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Science and Technology Country Report

BOSNIA AND HERZEGOVINA

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1 Introduction

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

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

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

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

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

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

1.1 Bosnia and Herzegovina - A Brief Profile

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1.2 Relations between Bosnia and Herzegovina and the EU

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

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

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

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

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

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

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

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

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

[6] Please see List of Acronyms

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

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

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

2 Contemporary Institutional Landscape

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

2.1 Main Stakeholders Involved in Policy Making in Bosnia and Herzegovina

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2.2 International Cooperation

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

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

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

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

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

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

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

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

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

[10] Please see List of Acronyms

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

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

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

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

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

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

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

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

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

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

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

3 The Input Side of the National Innovation Systems

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

3.1 Expenditure on R&D

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

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

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

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

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

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

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

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

3.2 R&D Infrastructure

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

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

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

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

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

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

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

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

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

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

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

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

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

3.3 Human Resources in R&D

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

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

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

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

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

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

4 The Output Side of the National Innovation Systems

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

4.1 Patenting Activities in Bosnia and Herzegovina

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

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

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

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

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

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

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

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

5 National R&D Strategy and Legal Framework

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

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

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

5.1 Legal Framework for the National R&D Strategy

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

broadband development and uptake.

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

5.4 Guidelines for the Future S&T Framework

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

6. Summary and Draft Conclusions

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

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

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

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

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

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

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8 List of Acronyms

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

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

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