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Information compiled by:
Maruška Bračić
Elke Dall

Reviewed by:
Florian Gruber, Centre for Social Innovation
Ammar Mirascija, National Information Point for the Framework Programmes in Bosnia and Herzegovina

Proof Reading by:
Chloe Blackmore


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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 BiH. For the complete list of references please see References in chapter 7, starting on page 30 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 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 and reviewed by the following actors:
Mr. Florian Gruber, Centre for Social Innovation, Vienna, Austria
Mr. Ammar Mirascija, National Information Point for the Framework Programmes in Bosnia and Herzegovina

1.1 Bosnia and Herzegovina – A Brief Profile

Bosnia and Herzegovina is a small economy 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 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: the Bosniak-Croat Federation of Bosnia and Herzegovina and the Bosnian Serb-led Republic of Srpska. There is also the self-governing

[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.

district of Brčko, which remains under the sovereignty of the central-state government. In accordance with the Dayton Peace Agreement, a Peace Implementation Council was established and a UN-mandated High Representative appointed, in order to 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 "Dayton Peace Agreement" includes the constitution in force (European Commission 2006b).

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 during the initial years after the war 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 the year 2003 due to a severe drought. Growth in the year 2004 rose to 5.1 % and is expected to grow at rates around 6 % between 2005 and 2008. GDP has more than tripled since 1995 and had climbed to 70 % of its pre-war levels in 2005 (USAID 2005).
The service-sector accounts for the largest part of the economy, 62 % of the 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 equalled 85 %. However, this high 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 2006b).
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 January 1, 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).
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 after accounting 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).
As regards he 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 2006b).
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).

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. Although at this stage there is no contractual instrument between the EU and 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. However, the conclusion of the negotiations is dependent on Bosnia and Herzegovina's progress in implementing key reforms (European Commission 2006a).
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 the guarantee of 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 responsibility, is ultimately unsustainable, and is impeding economic growth. It left the BiH State government small and with only limited competences. Thus, a consistent and co-ordinated vision of the country's future as a modern state is highly necessary (USAID 2005).

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 between 1991 and 2000 (mainly through the ECHO, PHARE and OBNOVA programmes)[2] focussed on refugee programmes and reconstruction.
- EUR 312 million was allocated through the CARDS programme (the EC's main financial instrument for the Western Balkans) between 2001 and 2004, with focus shifting from post-war reconstruction to institutional capacity-building and economic development, i.e. putting Bosnia and Herzegovina in a better position to fulfil its own responsibilities as a state, particularly taking responsibility 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).

Programming for the preparation of the future Instrument for Pre-Accession Assistance (IPA) during the period 2007-2013, of which BiH is also a beneficiary, is ongoing. The IPA aims to provide targeted assistance to EU candidate countries and potential candidate countries, and will entirely replace CARDS and other pre-accession financial instruments. The programming will have 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 will apply to potential candidate countries (including BiH). The IPA will allocate over EUR 11 billion during the 2007-2013 period (SEE-science 2006).
Even though science is not among the main objectives of the IPA, support of S&T infrastructure and related activities is envisaged. This significant change is mainly a 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 EC officials. Hence, 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. 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

[2] Please see List of Acronyms

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).
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 as loan and EUR 40 million as grant). This assistance was followed by a similar allocation in 2002. This assistance is dependent on both political conditions and the IMF's economic standards (European Commission 2006b).
Despite the absence of formal contractual relations, the European Union remains 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).

2 Contemporary Institutional Landscape

The BiH state-level government was granted limited powers under the Dayton Peace Agreement, although the government 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 2006b).

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 (S&T). At present there are three levels of political and administrative competence 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 competence 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.

Unlike at the state-level, both entities (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 regarding 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, Pejovnik 2006).

The Department of International Scientific, Cultural, Technical and Educational Cooperation, part of the Ministry of Foreign Affairs, was responsible for the international cooperation in projects such as SEE-ERA.NET, because at the time that such projects started, the Ministry of Civil Affairs did not have its current mandate (i.e. to take over international obligations, etc.) (Dall 2006).

Table 2.1: Main S&T Stakeholders in the Federation of BiH[3]

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
Further Ministries Involved	- Ministry of Trade - Ministry of Agriculture, Water and Forestry - Ministry of Energy, Mining and Industry - Ministry of Health - Ministry of Finance - Ministry of Transport and Communications
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 out-dated. Efforts are being made to improve the conditions in higher education through the adoption of a state-level law (which has yet to be adopted) and harmonisation of entity 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[4] to support research projects but it lacks relevant statistics and data on R&D activities (scientific manpower,

[3] There are also several ministries on canton level dealing with Science and Technology.
[4] Around EUR 900,000, www.oanda.com/convert/classic

finance, infrastructure, scientific publications, patents) in the Federation (Papon, 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[5] to support research projects based on expert evaluation under the responsibility of the Academy of Sciences and Arts of BiH (ANUBiH). Minister Turkusić has been commissioned by the BiH Ministry of Civil Affairs to draft the new 'Law on Science' (the first draft has been available since the beginning of 2006 and is under discussion) (Papon, Pejovnik 2006).

Table 2.2: Main S&T Stakeholders in the Republic of Srpska (RS)

Main Ministry in the Republic of Srpska responsible for S&T	- Ministry of Science and Technology
Further Ministries Involved	- 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
Universities of the Republic of Srpska	- University of East Sarajevo - University of Banja Luka

Within the Republic of Srpska, issues of science and technology are dealt with by the Ministry of Science and Technology, which dedicated 80 % of its budget (approximately BAM 3 million[6] 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 inside the higher education institutions, research institutes and industry (Papon, Pejovnik 2006).

Any BiH state-level law on science should be harmonised with the existing laws in the other political entities of BiH. 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 law could prove as necessary (Papon, Pejovnik 2006).

Table 2.3: Other Important Stakeholders in S&T in BiH

- Institute for Standardisation, Metrology and Intellectual Property (BASMP) - Institute for Genetic Engineering and Biotechnology - Agriculture Institute of the Republic of Srpska - Institute of Metallurgy "Kemal Kapetanović", Zenica - Rectors Conference

[5] Around EUR 800,000, www.oanda.com/convert/classic
[6] Around EUR 1.4 million; www.oanda.com/convert/classic

- Working Group for Higher education, Quality and Modernisation (OSCE. co-chaired by the EC Delegation in Sarajevo and the Council of Europe)
- 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 in BiH (NIP-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, Pejovnik 2006).
The non-existence of an undisputed national authority with responsibilities for education and science reflects the strong resistance to the creation of a centralised administration. 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. The existing Ministry of Education and Science thus acts mainly as a co-ordinating body for education policy among the cantonal ministries, which in many cases have very little power (Federal Ministry of Education; Science; Culture and Sport of Federation of BiH). 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 encompasses the Academy of Sciences and Arts of the Republic of Srpska under its jurisdiction, whereas education comes under the remit of the Ministry of Education and Culture (Dall 2006).

In order to pre-empt stagnation of the higher education sector and to create a basis for its improvement, the Council of Higher Education was established as the first institutional mechanism in the process of rationalising the university system in Bosnia and Herzegovina. 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).

Bosnia and Herzegovina's S&T system is further based in eight universities (Sarajevo, Bihać, Tuzla, Zenica and two universities in Mostar for the BiH Federation; East Sarajevo and Banja Luka for the Republic of Srpska), several public-mission oriented research institutes (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).

2.2 International Cooperation

Countries of the Western Balkans have seen a constant renewal of international cooperation and support, especially in the last five 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. 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, UNECE[7]. 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).

[7] Please see List of Acronyms

In the first seven years following the signing of the Dayton Peace Agreement, BiH received nearly USD 5 billion[8] 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[9] 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[10]) 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 2006b).
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[11] 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 focuses on reforms in the areas of public finance and administration, private sector development and key social and economic infrastructure (European Commission 2006b).
In 2003, the European Bank for Reconstruction and Development (EBRD) signed two new projects in Bosnia and Herzegovina, granting EUR 39 million (European Commission 2006b).

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 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).
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 June 26-27, 2003. The "Action Plan", along with the "Shared Vision", defined the priorities of the research cooperation

[8] EUR 3.7 million (05.12.2006); www.oanda.com/convert/classic
[9] EUR 253 million (31.12.2005) ; www.oanda.com/convert/classic
[10] EUR 102.3 million (01.08.2002); www.oanda.com/convert/classic
[11] EUR 28.4 million (01.05.2004); www.oanda.com/convert/classic

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).
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. In March 2004, it was re-registered as a civil association and in 2006, as the Foundation for Higher Education. 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 etc. (SUS B&H 2006).
The WUS Austria has successfully realised various projects in the Western Balkans, a few of which include, Centre of Excellence Projects, Networking Infrastructure Projects, Training Courses on Project Management and International Cooperation, Internet and Computer Training Programme etc. 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).

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 the FP6[12] (Papon, 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.

Although it is obvious that Bosnia and Herzegovina could benefit a great deal from research projects funded by the European Framework Programme, a

[12] FP6 will be running up to the end of 2006. FP7 will be fully operational as of January 1, 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.

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, Pejovnik 2006). As regards the FP6 which ran between 2002 and 2006, entities from BiH could participate, with the possibility of funding within the category 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 can participate 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 projects' consortia. Partners from Bosnia and Herzegovina acted as parts of the consortia in some successful projects in the previous, Fifth Framework Programme - FP5. Under the FP6, BiH has had a significant percentage of success compared to FP5. Five projects have already been successfully completed, and a further 29 are in the process of implementation (NIP FP6 2006).

The NIP BiH (National Information Point for Bosnia and Herzegovina) is a project supported by the Republic of Austria, with the aim of promoting involvement of researchers and research organisations from Bosnia and Herzegovina in the FP6 for Research, Technological Development and Demonstration. The National Information Point (NIP) system is the first pilot project of its kind in the Western Balkan region. It actively supports the integration of Bosnia and Herzegovina into the European Research Area (ERA). The main responsibility of the NIP BiH is to provide information and advice on the participation of BiH researchers in Europe's largest fund for research and technological development: the 6th (and the forthcoming 7th) European Framework Programme for RTD, which is earmarked with several billion euros. The task of the NIP office is to provide its potential clients, mainly researchers from academia and industry, with all the relevant information and knowledge needed to get actively engaged in collaborative European research projects, and to access the European RTD funds. These services include face-to-face consultations, as well as information workshops and on-line information services and distributing information etc. Through the system of Focal Point Partners, the NIP BiH is able to run activities covering the whole territory of Bosnia and Herzegovina. The NIP's partners during the first stage of the project are universities in Tuzla, Mostar, Banja Luka, and Sarajevo (NIP FP6 2006). From 2007, BiH Contact Points are included in the project ERA WESTBALKAN +, which is coordinated by the Austrian Research Promotion Agency.

Experts highly recommend participation of BiH in the COST and Eureka Programmes, which would entitle both SMEs and academic laboratories to be involved in research and technological development activities of a wider range. Participation of BiH in these two programmes should be funded in the long term by the State Agency for Science and Technology (Papon, Pejovnik 2006) but until it's implementation, coordination and funding could come from the Ministry of Civil Affairs (or eventually the Ministry of Foreign Affairs eventually).

3 The Input Side of the National Innovation Systems

The current economic situation in countries of the Western Balkans 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 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 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), 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.[13]

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 the year 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 statistic 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 such an 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,

[13] In the EU-15 in 2000, average general expenditure for R&D was 1.93 % of GDP (against 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 Commission); see European Commission (2003a, p. 48 and 2003b). Industry-financed R&D in 2000 was 56.3 % of total R&D spending (against 68.2 % in the US and 72.4 % in Japan); see European Commission (2003).

Pejovnik 2006). Other estimates made by the country's stakeholders range between 0.05 and 0.15 %.
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) is out of function (as described in the chapter 3.2 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, 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 institutes that operate at the state level, co-operating with partners in several regions and abroad. This clearly shows that the possibility of undertaking joint tasks at the state-level does remain, despite 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, Pejovnik 2006).

3.2 R&D Infrastructure

In her survey on the national systems of research and development in the Western Balkan Countries[14], Milica Uvalić 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 (e.g. Energoinvest Company), and to a much lesser extent, at 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).

[14] For the purposes of SEE-ERA.NET Consortium – Integrating and Strengthening the European Research Area in Southeast Europe. The project was launched in September 2004, with a 60 month duration.

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 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 2006 (approximately 16.7 % or 1 billion internet users around the world, according to the latest statistics), although it does not compare to the EU average (52 % or about 240 million Internet users in 2006, according to the Internet World Stats[15]).

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 entirely disconnected BIHARNET, leaving the academic community of BiH without international connectivity. Due to the lack of any significant funding, BIHARNET has been out of function since the end of 2000 (TERENA 2003). From January 2007 onwards a new cross-border dark fibre cable provides high speed internet connection for the research community in Bosnia and Herzegovina. This initiative is part of the South-Eastern European Research and Education Network (SEEREN2) and 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 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.

[15] http://www.internetworldstats.com/stats4.htm

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 operate in Bosnia and Herzegovina, collaborating with the World University Service of BiH (SUS B&H).

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. 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 (Uvalic 2006).[16]
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 of 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. In 2006, 18 European national libraries participated as full members of the project, along with 26 other European national libraries, including BiH. 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, 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

[16] 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, M. (2006): National Systems of Research and Development in the Western Balkan Countries.)

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 exist. INASP has suggested various areas for activity, e.g. providing access to international journals, online journal services, open access publishing and archiving, regional cooperation, etc. (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 the military conflicts, recurrent economic crises, severe budgetary restrictions, industrial restructuring and other reforms accompanying the transition to a market economy. Over the last fifteen 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 Western Balkan countries', especially in Bosnia and Herzegovina, Serbia and Montenegro (Uvalic 2006).

Before 1989, the number of researchers and research institutes 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, limited other incentives etc). 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 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[17]. 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, research activity at higher education institutions is reported to be almost non-existent, since professors are mainly oriented towards teaching (Uvalic 2006).

[17] 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.

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 institutes and to invest more time in research activities (Papon, 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. 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. Referring once more to the wider region of the Western Balkans, an upward trend in patent applications in recent years has been registered (Uvalic 2006). All Western Balkan countries have recently undertaken measures in order to apply international standards in evaluating their scientific output. This chapter focuses on the results of the innovation processes and their output indicators in Bosnia and Herzegovina.

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 Bosnia and Herzegovina that have not acceded to the EPC. BiH holds a so-called "Extension state" status with the EPO – this means it recognises European patents, although it is formally not 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 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 December 1, 2003, the president of the EPO and the Minister of Foreign Trade and Economic Relations of Bosnia and Herzegovina signed an agreement on cooperation regarding patents (Co-operation and Extension Agreement). This agreement entered into force on December 1, 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 December 1, 2004, but is neither available for applicants filed prior to this date, nor for any European patents issued from such applications (EPO 2006).

The CARDS IPR project launched by the European Commission will help 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. Realisation 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 established 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 had 13 employees at the time of writing this report but the 2006 budget provides for the recruitment of 34 additional staff, with the aim of expanding to a total of 64 members. The institute is currently significantly under-resourced, undermining its capacity to perform its tasks efficiently. The institute, which is also competent for administering patents, has received three applications since the beginning of 2006 (European Commission 2006a).

The Hörlesberger survey states that around 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 (only two examiners were employed at the institute at the time of writing this report), the author only discusses the number of patent applications (in total from 1992 to 2005). The record shows that the pharmaceutical and cosmetics industries accounted for more than 70 % of all patents applied for, followed by the organic fine chemistry industry, 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 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 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 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 some is based on entity laws, and some on 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 'Law on Science' at the state-level was drafted. There have also been substantial delays in preparing some other important laws – laws which should be prepared (or harmonised) and adopted soon include the 'Law on Scientific and Research Activity' and the 'Law on University Education' (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

Papon and Pejovnik strongly recommend 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 institutes 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 science and technology policy in the country (Papon, Pejovnik 2006).

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

- the responsibility of the BiH state in the definition of a science and technology policy;
- the role and means of a state-level institution to be created for the implementation of this policy;
- the legal framework needed to implement this policy: statutes of state institutes 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 institutes;
- the rules for intellectual property protection.

In principal, the 'Law on Science' will define the general objectives of BiH's science 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 the state level (Papon, Pejovnik 2006). On the other hand, the draft 'Law on Higher Education' gives guidelines for the operation of higher education institutions in accordance with the Bologna Principles and sets the standards and criteria for the accreditation of diplomas. The adoption of the 'Law on Higher Education' and the 'Law on Education Agency' is particularly important for BiH to meet the requirements of the Bologna Process and the Lisbon Convention. Unfortunately, in the area of education, BiH is still lagging behind its targets (European Commission 2006a).

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

International assistance helped in formulating many of the 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, Office of the BiH Coordinator for PRSP 2004a). 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 detail. In the ICT sector, the focus is on the academic ICT network BiHARNET. Although there is currently no systematic mechanism at the national level to develop a national research and education network, the vision is to re-establish BiHARNET, which although formally exists, does not function in practice (see chapter 4.1) (Council of Ministers of Bosnia and Herzegovina, Ministry of Foreign Trade and Economic Relations, Office of the BiH Coordinator for PRSP 2004b).

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.

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.
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 - 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 (including the higher education sector), 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).

Another important strategic document is the "National Environmental Action Plan of BiH", which includes objectives to provide support for scientific research and continuous education in the field, stimulate the development of new technologies, and upgrade existing ones and/or replace them with environmentally acceptable alternatives (Federation of Bosnia and Herzegovina 2003) .

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.

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 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, including 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 Higher Education' and 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 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[18]. 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 the 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, chemical and petrochemical industry (Dall 2006).

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 etc. French professor and scientist Pierre Papon, Professor of Thermical Physics at the 'l´Ecole Supérieure de Physique et Chimie Industrielles' in Paris is one of the authors who have dealt with this issue in past years, 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 he discusses 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 tripartite, including the BiH state; the political-administrative entities such as the Republic of Srpska, 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 be taken into account during the revision of the "Medium-term Development Strategy". The objective of this being at least doubling current investments in research infrastructures. For the mid-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 (from the European

[18] BIHARNET is currently not functioning due to the lack of funding. See Chapter 3.1

Investment Bank and the World Bank, for example). During the same period, industry should increase its own R&D investment, which might represent, by 2012, one third of total R&D expenditure of the country. In the long term, the authors agree that BiH should invest 2 % of its GDP in R&D (Papon, Pejovnik 2006).

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

- 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 the 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, Pejovnik 2006).

In order to define and implement a functioning state-level R&D policy, the authors recommended the establishment of several institutions, above all, a state-level ministry responsible for science and research policy (either an existing ministry, e.g. 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, 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 institutes. However, the situation is not completely grim, some cooperation between higher education institutions, research laboratories, and occasionally between local firms and research institutes, 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, 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 former Yugoslavia, as well as with Albania, Bulgaria, Romania, etc.). An obvious advantage of such cooperation lies in the fact that neighbouring institutes within the region might eventually share important research infrastructures through cooperation.

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 mid-term (2006-2015) are (Papon, 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 institutes and its large, technology-exporting, industrial companies (Papon, 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 research and development 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 in the years during the war. 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, Uvalić acknowledges the existence of some limited links between business enterprises, higher education institutions and research institutes, and any government measure to encourage the development of further such networks in this respect would be highly welcomed (Uvalic 2006).

According to Uvalić, 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, gained in recent years should continue. As most of 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

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
CEI - Central European Initiative
CIP - Cataloguing in Publications
COBISS - Cooperative on-line bibliographic system and services
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

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 Propersty]

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

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

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

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

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.
The Information Office contributes to a dialogue on S&T issues between the EU and the Western Balkan countries and the integration of the research and innovation systems of the WBCs into the European Research Area (ERA).
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The Authors

Elke Dall is the coordinator of the project see-science.eu (Information Office of the Steering Platform on Research for Western Balkan Countries) at the Centre for Social Innovation, ZSI, in Vienna. She holds a MA in Sociology and Communication Sciences. At the ZSI, she has been involved in the SEE-ERA.NET project as well as the study on innovation systems in South East Europe by the Gesellschaft zur Förderung der Forschung and several other projects.
Maruška Bračić is a law graduate from University of Maribor, Slowenia. She has been working at the Centre for Social Innovation during summer and autumn 2006. She currently pursues further studies in Maastricht.

Reviews and Contributions

The readers are invited to contribute to the development of the report. It is planned to update it on a continuous basis and to publish the results in a book in the end of 2007. Please send your remarks to Ms. Elke Dall at dall@zsi.at