of Mr. Johann Günter and Mr. Xhavit Rexhaj, the author submitted a questionnaire to three of the largest faculties[7] of the UP to identify performance data, including research activities. The results revealed that a strong focus was put on teaching activities, but not a singular research activity has been reported by the three investigated faculties. Research is also very seldom quoted as one of the top priorities under the current reform process at the UP. A few practical steps in this direction have been made, such as the signing of a MoU between the UP and the University of Regensburg in October 2006, under which also research cooperation is targeted.

The University of Mitrovica[8]

The University of Mitrovica (UM) is the second largest university in Kosovo. Since the University of Prishtina was taken over by Albanian staff, only the Faculty of Mining and Metallurgy located in the northern part of Mitrovica remained in the Serbian majority area. In 1999, Mr. Jagos Zelenovic was appointed as rector by Belgrade. He was not only formerly the Vice-Dean of the Faculty of Economics of the University of Prishtina, but also Federal Minister for Science in the government of Milosevic (Pichl and Leutloff, 1999). Beginning in summer 2001, the so called 'exiled' Serbian faculties began to return to Kosovo, justified by Belgrade (without coordination with UNMIK) by citing the need to ensure the legitimate right of the Slavic people of Kosovo to have higher education on their territory (Wöber, 2005a). A combination of 14 faculties had re-assembled essentially at two major locations in North-Mitrovica and Leposavic, *"with the need to re-establish there more than 90% of its basic infrastructural requirements, ranging from lecture rooms, laboratories and teachers offices to student dormitories and restaurants as well as appropriate private accommodation for the staff" (Wöber, 2005a, p.6)*.

The establishment of the UM as a vital higher education provider in Serbian language was supported by UNMIK, which also provided the license for the UM in absence of an appropriate Kosovo higher education law (EUA, 2002). UNMIK claimed its authority over all institutions on Kosovo territory and intensive negotiations between UNMIK and Belgrade took place about the formal and political recognition of this newly established combine of faculties, teaching in Serbian language and located on UNMIK/Kosovo territory (Wöber, 2005a). The negotiations on the side of UNMIK were conducted first by Mr. Michael Daxner and then by Mr. Aziz

[7] The Faculty of Medicine, the Faculty of Law and the Faculty of Philosophy.
[8] In compliance with international practice, the term University of Mitrovica has been chosen, although the University of Mitrovica, defined here as the Serbian speaking university in North-Mitrovica, has given herself a different name.

Khan, Mr. Daxner's successor as UNMIK Head of Education. However, UNMIK always had a difficult position in the region of North-Mitrovica. Serb parallel structures continued to operate and UNMIK was sometimes perceived as a *'colonial master'* by Serbs (Kellerman, 2006). Especially problematic in this respect is the field of education. Serb teachers follow Serb curricula, sometimes obtaining double salaries from both Serb and Kosovar authorities which manifested in a conflict on the signing of labour contracts of teachers in 2004 (Kellerman, 2006).

In the UNMIK Administrative Direction No. 2002/2 (dated 14th February 2002, signed by the Special Representative of the UN Secretary-General, Mr. Steiner) it was outlined that a higher education facility is provisionally established which provides instruction in Slavic languages, labelled 'North Kosovo University (NKU)' and which shall have the status of an autonomous component within the Kosovo Higher Education System. Moreover, NKU received a provisional accreditation for the academic year 2001/2002 and it was outlined that NKU falls under the authority of UNMIK and the Transitional Department of Education, Science and Technology (Wöber, 2005a). In a report of the Secretary-General of UNMIK (dated 9th October 2002), Mr. Annan criticised the vote of the Kosovo Albanian majority to delete a provision in the draft law on higher education which would have made the NKU part of a unified education system of Kosovo (Wöber, 2005a). By UNMIK Executive Decision No. 2002/14 (dated 6th December 2002, signed by Mr. Steiner) the NKU was renamed into University of Mitrovica (UM). In UNMIK Regulation No. 2003/14 (dated 12th May 2003) on the promulgation of a law adopted by the assembly of Kosovo on Higher Education in Kosovo it was determined that the Law on Higher Education shall be supplemented with a new section 10.8. which reads: *"All providers of higher education that were authorized to operate in the academic year 2001-2002 will be licensed under this Law and in conformity with international non-discrimination principles, while working to meet the standards set forth by the law"* (quoted from Wöber, 2005a, p.6). By this paragraph the UM was integrated into the Kosovo legal framework of higher education and in accordance with Article 10.6 the accreditation of the UM was automatically extended until it has been inspected by the Kosovo Accreditation Agency[9] or until 31st August 2004 at the latest (Wöber, 2005a).

The years 2002 and 2003 saw a period of a pragmatic approach to upgrade the UM in terms of standards under the authority of the new UM Rector, Mr. Gojko Savic, and his Secretary General, Mr. Ranko Djokic. Between 10th and 13th December 2002, a site visit of the EUA took place at the UM, resulting in a sober report indicating that most students and staff of the UM considered their university as a "university in exile" and awaiting the opportunity to return to the original premises (EUA, 2002b). For the majority, it was also not imaginable to have a future university financing through the Kosovar Ministry of Education, Science and Technology. Nevertheless, with support from UNMIK[10] and the Austrian Ministry of Education, Science and Culture a new draft statute for the UM has been established under guidance of Mr. Wöber and reform measures along the Bologna requirements introduced until December 2003. On 15th December 2003, the Serbian Deputy Minister of Education and Sports, Ms. Srbijanka Turajlic, commented the draft statute of the UM in a letter positively and stated that *"by adoption of this statute the UM will create the preconditions for its outgrowing into a modern university and an equal member of European Higher Education Area" (EUA, 2002a; Wöber, 2005b; Wöber, 2005a, p. 24)*. However, in view of the forthcoming general elections in Serbia the Senate of the UM decided not to discuss the Statute in the session on 25th December 2003 as initially planned. On 28th December 2003 the general elections brought a change of government in Serbia and on 22nd April 2004 the recently appointed Serbian Minister of Education and Sports,

[9] The Kosovo Accreditation Agency (KAA) began to commence its work in 2007.
[10] Especially from UNMIK's Regional Education Officer, Mr. Patrick Duong.

Ms. Ljiljana Colic, dismissed Rector Gojko Savic and installed Mr. Radivoje Papovic (the old UP rector in the 1990s) as interim rector (detailed timelines provided by Wöber, 2005a).

International protest against this decision was expressed by various stakeholder such as the International Helsinki Federation for Human Rights (according to a letter to Serbian Prime Minister Vojislav Kostunica on 8th May 2004), EUA (press statement on 2nd June 2004) and also by UNMIK (letter of UNMIK PDSRSG Charles Brayshaw to the Serbian Prime Minister on 15th June 2004) recalling the lack of legal basis of the removal of Rector Savic and the replacement with Mr. Papovic (detailed listing provided by Wöber, 2005a). Ms. Colic replied to him by letter on behalf of Serbian PM Kostunica on 5th July 2004 explaining that her action was conducted respecting the law in the same way as when Mr. Savic was appointed as Rector in 2000 (Wöber, 2005a). On 15th September 2004, the UM finally adopted a new statute in accordance with Serbian legislation of 2002, following the example of the former statute of the then UP of 1998. In Article 1 and Article 6 the university's name was referred to as "University of Prishtina", with temporary residence in Kosovska Mitrovica. In Article 7 it was stated that the stamp bears the text: *The Republic of Serbia - the University of Prishtina (Wöber, 2005a, p.28)* and in Article 36 that *"The costs of the university are covered by the Republic of Serbia as its founder …" (Wöber, 2005a, p. 29)*. Mr. Papovic was elected as new Rector of the UM on 15th September 2004. On 16th September 2004, Ms. Colic resigned from her position. The reform oriented governing offices of the UM were dismissed in the meantime.

On 20th September 2004, UNMIK informed international offices and agencies of higher education that it decided to suspend any further accreditation of the UM for the time being until the UM is re-integrated into the legitimate Kosovo legal framework (Wöber, 2005a). On 15th October 2004 the EUA also called for a boycott of the UM in a press statement. On 19th October 2004, Mr. Slobodan Vuksanovic became the new Serbian Minister of Education and Sports and on 21st January 2005, the "University of Prishtina with temporary residence in Kosovska Mitrovica", reflecting the data of the UM, was listed as one out of six Serbian universities in the National Report 2004-2005 of the Serbian government about the Bologna process (Wöber, 2005a). On the international level, however, the UM remained isolated. Diplomas issued by it are neither recognised in the EU nor USA. International exchange programmes for students or staff were stopped and any international support for the UM has been put on ice or terminated (Wöber, 2005a). On 15th May 2006, Mr. Winckler, the President of the EUA stated in a letter to Mr. Ahtissari, Special Envoy for Kosovo*: "However, both UNMIK authority under Security Council Resolution 1244, and principles of institutional autonomy were violated by the Serbian Minister of Education's decision in 2004 to remove the Rector, and impose the former rector of Prishtina University. Since this time, the status of the university and its role in future provision has failed to be resolved"* (EUA, 2006).

After the election of a new UM rector, Mr. Zdravko Vitosevic, it was decided by UNMIK Executive Decision no. 2007/17 of 11th March 2007 to grant an extension of the accreditation of the UM until summer 2008, not at least to create a better position in the status negotiations. By doing this, the Kosovar authorities confirmed their responsibility for supporting higher education for its Slavic population and, of course, aimed to demonstrate its legal authority over the university. The political effect of this approach was close to zero. After this initiative by MEST, EUA soon followed with an offer for cooperation in a letter sent by EUA President Mr. Georg Winckler to Mr. Vitosevic on 15th March 2007 (EUA, 2007), which was reconfirmed at a meeting in Brussels between the UM, the EUA, OSCE, European Commission, the Council of Europe, the Stability Pact, the European Students Union and SPARK in October 2007. At least, the implementation of Bologna process standards and requirements started at the end of 2006 and in 2007. ECTS was introduced with the help of OSCE. The transformation of curricula is still ongoing.

In an interview given to Nature (Nature, 2008) after the declaration of independence of Kosovar authorities on 17th February 2008, Mr. Aleksander Jovanovic, the vice-rector for science and international relations of the UM, confirmed that the UM is dedicated to stay with Serbia and to continue its operations as a Serb university. As an argument he also used the strong economic importance of the UM with its 10,000 members in a region of around 100,000 Serbs: an economic fact, which had already been stressed by the EUA five years before (EUA, 2002b).

Since the UM is currently under full operational control of Belgrade, both in terms of budget allocations and a disputed legal framework, which is contradicting the Kosovo legislation, it is in the middle of a political game. Its annual budget requirements are estimated to EUR 10 million (see, Nature, 2008), a sum which - in case of very unlikely delivery under Kosovar control again - could not easily be borne by the MEST against its total yearly budget estimated between EUR 23 million (Wöber, 2005a) and EUR 30 million (MEST Kosovo, 2005b).

In 2006, the European Stability Initiative (ESI) has suggested the establishment of a new, multi-lingual university in Mitrovica along the model of the South East Europe University in Tetovo, and under the Kosovo legal framework. OSCE has conducted a preliminary feasibility study on this issue and the discussion of this idea was 'boiling hot' for a couple of months (see also the contribution of Wöber, 2006) during the international conference on "Higher Education for Minorities in Kosovo", held in Prishtina on 18th May 2006). The idea, however, soon vanished from the discourse. A humble but reputed attempt to bridge between the minorities is done by SPARK (formerly ATA - Academic Training Association) by reserving some places for Serbian Students from the UM in the (almost annual) International Prishtina Summer University.

These days, an estimate of around 10,000 students are enrolled at the UM. It consists of 10 faculties, including faculties for science, medicine, engineering, economics and agriculture, served by 700 to 800 faculty and staff members (University of Mitrovica, 2007) and 200 persons in the administration. Two of the 10 faculties are in Serbia. Many of the staff members are commuting to Mitrovica from different locations in Serbia. The staff receives a 100% "Kosovo bonus" to work and teach at the UM (Nature, 2008). Little research work is done, not at least due to an obsolete scientific infrastructure. There are no scientific collaborations between the University of Prishtina and the University of Mitrovica. For the time being, only 46 small scientific projects are carried out, many of which, however, were already started before 1999 (Nature, 2008). Due to its de facto inclusion into the Serbian system of higher education at least a few opportunities for scientific research collaboration seem to be available and little progress could be made since the harsh assessment of research activities by EUA in December 2002[11]. The UM, for instance, received a research grant under the Southeast European ERA-NET (SEE-ERA.NET) (see-science.eu e-journal, 2007). It also has collaborated in material sciences with the Queens University in Ontario, Canada, and partnerships with a few universities in Serbia, FYR of Macedonia, Greece and Bosnia-Herzegovina (Nature, 2008). According to Mr. Jovanovic, health and environmental issues related to the mining activities in the region could be a priority for future research activities (Nature, 2008).

Other Higher Education Institutions

At the beginning of February 2008, 32 Higher Education Institutions (HEI) are operating in the territory of Kosovo, including the UP, the UM and the American University in Kosovo. All but the latter are supposed to operate in accordance with the Bologna Process. The remaining 29

[11] There it was stated, that *„... a university with no possibility to undertake even the most basic research cannot lay claim to the title of university. An institution with no library and no communication with external academic community can scarcely live up to the title of educational institution"* (EUA 2002).

licensed private institutions are offering ISCED level 5+ awards. 19 bear the title “university” or “University College” (see Table 5.1). The number of faculties in each institution ranges from 1 to 11. In total 17,809 students are enrolled in these private HEI in the academic year 2007-2008. Most of these private HEI offer applied studies in the field of economy, informatics and law. The low coverage of natural sciences is striking.

Table 5.1: Private Higher Education Institutions in Kosovo (Feb. 2008) - ranked by number of enrolled students

Name of Institution	Number of Faculties	Number of Students (2007-2008)
Universiteti AAB	11	4876
Kolegji Universitar Fama	5	4570
Universiteti Mbreteror Iliria	5	1938
Universiteti Dardania	7	1720
K. Universitar Vizioni Evropian	5	771
Kolegji i Biznesit	3	549
Kolegji Universitar I Gjilanit	8	502
Universiteti I Prizrenit	7	448
Universiteti I Shkencave Organizative Pjeter Budi	4	429
AUK	1	424
UBT	5	377
KFU	3	355
Kolegji Universitar Universum	4	292
Universiteti i Sh. Mjekesore Rezonanca	5	287
Universiteti International I Prishtines	5	152
Kolegji Universitar Victoria	2	107
Kolegji Universitar Templi	2	96
Universiteti Riinvest	3	89
Kolegji Universitar Eurosport	1	76
Istituti I Modes Evolucion	4	54
Akademia e Studimeva te Avancuara ASAU	1	33
Shkolla Design Factory	1	30
Kolegji Universitar Ameri-Kos	1	28
Akademia e Aktrimit	2	20
Fakulteti Faik Konica	1	?
Fakulteti Ekologise	1	?
Istituti I Fotografie dhe Filmit Gjon Milli	1	?
Akademia per Film, Televizion dhe Radio	1	?
Istituti Nic Holding	?	?

The expansion of private HEI boomed especially under the terms of Minister Osmani and Minister Veliu. Private universities were seen as a means to overcome the monopolistic position of the UP. This attitude was especially supported by the USA: *“The only way I can see to raise your enrolment is to have more universities in Kosovo. What you do not need is one giant university that controls everything and that works without competition from other universities”* (McClellan, 2003).

The relatively high number of licensed private HEIs is absolutely unusual in Europe, especially for a country with only 2 million inhabitants, and there are profound doubts that the huge majority of them have a justified substance to be labelled university. In Section 8.2 of the Law on Higher Education in Kosovo, it is clearly stated the *"the title 'university' may be granted under the provisions of this Law only to an accredited provider of higher education with an independently audited enrolment of at least 3000 full-time-equivalent students and providing courses or programmes in at least five different subject groups as prescribed in administrative instruction to be issued by the Ministry"* (UNMIK, 2003). However, in 2004, Minister Osmani demanded a reduction of the number of full-time-equivalent students to at least 500 and a provision of courses or programmes in at least three different subject groups. It should also be mentioned, that some of the HEIs are suspected of money laundering. According to Wöber (Wöber, 2006: p.17), *"the private university system of Kosovo - so far - is no success story, it rather exceeds the worst expectations".*

In February 2008, Minister Hoxhaj decided that an ad-hoc commission should review all HEIs until May 2008, including their scientific and research activity. The board of the Kosovo Accreditation Agency postulated, that academic staff of any higher education institute has to carry out scientific research. It was, thus, decided to evaluate the scientific and research activities on the basis of:

- the number of publications in the last 3 or 5 years
- the number of quotes by other authors
- total number of submitted projects in the last 3 or 5 years
- total number of implemented projects in the last 3 or 5 years
- the participation in seminars, conferences, symposia (national and international) in the last 3 or 5 years
- total number of organised scientific events in the last 3 or 5 years
- visiting lecturers from abroad
- relatedness of research with regional and national needs and
- awards for scientific and research activities on a national and international level (quoted from the minutes of the 4th Meeting of the National Quality Council of the Kosovo Accreditation Board of 14th February 2008)

Although data has to be first recorded, it is definitely not likely, that the level of scientific and research activity of the private HEI will be better than the poor one of the University of Prishtina.

The Kosovo Academy of Science and Arts

According to the Law on the Academy of Science and Arts of Kosovo, the Kosovo Academy of Science and Arts (KAS) should be *"the supreme institution of science and arts in Kosovo"* (Article 1, Assembly of Kosovo, 2004). Its homepage (assessed on 21st July 2007) reveals the picture of a learned society consisting of honorary men. According to Article 16 of the Law on the Academy of Science and Arts of Kosovo being a member of the Academy is a permanent membership. The Academy Law foresees a special status of the Academy of Science and Arts of Kosovo as an independent institution in the area of science and arts, however, with special public and national interest, which is expressed in exercising its activity in the area of science and art, including cultivation, stimulation and development of scientific thinking and artistic creativity (Article 2). Article 5 and Article 26 state that its assets and activities are financed from the budget of Kosovo. Article 26.3, however, limits this general statement, by regulating that the Academy's projects are financed under tendering processes. It can also receive funds from donations and sponsors and is entitled to use them for supplementary activities (Article 26.4).

The main purpose (Article 6) of the Academy is to promote scientific thinking and artistic creativity by means of

- being a suggestive and consultative institution for the development of science and art complying with the needs of Kosovo's development
- evaluating existing circumstances and proposing measures to advance scientific thinking and to improve the quality of artistic creativity
- reviewing general problems in the areas of scientific activity and artistic creativity
- participating in creating scientific activity and artistic creativity policies
- organising scientific and cultural events
- publishing its own regular and periodical publications
- conducting internal and international cooperation
- creating conditions for exchange of scientific thinking and artistic creativity with abroad and
- improving the working conditions for the Academy members.

By reviewing the Law, it seems that the Academy of Science and Arts is more a consultative institution than a pure scientific research institution. Its division of labour with the Kosovo Council of Science seems to overlap, not at least because the president of the Academy also presides the Council of Science.

Despite its status of being an independent institution (Article 2.1), a strong interface with governmental policies in form of an executive governmental agency can be assumed, especially referring to Article 8d-f. There it is stated, that the Academy has the right and responsibility to carry out projects with the purpose of building the overall development strategies of the county and their implementation in practice (Article 8d) and to work in joint projects of studying and developing cultures in Kosovo (Article 8f). The two paragraphs above receive a slightly different connotation in connection with Article 8e, where it is stated that the Kosovo Academy of Science and Arts has the duty and responsibility to "*work in joint projects with similar institutions in Albanian territory* (sic.)*, with the purpose of preserving, protecting and developing the values of national cultural and linguistic inheritance of the Albanian people and building its future".* It seems that the Academy is engaged in some kind of "state" building. The absence of any hint on academic freedom in the Law on the Academy of Science and Arts of Kosovo aggravates this impression. The true mission and orientation of the Academy will be revealed in real practical terms by its future activities. By now, however, its scientific work seems to be rather limited. The Academy is involved in the Inter-Academy Council for South-East Europe and is a member of ALLEA ("All European Academies").

The Institute of Albanology in Prishtina

Next to the Academy of Sciences, the Institute of Albanology in Prishtina, gains the highest reputation as a non-university scientific research organisation in Kosovo. It is an independent public research institute to study *"the spiritual and material culture of the Albanian nation"* (Institute of Albanology, 2007). Like the Academy it serves the interest of nation building.

The Institute of Albanology (IA) was established in the Socialist Republic of Yugoslavia on 1st June 1953. It had its heyday in the 1960s and 1970s. After 1981, however, the overall work of the IA became subjected to political monitoring and assessment and cooperation with scientific institutions in Albania was interrupted. On 25th December 1995 the IA was closed down and forced to continue its operation "underground" thanks to private donations. In June 1999, the IA returned back to its research and scientific work, which is organised along five branches:

1. the Linguistics branch with the sectors of Dialectology, Lexicography, Language Culture and Onomastics
2. the Literary branch
3. the Folklore branch with sectors of Folk Literature and Ethno-musicology
4. the History branch with sectors of History and Archaeology
5. the Ethnology branch

Nowadays, its staff of 35 researchers, headed by its director Mr. Sadri Fetiu and supported by 14 additional administrators, works on more than 40 collective and individual projects (Institute of Albanology, 2007). The regular publications of the IA are "Gjurmime albanologjike" (Albanological Research) and "Gjuha shqipe" (Albanian Language).

The Institute of History

Another institution working in the field of scientific research is the Institute of History. In the last years (cut out sentence) a good deal of the earmarked budget was spent for construction and refurbishment work to create the physical infrastructure for scientific operations. Most of the few research activities of the Institute of History are in fact only mobility scheme-based (for example, several visits to libraries and archives in Albania and FYR of Macedonia). In 2005, the Institute had a few edition projects and it also organised symposia, many of which are clearly oriented towards national identity issues, such as *"The Resistance of Nationalists in Ethnic Albania and Diaspora against Yugoslav Invaders during 1945-1990"* in Shkoder, *"Kosova in the World War II"* in Prishtina, *"Bajram Curri - a significant person in the national democratic movement"* in Gjakove, *"Gjergj Kastrioti - Skenderbeu and his Époque"* in Prishtina and *"Mehmet Ali Pasha - Misiri Founder of Modern Egypt"* in Prishtina. (all organised in 2005 by the Institute of History, full list see MEST Kosovo, 2005b).

Kosovo Standardisation Agency and Department of Metrology

An important technology-based organisation to foster economic growth, especially through foreign trade, is the Kosovo Standardisation Agency, which works under the Ministry of Trade and Industry, however, still understaffed and not yet fully operational. Until the end of 2007, 171 European standards have been adopted as Kosovo standards and four technical committees have been established in the fields of construction products, liquid fuels, quality management systems, and transport and telecommunications. There are 12 testing laboratories in the process of accreditation, but at present no conformity assessment bodies have been either accredited or designated in Kosovo. In addition, the Ministry of Trade has a Department of Metrology in process of establishment, which will act as an executive agency. The necessary implementing legislation has been adopted and a first private laboratory was licensed for the preparation of measuring units for verification in December 2006. Preparations are underway to build a central calibration and verification laboratory of metrology within the Ministry of Trade and Industry (all information taken from (European Commission, 2007).

Other Institutes with Research Components

There are a few other institutes appearing from time to time in grey literature or on some websites, which are supposedly also conducting to a certain extent scientific research, however, obviously not as a core activity. Neither the status of these institutes, their resources nor their missions have become clear to the author. Among these institutes, the following should at least be listed (see also UNMIK/MEST, 2003):

- Institute of Public Health (IPH). Some Kosovar microbiologists from the IPH were trained at the National HIV and Retrovirology Laboratories in Ottawa, Ontario, part of the Public Health Agency of Canada. Plans were reported to take measures for reconstructing three laboratories necessary for appropriate polymerase chain reaction testing (USAID, 2005a).
- Institute of Livestock Raising and Veterinary, Prishtina
- Institute of Crops Processing and Sapling, Peja
- Institute of Chemistry, Prishtina
- Institute of Agro-economics, Fushe

6 International Donors

Many donor organisations and implementing agencies are active in Kosovo. The investment share of donors in Kosovo is significant, but it has been decreasing from a 14% share in total investments in 2005 to 11% in 2006 (European Commission, 2007). Donor coordination has been generally weak. In February 2007, the PISG established a donor co-ordination steering committee, designing strategic policies on donor coordination. A donor coordination centre was set up in the Prime Minister's office to ensure coordination among the ministries and to function as the committee's secretariat. According to the EC (European Commission, 2007), the established Agency for European Integration, which is responsible for the co-ordination of EU pre-accession assistance in Kosovo, is increasingly fulfilling its role as co-ordination body for EU integration measures. In 2003-2005, the overall grant assistance to Kosovo totalled EUR 769 million. An additional EUR 169 million was to be expected for 2006. In addition to grant financing, the EBRD and the European Investment Bank are lending to the private sector in Kosovo (2006 EBRD: EUR 17 million; EIB EUR 20 million) (data cited from OEZA, 2007). The European Commission is by far the biggest donor in Kosovo, followed by the EU Member States (especially Austria, Finland, Germany, Sweden, Switzerland and the UK) and the USA. The latter seems to be most acknowledged by the majority of Kosovars, not at least because of its leadership in the 1999 intervention.

EC assistance under the Community Assistance for Reconstruction, Development and Stabilisation (CARDS) instrument, implemented by the European Agency for Reconstruction, amounted to some EUR 170 million, involving over 80 projects (European Commission, 2007). 2007 is the first year of the Instrument of Pre-Accession Assistance (IPA), which replaced CARDS. In June 2007 the first Multi-Annual Indicative Planning Document for Kosovo for the period 2007-2009 (amounting to EUR 68.3 million) was approved. Key priorities include the strengthening of administrative capacity, enhancing rule of law, human rights and good governance, improving socio-economic conditions for all communities and developing regional co-operation. IPA assistance will be implemented by the EC Liaison office (European Commission, 2007).

As regards the field of education in general, most short-term assistance immediately after the war was provided by the Japanese government together with UNICEF (8 million dollars in 2000), followed by ECHO/EC (7 million dollars in 2000) and IDB and Danida (each 6 million dollars in 2000) (CEPS, 2000). The amount of average yearly donations to the field of higher education is estimated to be slightly below EUR 3 million (MEST Kosovo, 2005a). In the field of higher education, OSCE and Austria can be considered as the most sustainable donors.

The OSCE Mission in Kosovo (OMiK) is one of the central institutions in the field of Higher Education in Kosovo. Its mandate in higher education is derived from its UNMIK Pillar III mandate of Institution Building. Through its Youth and Education Support Unit (YESU), which is part of the Department of Democratisation, it provides technical assistance. Among its

intervention lines it supported:

a) the re-installation of lawful governance at the University of Prishtina and the OSCE-chaired Expert Group (Mr. Jens Modvig, OMiK Deputy Head of Missions), which supervised the full-scale re-election process to redress irregularities and cases of non-compliance with the legal framework during elections at the UP between 9th July and 1st December 2004
b) a project aimed at strengthening the financial management capacities of the UP
c) hands-on training for the UP's newly established European Credit Transfer Systems (ECTS) Coordination Unit
d) the establishment of information hubs for students to promote more active student participation in the University's academic programmes
e) the development of an alternative concept for public higher education in Slavic languages with distant learning elements by engaging the consultancy of Mr. Georg Wöber
f) measures fighting unlawful politicisation and corruption within Kosovo higher education institutions by launching a project directed at the UP Student Parliament in capacity building.

In 2007 there was a continuous focus on university reform, to advise both the MEST and the UP and to examine a transitional year programme both for minorities wishing to study through the Albanian language at the UP, as well as for secondary-school graduates ill-prepared for university studies. Acting head of YESU is Mr. Christophe Pradier. The Higher Education Project Manager in this unit is Mr. Matthew Hartman (OMIK, 2006). OMiK also supported the implementation of a quality assurance group at the UP in 2007, whose further financing is currently (as of February 2008) under question mark.

As a single country, Austria can be considered as the leading European country in terms of assistance to support the reforms of the higher education sector in Kosovo. This was immediately done after the war by using the services of World University Service Austria (WUS). WUS was the first international NGO supporting academic staff and students at UP during 1999 and remained in operation with an acting office located at the UP until now. Funded by the Austrian Ministry of Sciences and a few other donors, WUS-Austria distributed "start-up kits" for each faculty of the UP which included computers, a copying machine etc. already in 1999 (Pichl and Leutloff, 1999). Its main support until 2007, mostly funded by the Austrian Development Cooperation, was in the field of:

- Provision of small grants to update and modernise teaching courses (Curriculum Development Programme)
- Provision of medium grants (around EUR 20,000) to enable the procurement of technical devices (Centre of Excellence Programme)
- Provision of grants to support short-term teaching stays of foreign or emigrated professors at the University of Prishtina (Brain Gain Programme)
- Support to introduce eLearning at the University of Prishtina and
- Student counselling.

Since 2008, also a pilot master study development programme is offered by WUS-Austria. These activities are entirely confined to the University of Prishtina. WUS-Austria is also active under the TEMPUS-programme, for instance as regards the support for a business-start-up facility at the UP.

In order to formalise and to enhance the bilateral cooperation, an umbrella framework

agreement between the Austrian Minister for Foreign Affairs as well as Education, Science and Culture on one hand and UNMIK/Kosovo on the other hand has been established in 2006. The purpose of this framework agreement is to initiate and to steer a sustainable cooperation between Austria and Kosovo in the field of higher education and research. As a first result a multidimensional project for the implementation of institutionalised partnership between Austria and Kosovo in the field of higher education, research and innovation was negotiated (the PAIK project). This EUR 3 million project became operational as of winter 2006/2007 and is considered to be the most structural intervention in this field. It lasts until the end of 2009 and comprises nine modules:

1. Establishment of the Kosovo Accreditation Agency (KAA)
2. Establishment of the Centre for Innovation and Technology Transfer (CITT)
3. Establishment of the Kosovo Centre for International Higher Education and Technology Co-operation (K-CIRT)
4. Support for the ENIC
5. Support for the Kosovo Council of Research and Technology
6. Promotion of collaborative RTD projects
7. Fellowship Programme
8. University Twinning
9. Sector Programming

The Austrian Development Agency (ADA) contributes the largest budget share to this project, which is implemented by the Austrian consultant and university professor Mr. Johann Günther. It is in accordance with the Austrian Development Cooperation Programme for Kosovo 2007-2010 (OEZA, 2007), where it is stated:

- "*to support the establishment of a well-functioning (higher) education system on the basis of European standards and values as laid down in the Lisbon strategy and the Bologna Declaration;*
- *enhance both capacities and quality standards of the educational system including RTDI;*
- *strengthen public institutions in the field of education by securing good governance on all levels;*
- *increase the practical relevance of educational programmes, especially regarding employability;*
- *benefit the most disadvantaged groups, especially the young"* (OEZA, 2007, p.16).

Parts of the multidimensional project are also directly supported by the Austrian Ministry of Science and Research, both in terms of funding and intelligence inflow. As regards the field of scientific research, the Austrian Ministry of Science and Research was launching through its Austrian Science and Research Liaison Offices (ASOs) network an open call for proposals in October 2007 to support RTD collaboration between researchers from Kosovo, Austria and at least one additional country in Southeast Europe. The response to this call was high. 30 project proposals were submitted, but around half of the submitted proposals could not surpass the eligibility check despite the lack of complex formal requirements, which indicates the necessity to upgrade the proposal preparation and proposal writing skills of Kosovar researchers to average European standards. The ASO holding organisation in Vienna, the Centre for Social Innovation (ZSI) was responsible in designing the multidimensional project for the implementation of institutionalised partnership between Austria and Kosovo in the field of higher education, research and innovation (Schuch, 2006).

One of the largest projects implemented at the UP was developed specific to teacher training.

CIDA (Canadian International Development Agency) provided funds and expertise through KEDP (Kosovo Education Development Project) to modernise teacher training in Kosovo. It was aimed to

a) bring to Kosovo pedagogical experts from the University of Calgary to train local facilitators
b) send several groups of Kosovar teachers to Canada for teacher training, and
c) send officials and advisors from the MEST to Canada to observe teacher preparation (Anderson and Breca, 2005).

The project implementation was confronted with a lot of difficulties. Initially it was agreed to create a new Faculty of Education at the UP in 2001. That same year, the Senate of UP approved a new teacher education curriculum, and in 2002, opened its new Faculty in four urban centres: Prishtina, Gjilan, Gjakovo, and Prizren. However, soon after a change oriented Dean was appointed at the new faculty, within short order the faculty voted to remove the newly elected Dean and replaced him with a Dean who was reluctant to accept the new teacher preparation initiatives. Change in the teacher preparation programme in Kosovo had effectively come to a halt (Anderson and Breca, 2005) and only after the turmoil regarding the appointment of a new rector (in 2006) of the UP, the project is again progressing.

Another big overseas player is notably USAID. Between September 1999 and September 2004, over 238 million USD were committed by USAID to the reconstruction of Kosovo. Operating under a five-year strategic plan for 2004-2008, USAID/Kosovo focuses on measures for economic growth and democracy and governance. In the field of higher education, a Higher Education Collaborative Partnership Programme with Kosovo and Nigeria was issued in 2006 with the overall goal to strengthen the capacity of higher education institutions to teach, train, conduct research, and promote community service (Higher Education for Development, 2006). The focus in Kosovo is on the implementation of a graduate degree programme in accounting at the UP with a budget of up to USD 350,000 and on the establishment of a Centre for Energy and Natural Resource Development at the American University of Kosovo (AUK) with a budget of up to USD 400,000.

On the side of the Europeans, there are a few other players, whose efforts, however, are sometimes much more decentralised and, thus, more difficult to grasp. Germany is a good example for this, where several players (for example, several individual universities) across several ministries and federal provinces are operating. More easily to follow-up are the activities of the Dutch, since they are implementing a big share of their activities in the field of higher education through SPARK. SPARK, the former ATA (Academic Training Association), is an NGO with its headquarters in The Netherlands. Comparable to WUS-Austria, it has local offices in the region of the Western Balkan Countries. Unlike WUS-Austria, however, it is the only explicitly higher-education oriented NGO with an office in North Mitrovica. Its main activities include the promotion of Bologna rules and standards and direct support for students (for example, via the organisation of a yearly summer school and business-plan competitions for students).

It goes without saying, that other European and international donors (such as Italy, the UK, EUA, SOROS and the European Rectors Conference) have been and are still active in the field of higher education in Kosovo, but the available resources did not allow for the completion of activities. Thus, the selection of donors above reflects just the assessment of the author, probably with an ‘Austrian biased’ perception.

7 Conclusions

By now, neither a research nor an active innovation policy can be traced in Kosovo. This is not surprising. Especially as regards the vast field (and demands) of research, Kosovo is too poor, to enter this field with juvenile effusiveness. By now, the interventions of the MEST were rightfully mostly focused on higher education, first of all on teaching related aspects (under the spotlights of the Bologna process) and also concentrated on some structural, administrative and management issues, refraining, however, from interventions in the field of scientific research.

Kosovo is not in the position, not in the next 10 years, to establish a full-fledged system of research. A focus on certain starting points is essential and should be taken with great care. Right from the beginning a strong interaction with social and economic objectives should be sought and ensured. If the beginnings of scientific research are capable to respond to business and social demands, then the sector will gain importance and recognition and the seeds for more economically and social distant scientific endeavours can be spread. Firstly, however, research should contribute to economic growth and well-being before it becomes a beneficiary of economic growth and social well-being. Thus, the general spirit of the present Law on Scientific Activities should be reviewed. It should also be openly discussed, if the meagre budget appropriations for scientific research, which are currently under way, are channelled in the right directions. The notion on state-, identity- or even "nation"-building is understandable, but it is by far not sufficient for a modern research agenda. A temporarily sub-ordinance of research under the conceptual framework of an active innovation policy should be approached. This would request, however, a much closer coordination with other stakeholders, notably the ministries responsible for economic and social affairs and the NGO scene as well as the Chambers of Commerce.

Another significant issue is an active opening towards European activities. This should not be confined to the issue of technology transfer, despite its immanent potential importance for radical economic jumps. Examples of other Western Balkan countries have shown how important the participation in the European Framework Programme for RTD is for the transfer of modern scientific methods and knowledge in order to create connectivity points for further state-driven excellence developments. But also the transfer of structural issues, for example, through the establishment of transparent processes in terms of calls for proposals and the introduction of evaluation standards, as well as the transfer of research management standards can be regarded as essential elements for self-help and continuous performance improvements. These aspects, however, are not limited to the European Framework Programme for RTD, but are also relevant for other programmes and initiatives such as CEEPUS, CIP or COST.

The future developments, including intended and unintended positive or negative results, should be carefully monitored to draw the right lessons in due time. Since it will definitely not be possible for Kosovo to follow a "broadband policy" in science and technology, a selective strategy in terms of establishment of national Centres of Excellence should be pursued. In this respect, an international division of labour (for example, through twinning mechanisms or shared undertakings) should be established right from the start. Such an effort should go along with a longitudinal international benchmarking procedure, in order to build up capacities, to learn from best practices and to have enough evidence to make the right decisions to steer the developments[12], not at least in terms of budget allocations. International advice and international cooperation should be identified for such a purpose and an early integration in international networks established.

[12] The RECORD manual provides a handy format to benchmark innovative research organisations (see Borsi, 2004)

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9 List of acronyms

AAK	Alliance for the Future of Kosovo
ADA	Austrian Development Agency
ATA	Academic Training Association
AUK	American University Kosovo
CARDS	Community Assistance for Reconstruction, Development and Stabilisation
CIDA	Canadian International Development Agency
CITT	Centre for Innovation and Technology Transfer
Danida	Danish International Development Agency
EBRD	European Bank for Reconstruction and Development
ECHO	European Commision Humanitarian Aid
ECTS	European Credit Transfer Systems
EHEA	European Area of Higher Education
ESI	European Stability Initiative
EUA	European University Association
FP7	Seventh EU Framework Programme for R&D
HEIs	Higher Education Institutions
IDB	Islamic Development Bank
IA	Institute of Albanology
IHP	Institute of Public Health
IPA	Instrument for Pre-Accession Assistance
IPR	Intellectual Property Rights
ISCED	International Standard Classification of Education
KAA	Kosovo Accreditation Agency
KAS	Kosovo Academy of Science and Arts
KBPT	Kosovo Bologna Promoters' Team
K-CIRT	Centre for International Higher Education, Research and Technology Cooperation

LDK	The Democratic League of Kosovo
MEST	Ministry of Education, Science and Technology
NKU	North Kosovo University
OmiK	OSCE Mission in Kosovo
OSCE	Organization for Security and Co-operation in Europe
PDK	Democratic Party of Kosovo
PISG	Provisional Institutions of Self Government
R&D	Research and Development
RAE	Roma, Ashkali and Egyptians
RTD	Research and Technological Development
SEE-ERA.NET	FP6 project “Southeast European Era-Net”
SPARK	an independent non-profi foundation on the field of Higher Education (formerly ATA - Academic Training Association)
SRSG	Special Representative of the Secretary General
TEMPUS	Trans-European Mobility Scheme for University Studies
UM	University of Mistrovica
UN	United Nations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNMIK	United Nations Interim Administration Mission in Kosovo
UNMIK/Kosovo	The United Nations Interim Administration in Kosovo Acting on behalf of and for the benefit of The Provisional Institutions of Self-Government in Kosovo
UNSCR 1244	United Nations Security Council Resolution 1244 of 9 June 1999
UP	University of Pristina
USAID	United States Agency for International Development
WUS-Austria	World University Service Austria
ZSI	Zentrum für Soziale Innovation (Centre for Social Innovation, Austria)

The Project

The Information Office of the Steering Platform on Research for Western Balkan Countries (see-science.eu) acts as a source of high quality targeted information on research in the Western Balkan countries (WBCs) by supporting the Steering Platform through a regular eJournal, analytical studies and reports and directories.

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