

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

Science and Technology Country Report
MONTENEGRO

Information compiled by:
Maruška Bračić
Elke Dall

Reviewed by:
Carmen Siller, Centre for Social Innovation
Sreten Škuletić, University of Montenegro
Tatjana Knežević, Ministry for Education and Science
Jure Zrilić, Centre for Social Innovation
Proof Reading by:
Chloe Blackmore
Sylvia McCarthy

1 Introduction

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

The report summarises main papers published by the United Nations Educational, Scientific and Cultural Organization (UNESCO), the South-East European ERA-NET (SEE-ERA.NET), the Austrian “Gesellschaft zur Förderung der Forschung”, and several independent scholars on the issue of S&T in Montenegro. For the complete list of references please see References in chapter 7, starting on page 222 of this report.

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

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

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

The report was compiled in autumn 2006 by the Information Office, by Ms. Elke Dall and Ms. Maruška Bračić, Centre for Social Innovation, Vienna, Austria and reviewed by Ms. Carmen Siller, Centre for Social Innovation, Vienna, Austria and Mr. Sreten Škuletic, University of Montenegro, Montenegro. A brief update was carried out in summer 2007 and a final review carried out by Ms. Tatjana Knezevic from the Ministry for Education and Science in February 2008.

1.1 Montenegro - A Brief Profile

On 21st May 2006, Montenegro exercised its right provided in the Constitutional Charter of Serbia and Montenegro to hold a referendum on independence, which proved successful. The “Declaration of Independence” was adopted by the Montenegrin Parliament on 3rd June 2006, stating that the Republic of Montenegro is independent with full legal personality under international law. Recognising legitimacy of the whole process, the EU Council adopted conclusions on 12th June 2006, where it stated that the EU and its Member States will develop further relations with Montenegro as a sovereign, independent state. In the “Declaration of Independence” Montenegro expressed legal continuance regarding the international treaties and agreements to which the State Union of Serbia and Montenegro was a party and which remain relevant for Montenegro (European Commission, 2006). The new Constitution was adopted on 19th October 2007.

Today, Montenegro is a modern parliamentary democracy with a population of approximately 620,000 people (45 per km²). Montenegro is geographically located in the Central Mediterranean or South-East Europe, and has a total land area of 13,812 km².

The main unresolved problems in Montenegro result from the dissolution of the State Union with Serbia. Issues for discussion include the implementation of comprehensive institutional, political and economic reforms within the context of the EU's Stabilisation and Association Process (SAP); the adoption of a new constitution in line with European values and standards and negotiations regarding the accession to international organisations, to which the State Union was a party, and continuation of negotiations regarding future membership in others, for example, the World Trade Organisation (WTO) (European Commission, 2006). The 5th session of negotiations on accession to WTO took place from 26th to 29th February 2008 in Geneva. The official statement was that Montenegro has made immense progress since the previous round of negotiations. It is expected that full membership will be achieved in October 2008 (Knezevic, 2008).

Regarding the economic situation, real GDP in Montenegro rose by 4.1% in 2005, despite the 1.9% fall in industrial production, notably due to problems in the coal mines, the thermoelectric power plant and the steelworks. Tourism and the financial sectors were the most dynamic factors behind economic growth. The budget deficit continued at 2.6% of the GDP, while public debt decreased to 43% of GDP and the external debt reached 30.6% of GDP. The WTO accession process will require further reforms and the establishment of new institutions (European Commission, 2006). In 2006, the real GDP growth rate was 6.5% (U.S. Department of State, 2007). In the first quarter of 2007, real GDP grew by 6.6% year-on-year. The main driver was the solid expansion of the services sector, in particular: tourism, financial intermediation and real estate. In addition, the low inflation environment also facilitated the positive performance of the economy (European Commission, 2007).

Unemployment rate in Montenegro has been declining, in 2005 it was 18.5% and in 2006 already 14.7% (European Commission, 2007). Since the beginning of the year 2007 employment has increased by 8%. Some 12,714 new jobs have been created, of which, 18.6% were seasonal. The major contributor to employment remains the services sector while labour in construction industry is contracting (European Commission, 2007).

1.2 Relations between Montenegro and the EU

Policy development in the Western Balkan countries (WBCs) is often intertwined with the EU accession process. Montenegro started the Stabilisation and Association Process (SAP) on 26th September 2006; the implementation of the required policies and strategies is a necessary prerequisite for creating an innovative knowledge-based economy for the future, helping the countries to withstand competitive pressure in the market economy of the European Union (EU).

The government of Montenegro declared European integration to be one of the strategic priorities for the Republic and also decided to inform the EU of its intention to pursue bilateral relations, notably negotiations on the SAA, starting from the point reached before the referendum (European Commission, 2006).

Due to a decision of the EU Council of Ministers dating from 15th September 2006, regular political dialogue was established on minister's level, when the EU invited Podgorica to coordinate its future policy with the foreign policy of the EU, due to the promotion of full integration of Montenegro in the community of European Nations and its gradual association to EU membership. The first political dialogue between Montenegro and EU was held in Brussels, on 22nd January 2007, when the Minister of Foreign Affairs met with the EU Troika (Djurovic, 2007).

Since 2001, Montenegro has benefited from the EU policy advice provided through the EU-FRY Consultative Task Force, later replaced by the Enhanced Permanent Dialogue. The task of the Enhanced Permanent Dialogue is to encourage and monitor reforms on the basis of the European Partnership adopted by the EU Council in June 2004 and updated in January 2006. Although the current text takes due account of the respective competences and different priorities of Montenegro and of Serbia, it will require an adaptation following the change in status of Montenegro. The structures of the Enhanced Permanent Dialogue will remain in place and continue to provide support for the reforms in Montenegro until formal contractual relations between the EU and Montenegro are established through the Stabilisation and Association Agreement (SAA) in the context of the Stabilisation and Association Process (SAP). On the basis of decisions made at the Thessaloniki Summit in June 2003, and confirmed on several further occasions by the EU, Montenegro is a potential candidate country for the EU accession (European Commission, 2006).

SAA negotiations with the State Union and the two constituent republics were launched in October 2005. Since then, two official and two technical rounds of talks have been conducted and progress has been made in discussion of the text of the future agreement. Following a negative assessment on the state of co-operation between Serbia and Montenegro and Serbia's failure to comply with ICTY (UN International Criminal Tribunal for the former Yugoslavia) obligations, the Commission decided to call off the next round of negotiations on 3rd May 2006. In light of the referendum outcome in Montenegro, the Commission announced its intention to submit a proposal to the Council for a new SAA negotiating mandate for talks with the Montenegro. The SAA is a comprehensive agreement between the European Communities and their Member States on the one hand, and Montenegro on the other and will provide a legal framework for relations between the EU and Montenegro for the entire period prior to possible future accession. However, no further enlargement with a large group of countries is currently envisaged. The Western Balkan countries are at different stages on the road towards EU membership. Future enlargements will move at a pace dictated by each country's performance in meeting the rigorous standards, in order to ensure the smooth absorption of new members (European Commission, 2006).

On 15th March 2007, with positive confirmation of all 27 EU Member States, the Stabilisation and Association Agreement was initialled and that concluded the first and most difficult phase of the integration process. The agreement was signed in October 2007 in Luxemburg (Djurovic, 2007).

EU assistance to the State Union of Serbia and Montenegro, combining the CARDS financial programme, macro-financial and humanitarian assistance, has amounted to more than EUR 2.9 billion between 1991 and 2002 (more than EUR 2 billion of which has been allocated since the fall of the Milošević regime in October 2000). The main focus and objectives of EU assistance have evolved during the 1990s, covering conflict management, post-conflict reconstruction and stabilisation, paving the way for a closer association with the EU. The support provided through CARDS in 2005 (EUR 22 million for Montenegro), focused mainly on the European Partnership priorities, taking account of the political and economic situation in Montenegro, and the requirements that the republic will have to meet in order to be able to conclude SAA negotiations and implement the agreement. Montenegro has also benefited from the regional CARDS programme, which in 2005 had an overall budget of EUR 40.4 million for supporting actions of interest in terms of infrastructure, institution building and cross-border co-operation, in the Western Balkans region (European Commission, 2006).

The Instrument for Pre-Accession (IPA) replaced CARDS in 2007. The IPA remains focused on institution building and socio-economic development and aims to provide

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

For the period 2007-2009, about EUR 100 million are to be allocated through IPA instrument to Montenegro. At the moment, the programming for IPA 2009 is in progress. The Ministry of Education and Science, together with the University of Montenegro, submitted five project ideas, dealing with higher education and science. The next step is the national prioritization of project proposals from all sectors, which is expected to be finished by the end of March 2008 (Knezevic, 2008).

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

As stated in the "Shared Vision" of the *Thessaloniki Agenda for the Western Balkans*, in their effort to adapt to the pervasive knowledge economy and to global competition, the citizens of the Balkan countries need to exploit the high level of motivation for social mobility and their relatively good educational background, as well as combining scientific and technological knowledge with entrepreneurship. This will create higher added value and bestow competitive advantages on the region. In this respect, science, research and technological development are seen as essential tools for future economic stabilisation and growth in the region (CORDIS, 2003b).

Montenegro also acceded to the Partnership for Peace Programme on 15th December 2006. Another significant contribution to the institutionalisation of the relations between all the countries of the region and the EU occurred on 13th April 2007, when the Agreement on Readmission and the Agreement on Visa Facilitation were initialled (Djurovic, 2007). On 18th September 2007 the EU and five West Balkan nations (among them Montenegro) signed nine agreements on visa facilitation and readmission, which will bring the two sides closer in cooperation in migration and movement of persons. The signature of these agreements is an important political decision toward closer cooperation between the EU and the Western Balkan countries in the sensitive areas of migration and movement of persons (see-science.eu, 2007).

2 Contemporary Institutional Landscape

The transition of Serbia and Montenegro's S&T system began in the period following the gradual dissolution of the former Federal Republic of Yugoslavia, the destruction caused by the war and the subsequent brain drain. The institutional landscape has also been altered during the process. The following chapter tries to map the current main stakeholders in the National Innovation Systems, relevant cooperation and the legal framework defining the system.

2.1 Main Stakeholders Involved in Policy Making in Montenegro

During the 1990s, the FRY Government Programme for Technology Development provided the main financial and moral support for the innovation activity in industry. Since sanctions prohibited international technology trade, “in-house” innovative activity was the main source of new technologies and activities (Kutlača, 1998). Even prior to the final dissolution of the State Union, the two entities carried out R&D activities completely independently, and thus needed to be analysed separately. A few institutions belonging to the innovation system have functioned on the State Union level, but the largest part of the R&D system was located in the Republic of Serbia (Kutlača, 2005a).

The Ministry of Education and Science (MoES) is the main research funding body in Montenegro. It follows the long-term Montenegrin requirements for development, transfer and application of scientific and technological achievements, especially from the point of view of greater valorisation of natural and man-made resources of the country. MoES creates the strategy for scientific and technological development, establishing a base for further development of knowledge and creativity. Furthermore, it takes account of the results and problems of science and technology application, the effects of public investments into scientific and technological development, and the quality and use of research infrastructure. It closely monitors status, problems and trends in the development of the research system of the country, especially in the field of scientific research priorities (biotechnology, marine biology, tourism, energy efficiency, telecommunications, computerisation and research on environmental protection, materials-related technologies, health care etc.), as well as speed, range and depth of diffusion of new technologies to the national economy and the obstacles faced in the process (Ministry of Education and Science of Montenegro, 2004).

The priority activities of the Ministry of Education and Science in the field of research are (BIS-RTD, 2007):

1. increasing stability in financing the existing research potential, paying special attention to research at universities
2. professional assessing research groups
3. improving research equipment and other infrastructure
4. increasing international cooperation in science
5. ensuring higher percentage of the population receiving higher education
6. increasing post-graduate education with emphasis on PhD students
7. providing scientific publications and participating in conferences.

The Government established the Council for Scientific-Research Activities in August 2006, which is among other things, responsible for the creation of the Strategy for S&T, for a period of 8 years. The Committee responsible for drafting the proposal of the strategy was appointed in March 2007. The Committee members are representatives of all scientific fields in Montenegro (Knezevic, 2007). The Council consists of nine members, one third from the Government and two thirds are representatives of the research community (Knezevic, 2008).

An additional relevant institution is the Agency for International Scientific, Educational, Cultural and Technical Co-operation of Montenegro. This is an institution of the Government of Montenegro which was established around 30 years ago. Its Department for International Scientific and Technical Co-operation performs the following duties (Government of Montenegro, 2007):

- preparation, co-ordination and implementation of the S&T programs and projects of scientific and technical nature;
- initiation and co-ordination of the establishment of immediate collaboration between Montenegro and foreign institutions and industrial organisations;
- participation in the preparation of multilateral and bilateral programmes on the basis of which RTD projects in Montenegro are being realized;
- professional training abroad within multilateral and bilateral programmes, organisation of international conferences, gatherings and seminars, etc.

The Agency of International Scientific, Educational, Cultural and Technical Cooperation consist of the following organisational units (Government of Montenegro, 2007):

- Department for International Scientific, Educational, Cultural and Technical Cooperation
- Department for General and Financial Issues.

Another important stakeholder in Montenegro is the University of Montenegro. It was founded in 1974 and is the only public university in Montenegro. The University of Montenegro comprises several faculties (17 at the time of writing) (Knezevic, 2008) and is located in 9 towns throughout Montenegro (Podgorica, Nikšić, Cetinje, Kotor, Budva, Bijelo Polje, Berane, Herceg-Novi - Igalo and Bar). Reforms in higher education started in Montenegro in 2000 as a consequence of the transition in society, the need for integration into European and international structures, transition in the economy, the Bologna Process and the employability concept (Ministry of Education and Science of Montenegro, 2004). Since 2004/2005, the regime according to the Bologna Declaration and the principles of the European Credit Transfer System (ECTS) has been applied in all faculties. Full implementation is foreseen by 2008 for undergraduates, 2009 at postgraduate level and 2012 for doctoral studies. The University has several scientific groups with respectable reference lists, but it lacks a proper scientific strategy (Vukcevic, 2007).

All higher education institutions in Montenegro are organised in accordance with Bologna principles, and in accordance with the Law on Higher Education (Koprivica, 2006a).

The Montenegrin Academy of Sciences and Arts (CANU) was established in 1978 and encompasses departments of natural sciences, social sciences and arts, plus the "Njegoš" Institute and other operative bodies. Its activities involve the organisation of scientific research projects, conferences and meetings, as well as enhancing international cooperation and publishing (Montenegrin Academy of Sciences and Arts, 2005). The work of the Academy is regulated by a special collective agreement (Knezevic, 2008).

In June 2005, the government of Montenegro established the National MREN (Montenegro Research and Education Electronic Network) for collaboration with EU institutions.

Regarding innovation and technology centres and cooperation, Montenegro is still in the policy elaboration phase, but has started to implement pilot projects (Machacova, 2007).

Table 2.1: Main S&T Stakeholders of Montenegro (Ministry of Education and Science of Montenegro, 2004; Knezevic, 2008)

| | |
|--|--|
| Main ministry in Montenegro competent for S&T | - Ministry of Education and Science |
| Other ministries with importance to the S&T sector | - Ministry of Economical Development - Ministry of Foreign Affairs - Ministry of Health - Ministry of Agriculture, Forestry and Water Management - Ministry of Maritime Affairs and Transportation - Ministry of Tourism and Environmental Protection |
| Other important stakeholders | - Council for Scientific Research Activities, nominated by the Government of Montenegro - Montenegrin Academy of Sciences and Arts (CANU) - ZAMTES (Republic Agency for International Scientific, Educational, Cultural and Technical Co-operation of Montenegro) - Centre of Information System - Council for Higher Education (within the Ministry of Education and Science) |
| Main university / research institutions | - University of Montenegro - Private Mediterranean University - Institute for Biotechnology - Institute for History - Institute for Maritime Biology - Institute for Foreign Languages - Institute for Geology - Institute for Steel Production - Institute for Aluminium - Institute for Strategic Studies and Prognoses (ISSP) - Institute for Health Care - Agency for Eco-toxicological Investigations - Centre for Meteorology and Seismology |

Higher education may be provided by universities and higher education institutions, as long as it is licensed and accredited in accordance with the Law on Higher Education. The Ministry of Education and Science issues licenses to the institutions and is also responsible for administering changes and divesting institutions of a license. Based on this law, the first private Faculty of Tourism and Hotel Management opened in September 2004 in Bar, Montenegro, enrolling 50 students. There is one private university in Montenegro, the Mediterranean University and five individual private faculties accommodating about 2,500 students. One other private university is preparing the documentation for opening (Skuletic, 2006; Knezevic, 2008).

There is almost no communication between main RTD stakeholders and the general public, in both directions. Practically speaking, the key RTD stakeholders are not visible and do not present themselves in media (BIS-RTD, 2007).

2.2 International Cooperation

The research community in Montenegro is small, thus it is of vital importance to preserve it and promote links with other international researchers, in order to establish a platform for the creation of knowledge-based society. The RTD strategy in Montenegro is oriented towards improving research capacities in the thematic priority domains of the Framework Programmes (FP) by reinforcing their S&T potential, by supporting and mobilising human and material resources, by disseminating scientific information and research results, by facilitating communication, by alleviating brain drain and by improving responses to the socio-economic needs of the country. Montenegro's bilateral and multilateral cooperation programmes should allow the possibility to create links inside the RTD market and facilitate stronger participation in European research endeavours, thus enhancing research perspectives in bilateral and multilateral activities (Ministry of Education and Science of Montenegro, 2004).

Countries of the Western Balkans have seen a constant renewal of international cooperation and support, especially in the last years. Montenegro has, since its independence, put into procedure bilateral agreements with 20 countries from the region and beyond. These agreements will provide additional support for strengthening existing and establishing new partnerships for other, multilateral and regional initiatives and programmes (Knezevic, 2008). This cooperation was substantially supported by many international organisations as well as by individual countries through bilateral and multilateral programmes (also providing significant benefits to the R&D sector). The largest part of financial support in this respect came from the funds of the Stabilisation and Association Process, the CARDS programme, the Stability Pact for Southeast Europe (now transferred to the Regional Cooperation Council (RCC)), the European Investment Bank, the European Bank for Reconstruction and Development, HP DAAD, etc. The European Union's Tempus programme has been important in the area of higher education, while the inclusion of the Western Balkan countries into the 6th Framework Programme (FP6) for R&D (Montenegro participated in FP6 as a partner in the project consortia), and their gradual integration into the European Research Area (ERA), has also been of particular importance. Inclusion of these countries into the European Investment Bank's Innovation 2000 Initiative ought to prove useful as well. Regarding multilateral cooperation in the area of science and research, the Western Balkan countries have closely co-operated with many specialised United Nations (UN) agencies, such as UNESCO, UNIDO, UNDP and UNECE¹. Some other international organisations, such as the World Bank and USAID, have also been important donors and have helped in the area of R&D (Uvalic, 2006). USAID has adopted a "Strategy Statement" for Montenegro (2006-2011), which addresses Montenegro's development needs in line with the U.S. government's foreign policy objectives. In 2006, USAID administered approximately USD 12 million to Montenegro in support of the mission's strategic objectives - namely, democratic governance, enterprise growth and political stability (USAID, 2005).

On 25th January 2008, the Memorandum of Understanding (MoU) was signed between Montenegro and the EC in Brussels, giving Montenegro full association to FP7. For 2008, the participation fee has been provided from the national funds. It is planned that the funds for subsequent years will be provided from both, national and IPA funds (in 50-50 ratio). The nomination procedure for Montenegrin representatives in the FP7 Programme Committees

¹ Please see the List of Acronyms, chapter 8.

was initiated in February 2008. These members will have observer status in the respective committees (Knezevic, 2008).

A network of National Contact Points (NCPs) has been established and has already carried out several info days for the research community, raising awareness on FP7. The Ministry of Education and Science, which coordinates the network, has registered approximately 40 teams involved in project proposals in the first year of the programme (Knezevic, 2008). As one of the measures for stimulating participation in FP7, the Ministry offers financial incentive for each positively evaluated proposal (Knezevic, 2007). During 2008 the amounts will be graded in accordance with the type of involvement in proposals, that is, if a participant is involved as a project partner or as a coordinator (Knezevic, 2008).

Many regional projects have been launched with the objective of promoting regional cooperation in South Eastern Europe. Regional scientific cooperation within the Western Balkans is currently being promoted by several regional organisations: the Central European Initiative (CEI), the Alps-Adriatic Task Force, the Stability Pact for Southeast Europe, etc. Montenegro has also filed an application for membership to the International Atomic Energy Agency (IAEA)².

On 7th December 2007, Montenegro signed the Memorandum of joining CERN (European Organization for Nuclear Research). The country has the status of the observer in this organization, which means that its researchers have right to take part in the joint research activities under this initiative, but there is no decision-making right for the country (Knezevic, 2008).

As of 5th March 2008, Montenegro has joined one of the Competitiveness and Innovation Framework Programme (CIP) components, namely the Entrepreneurship and Innovation Programme (EIP), aimed at projects supporting competitiveness and innovative capacities, especially in the field of small and medium-sized entrepreneurship. Association to this component also provides access to participation in other CIP programmes, which will contribute to further development of research activities in the country (Knezevic, 2008).

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

Montenegro also collaborates with the Joint Research Centre (JRC) which is a Directorate-General providing independent scientific and technological support for EU policy-making. Knowledge and information is gathered using specific application/issue-oriented research within the seven JRC Institutes as well as through close cooperation with over 1,000 public and private organisations in 150 networks within Member States and applicant countries. The JRC aims to contribute to the goals of the European Research Area and provide S&T support to EU policies. Its efforts in the ERA focus on five activities: developing scientific reference systems, networking, training and mobility, accessing and using its infrastructures, and a dedicated effort to support enlargement (European Commission, 2004). The government of Montenegro believes that the collaboration with the JRC could be of vital importance in

² In June 2006, IAEA membership of Serbia and Montenegro was continued by the Republic of Serbia. Subsequently, the Republic of Montenegro applied for membership to the IAEA (14th June 2006), a process that is pending completion.

preventing further brain drain, especially in encouraging talented students to stay and work in Montenegro, by making university and research careers more attractive (Ministry of Education and Science of Montenegro, 2004). After association to FP7 in January 2008, Montenegro was invited in February 2008 to nominate a representative for the JRC Board of Governors. The nomination procedure is ongoing (Knezevic, 2008).

The Ministry of Education and Science and the University of Montenegro supported mobility of junior and senior researchers with individual mobility grants. There have also been foreign researchers working in Montenegro in the fields of bio-technical, technical-technological and medical science, most coming from Russia, Italy, France, Slovenia and Germany (Uvalic, 2006).

Current bilateral S&T cooperation has also been used as a starting point for identifying partners for FP7, COST and EUREKA. The new state of Montenegro is not yet a member of COST (Co-operation in Science and Technology), which has developed into one of the largest frameworks for research cooperation in Europe and is a valuable mechanism for co-ordinating national research activity. According to the latest reports, COST has around 200 actions and involves nearly 30,000 scientists from 34 European member countries and more than 80 participating institutions from 11 non-member countries and non-governmental organisations. Ease of access for institutions from non-member countries also makes COST a very interesting and successful tool for tackling topics of a global nature.

In December 2006, thanks to an international endeavour, MoES published the 'Pilot Joint Call' (PJC) for the SEE-ERA.NET project along with thirteen other countries. The main goal of this project is to explore and utilise the synergies of bilateral scientific-technological agreements of partner countries. However, this call is only the introduction to a bigger, "Real Joint Call", which will be announced after the conclusion of the PJC. The idea behind this call is to connect scientists, who can apply for funding for cooperation through multilateral research projects, thematic networks or connection of scientific teams or institutions, but not individually. Projects in the following three fields will receive funding: "Environmental Protection", "ICT" and "Food, Agriculture and Biotechnology" (Ministry of Education and Science of Montenegro, 2006). The PJC can be considered as a success for all the participants, and therefore for Montenegro as well. Out of 321 positively evaluated proposals, Montenegrin research teams participated in 50 proposals and 6 are approved for funding (Knezevic, 2008).

Projects based on bilateral inter-governmental agreements have been numerous, while further integration is expected in line with the activities of the Southeast European ERA-NET (SEE-ERA.NET) (Uvalic, 2006).

The project ERA-WESTBALKAN aims at integrating the Western Balkan countries into the European Research Area. Over the course of two years, the National Contact Points in BiH, Serbia, Montenegro and FYR of Macedonia were established, trained and supported. From January 2007, the project is being continued and enlarged as ERAWESTBALKAN+. The focus is on the integration of scientists from the region into the European Research Area and specifically the Framework Programmes. It provides support to Montenegrin researchers through the project partner ZAMTES (The Republic Agency for International Scientific, Educational, Cultural and Technical Co-operation of Montenegro), an institution belonging to the government of Montenegro, established around 30 years ago.

Montenegro has also been included in the two ongoing projects, SEE-GRID 2 and SEEREN2, dealing with South Eastern European research and education e-infrastructure and networking (Skuletic, 2006). As a means of sustaining the work of the SEE-GRID 2 project, the SEE-

GRID-SCI project has been approved for funding (Knezevic, 2008).

Montenegro held the FP6/INCO partner country status under the EU-WB Countries Action Plan in S&T and participated in two FP6 projects. Furthermore, participation was reported for two UNESCO projects, 12 other multilateral projects (financed by UNDP, CERN, NATO, IAEA and COST) and other bilateral projects, mainly realised with partners from Greece, Slovenia and France. Within the Tempus programme, Montenegro contracted 22 projects and 31 individual mobility grants up until the end of 2007 and expects further proposals in the currently open call. The Individual mobility grant scheme has ceased, following the launch of the ERASMUS MUNDUS and ERASMUS MUNDUS External Cooperation Window programmes (Skuletic, 2006; Knezevic, 2008).

WUS (World University Service) Austria, a non-profit making organisation established in Graz in 1983, has developed a regional focus on South Eastern Europe since 1994. Since its shift of focus towards the Western Balkans, it has successfully carried out various projects; for example, CEP (Centre of Excellence Projects), NIP (Networking Infrastructure Projects), Training Courses on Project Management and International Co-operation, Internet and Computer Training Programme etc. Montenegro also benefits from the ongoing World University Service (WUS) projects - Course Development Programme Plus, Brain Gain Programme, Counselling and Information Centres, the Balkan Case Challenge project and others (WUS Austria, 2006; Knezevic, 2008).

Montenegro has also been a member of the Union of Mediterranean Universities since its establishment in 1983. The Union is active in promoting further development of science and cultural cooperation between its members - 175 universities and various research centres and organisations from 20 Mediterranean countries. Furthermore, Montenegro is also active as a hosting country of the Summer Academy, organised under the auspices of the Stability Pact for South Eastern Europe and German Institute for Academic Mobility (DAAD). For the past eight years, the Summer Academy has been welcoming top senior technical and computer science students from Southeast Europe and Germany (Prosvjetni rad, 2006). Other regional networks include the Inter-Balkan Forum on IST and the Balkan Physical Union.

Montenegro has also become a member of the ENIC (European Network of Information Centres) and has its own National Information Centre. National Information Centre should alleviate access to precise information about the system and qualification of higher education in Montenegro and in other countries - ENIC members (Ministry of Education and Science of Montenegro, 2007). The new Law on Recognition of Educational Certificates was approved on 28th December 2007, which more precisely defines the recognition procedures as well as responsibilities of the ENIC centre (Knezevic, 2008)

Montenegro also takes part in the Bologna Process. Implementation of the Bologna Process is overseen by a National Team of Bologna Promoters. This consists of Working Groups aimed at providing counselling to higher education institutions on the three Bologna priorities as defined by Ministers in Berlin; quality assurance; the three cycle system; recognition (ECTS, Diploma Supplement, Europass and the Lisbon Recognition Convention) (Koprivica, 2006a).

3 The Input Side of the National Innovation Systems

The current economic situation in the Western Balkan countries still poses significant constraints on national R&D policies. Most countries in the region are at less than 30% of the EU-25 GDP per capita average, hardly reaching 60-80% of their 1989 GDP. The restrictive fiscal and monetary policies, necessary for attaining macroeconomic stabilisation,

allow limited public expenditure and have generally contributed to the low investment rates, including those experienced in the R&D sector. Although financial assistance received from abroad is significant, it is not always provided on a continuous basis or with the best interests (Uvalic, 2006).

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

The sources which reports on R&D expenditures provide some conflicting figures for the different categories, for example, (Uvalic, 2006) and (Kutlača, 2005b).

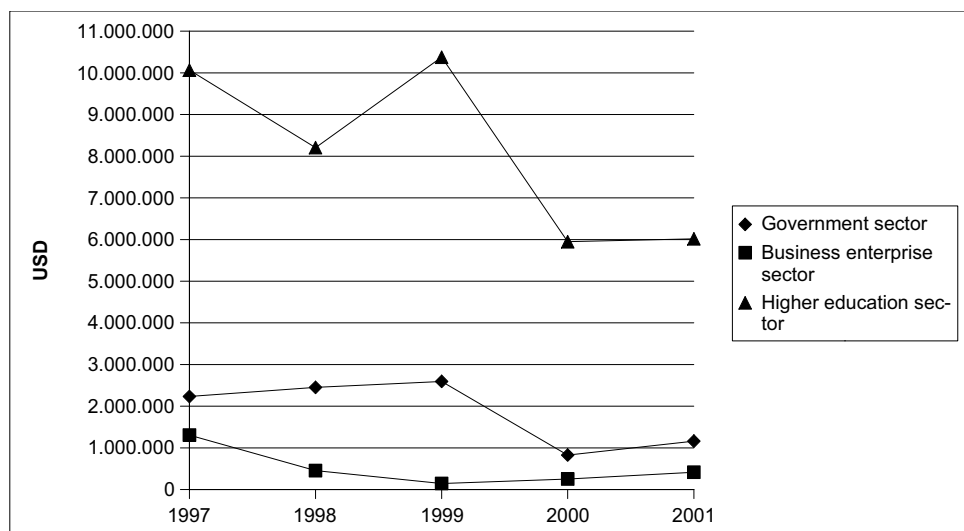
In Montenegro 80% of the RTD budget is spent on salaries and overheads for the projects, which leaves 20% for human resource development, equipping of laboratories, international cooperation and information system building (Koprivica, 2006b).

3.1 Development of Financial Resources Allocated to R&D

Generally, the dynamics of expenditure can be used as an important indicator of knowledge creation and absorption.

In Montenegro, the higher education sector is the sector with the highest expenditure on research and development, and as in other countries in the WB region, the business sector provides almost negligible investment. The downward trend of government expenditure was especially noticeable between the years 1999 and 2000.

Figure 3.1: Dynamics of Expenditure for R&D per Sector ³



³ Source: State Statistical Office according to Kutlača, 2005b

3.2 Government Sector Expenditure on R&D

As already stated above, a dramatic downward trend in government expenditure was registered in Montenegro between 1999 and 2000 (following the NATO intervention in the State Union in 1999). After 2000, a slight but steady upward trend in GOVERD can be observed, although the share of the government expenditure on R&D is still well below the requirement.

Table 3.1: Government Expenditure on R&D (GOVERD)⁴

| | 1997 | 1998 | 1999 | 2000 | 2001 |
|-----------------------------------|-----------|-----------|-----------|---------|-----------|
| R&D expenditure in total (in USD) | 2,233,671 | 2,451,944 | 2,595,711 | 827,626 | 1,162,139 |
| R&D expenditure as % of GDP | 0.25 | 0.32 | 0.23 | 0.16 | 0.11 |

Table 3.2: Government Expenditure on R&D (GOVERD) (Skuletic, 2006)

| | 2002 | 2003 | 2004 | 2005 | 2006 |
|-----------------------------------|-----------|-----------|-----------|-----------|-----------|
| R&D expenditure in total (in EUR) | 1,301,000 | 1,433,000 | 1,535,000 | 1,644,000 | 1,759,000 |
| R&D expenditure as % of GDP | 0.14 | 0.09 | 0.19 | 0.21 | 0.24 |

In an interview with the monthly scientific bulletin, "Prosvjetni rad", Sreten Škuletić, president of the Commission for Scientific Activity and International Cooperation at the Montenegrin Ministry of Education and Science, gave a critical overview of the current situation in the S&T sector in Montenegro. Škuletić expressed satisfaction with the financial sources allocated from the budget to the Ministry in 2005 - these sources were sufficient to cover all requirements, thus fulfilling the criteria for financing. According to Škuletić, the MoES allocated EUR 722,000 in 2005, financing 56 projects which received a positive review from the Ministry (out of 81 projects submitted). The projects were approved for two-year financing, and the MoES allocated EUR 383,500 during the first year. However, the expected increase in financial sources in 2006 failed to occur and the Commission has expressed its disappointment with the situation, questioning the further existence and development of scientific activities in Montenegro. In keeping with the financial responsibilities of the previous year, the Ministry was unable to open any new contests for scientific projects, MSc or PhD theses, or scientific newspaper publications. Škuletić has revealed that the government is planning to increase R&D expenditure to 0.75% of the GDP by 2007 (this percentage is currently significantly lower, see figures above). Montenegro has also signed the Lisbon declaration which aims to increase this percentage to 3% of the GDP by 2010. According to Škuletić's overall assessment, science and research in Montenegro is not receiving nearly enough attention and support from the state; furthermore, the financial sources allocated to the Ministry in 2006 were 47% lower compared to those received in 2004. In view of such conditions, little optimism regarding future improvements is possible (Prosvjetni rad, 2006).

The Ministry's expenditure by scientific field (1996-2006) focused on Biotechnology and Medicine (45%) and Natural Sciences and Engineering (40%). The remaining 15% of the budget funds research in the social sciences and humanities (Skuletic, 2006).

⁴ Source: State Statistical Office according to Kutlača, 2005b

3.3 Business Sector Expenditure on R&D

R&D investments in the business enterprise sector are evaluated by looking at the level and dynamics of business sector R&D expenditure at the aggregate country level. These activities are particularly essential for the innovative output and competitive dynamics of a country (Fischer, 2006).

The relative importance of the business sector's R&D efforts is indicated by the level of business expenditure on R&D (BERD) as a share of GDP. The relative importance of BERD in the total economic activity of South Eastern Europe (0.24% in 2003 as calculated by Fischer (2006), who includes Bulgaria and Romania but not BiH and Albania, due to the lack of data), lags considerably behind that of the EU-15 (1.26% in the year 2000). In Montenegro, the level of BERD expenditure as a percentage of GDP was 0.15% in 1997, only 0.01% in 1999 (the lowest percentage of all the years measured) and 0.05% in 2001.

The input of the business sector in R&D activities in comparison to overall R&D activities reveals the relative importance of profit-oriented knowledge creation and absorption. Nevertheless, thorough examination of the business sector's share of total R&D expenditure shows considerable variation within the Western Balkan region (only in Romania was business sector research responsible for more than 50% of total R&D, which is on a par with the EU-15 average of 65.5% in the year 2000). In Montenegro, a very low proportion of total R&D (5.5% in 2001, according to statistical data obtained by Kutlača, 2005) was spent on business research, thus reflecting a relatively low level of business sector knowledge investment in comparison with knowledge invested by the government and higher education sectors (Fischer, 2006).

The desolate state of the business and industry sectors, which have deteriorated in the past 15 years, explains the low level of business sector investment, although exact data is hardly available (Prosvjetni rad, 2006).

3.4 Higher Education Sector Expenditure on R&D

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

According to statistical data obtained from the State Statistical Office by Đuro Kutlača, the expenditure in the higher education sector, research institutes and other organisations with research units in 2001 was USD 6 million⁵, which represented 0.76% of the 2001 GDP. Although, as regards Montenegro this data is regarded unreliable, and official data on the budget of the University of Montenegro, the only public university in the country, is published in the Bulletin of the University of Montenegro (No. 211, from 15.11.2006) (Prosvjetni rad, 2006; University of Montenegro, 2006)

⁵ EUR 6.7 million on 31.12.2001, <http://www.oanda.com/convert/classic>

Table 3.3: Budget of the University of Montenegro for 2007 (Knezevic, 2008)

| | |
|--|----------------|
| Amount dedicated to the faculties | EUR 12,279,767 |
| Amount dedicated to the institutes | EUR 1,615,569 |
| Amount dedicated to other units, organisations, inside expenses, student activities etc. | EUR 2,504,664 |
| Total amount obtained from the government | EUR 16,400,000 |

3.5 R&D Infrastructure

In her survey on the National Systems of Research and Development in the Western Balkan Countries (compiled for the purposes of the SEE-ERA.NET Consortium), author Milica Uvalić established that the existing scientific infrastructure in Montenegro has a number of weaknesses - amongst them, large differences in the development of research units, a lack of adequate premises for laboratories and libraries, poor financial standing of research projects, a lack of interest for studies where experimental research is obligatory, such as engineering, and old and inadequate equipment (or lack thereof). Significant investment is required in printing and electronic equipment, which would help enhance research and learning resources, as well as providing new equipment, facilities and services. Thus, a clear strategy for R&D ought to be established, embracing all research institutes (Uvalic, 2006).

In October 2007, for the first time in 15 years, the Ministry of Education and Science was in the position to publish a call for financing the scientific-research infrastructure. While the interest in this call was not as high as expected, many of the eligible institutions submitted their proposals. As a result, an amount of EUR 363,538 was approved, which covered about 40% of the total requested funds. It is expected that a similar call will be opened during 2008 (Knezevic, 2008).

R&D infrastructure was much better and more modern prior to 1990 than it is at present. A lack of financial resources, as well as the presence of international sanctions, prevented an update of technical equipment and made foreign imports impossible, therefore preventing further development.

According to statistical data the number of Science and Research (S&R) organisations has been raised (see the table below).

Table 3.4: Structure of S&R institutions (Bacovic, 2007)

| Year | S&R Institutions | Experimental development units | Faculties | S&R organisations TOTAL |
|------|------------------|--------------------------------|-----------|-----------------------------------|
| 2002 | 4 | 4 | 13 | 21 |
| 2003 | 4 | 3 | 14 | 21 |
| 2004 | 4 | 3 | 15 | 22 |
| 2005 | 4 | 3 | 16 | 23 |

Regarding the ICT (Information and Communication Technology) sector - there were over 16,000 internet hosts per 100,000 inhabitants and 100 PCs per 1,000 inhabitants in 2006. Internet penetration in Montenegro increased to 29% in 2007 (Knezevic, 2008). This share still does not compare to the EU average of 52% (or about 240 million internet users in 2006, according to the Internet World Stats) (Internet World Stats, 2007). In order to demonstrate an awareness of the importance of ICT in educational process and a readiness to improve

the existing situation, in 2004 the government adopted a document called “Strategy for Development of Information Society - the way to knowledge-based society”. This strategic document comprises several strategic lines; one is ICT and Education, which covers all levels of education. It is based on the “Strategy of Introducing ICT into the Education System of Montenegro - Up to the University Level” (2003)⁶.

Among the first tasks of the Ministry of Education and Science was to decrease the number of students per computer (currently around 50 students per computer, which is discouraging compared to the European average of about 14 students per computer).

The Montenegrin Research and Education Network (MREN) was established in June 2005. It encompasses all networking services and facilities, which support the communication and information requirements of the education and research community in Montenegro. MREN aims to create, promote, offer, participate in, and preserve the necessary bases for effective use of modern telecommunication technologies in the fields of education and research in Montenegro. The main goal is to connect MREN to GEANT (a pan-European multi-gigabit data communications network), which is reserved specifically for research and educational use, via a high speed fibre optic connection. MREN's target is to support the substantial use of the Pan-European and world research networks by Montenegrin researchers, scientists, lecturers and students, as well as to facilitate the integration of Montenegrin educational, research and cultural resources in the international information space (Uvalic, 2006). The link, connecting MREN to the GEANT was operating at 4Mbps in 2006, and has been upgraded to 34 Mbps in 2007. The development and operation of MREN is co-financed by the European Commission through the SEEREN2 project (FP6) and the Ministry of Education and Science. MREN is also member of TERENA (Trans European Research and Education Network Association) (Koprivica, 2006b).

The libraries and the information and communication technology (ICT) services should be rationalised to provide more effective services, as existing technical equipment and informatisation do not meet international standards. Since May 2006, the University of Montenegro is subscribed to electronic databases THOMSON and EBSCO, which provide access to a significant number of articles from the most renowned scientific magazines and publications in the fields of Technology, Medicine, Economics, Sport etc. A new system of mutual categorisation among the Montenegrin libraries was established in December 2001 using the COBISS system, as well as a mutual bibliographic base (COBISS-CG), combining the local University Library, and the Central National Library of Montenegro. Some of the faculty libraries have local systems for computerized documentation, so their databases cannot be reached through the internet. The University of Montenegro possesses an academic computer network, maintained and developed by the Centre of Information System (CIS), which provides internet connectivity. However, the CIS equipment ought to be improved; presently, the communication infrastructure between the CIS server and the units is based on an optical fibre with low speed communication through copper twisted pairs. There is only one 4Mb link with Belgrade, which should have been upgraded to 34 MB link by the end of 2006, and a 34 Mb link with Greece (through Serbia) using the SEEREN-SENSE project foundation. The research units' communication equipment is generally satisfactory, apart from the lack of multimedia lecture halls (Uvalic, 2006).

The development of a strong and visible ICT sector in Montenegro is still more of a promise, than an easily traceable action. Like in many other target countries, statistics here must be taken with caution. Montenegro is very good at raising visibility and expectations, by organising international events, conferences and specialised seminars for students, scholars,

⁶ More details in chapter 5.2

ICT professionals, ICT companies and other various participants. These events are useful as they bring communities of ICT knowledge together, and promote innovation and collaboration through open peer networks. Depending on tangible outcomes of such initiatives, they could help reverse the brain drain and create more domestic opportunities for young generations and investors. Such events also mobilize public representatives in thinking and acting towards improving education levels for the rest of the population as well as the administration- in learning how to use new technologies.

Some great opportunities have occurred for Montenegro in the recent past: the University of Montenegro and several private companies successfully managed to open the Cisco Academy in Montenegro; Microsoft's donation of EUR 2 million worth of free education software to the Electro-technical Faculty had a major impact on the quality of IT training and support to research activities; positive regional ICT-IST trends and a potential for a 'spillover', innovation and experimentation through peer networks and open communities of knowledge (SBRA- Great-IST, 2007).

3.6 Human Resources in R&D

The mass emigration of young, educated people in highly sought-after fields of expertise (brain drain) has been one of the most alarming phenomena that the countries in the Western Balkans region have had to face since the devastating war and break-up of the former Yugoslavia. This loss of talent has led to an impoverishment of national capacities at a crucial time for reconstruction and development.

The number of scientists in R&D in Montenegro is reported to be low. The most recent data (from the Report on the external evaluation of higher education institutions in Montenegro (December 2007)) shows that for the University of Montenegro alone, 367 teachers/researchers (with a PhD), 346 assistants (PhD, MSc/MA), 77 professional associates and 398 people in administration and technical services are employed in full-time positions. The part-time staff add up to 242 teachers/researchers with an academic title (PhD), 98 teaching assistants (PhD, MSc/MA), 20 professional associates and 10-15 people in administration and technical services. In addition, the Medical Faculty, which has a special status within the University of Montenegro, employs 32 teachers/researchers with academic title (PhD), 59 teaching assistants (PhD, MSc/MA) and 27 professional associates (Knezevic, 2008).

These figures do not differ greatly from those provided in the Bulletin of the University of Montenegro in 2006, whereby the university employed 394 scientists with a PhD degree and 319 scientists with a MSc degree, as full-time engaged, and 242 scientists with a PhD and 98 scientists with a MSc degree as part-time engaged (Prosvjetni rad, 2006; University of Montenegro, 2006).

4250 students enrolled in the academic year 2007/08, which makes the current total number of students at the University of Montenegro 18,199. The number of new students slightly decreased compared to the previous year (when 4,442 new students enrolled), which is due to the fact of increased number of private faculties, that enrol about 2,500 students at the moment (Knezevic, 2008). Even so, these numbers are still important when one considers that in the previous 10 to 15 years, the number enrolled hardly exceeded 1,500. The percentages for 2007 have not changed significantly on the figures for the previous year, when 58% of students enrolled in Humanity Studies (including Business, Financial Management and Law), 40% in Engineering Studies, Natural Sciences etc. and 2% in Arts (Prosvjetni rad, 2006).

Table 3.5: S&R organisations (Bacovic, 2007)

| Year | S&R organisations | No. of Employees | Scientists/researchers | Scientists/researchers as % of total population |
|------|-------------------|------------------|------------------------|---|
| 2002 | 21 | 1,185 | 605 | 0.00097 |
| 2003 | 21 | 1,127 | 602 | 0.00096 |
| 2004 | 22 | 1,200 | 597 | 0.00096 |
| 2005 | 23 | 1,246 | 633 | 0.001 |

The breakdown of researchers by scientific field shows that the largest concentration work in the field of Social Sciences and Humanities, followed by Engineering and Technology (Ministry of Education and Science of Montenegro, 2004).

Table 3.6: Relative structure of Researchers by scientific fields (Knezevic, 2008; Ministry of Education and Science of Montenegro, December 2007)

| | |
|-----------------------------------|--------|
| Natural and Mathematical sciences | 13.4 % |
| Biotechnology | 5.7 % |
| Engineering and Technology | 22.2 % |
| Medicine | 10.5 % |
| Social sciences and Humanities | 48.2 % |

There are, however a disproportionate number of researchers in the field of Social Sciences and Humanities (48%) compared to the budget that the Ministry of Education and Science allocates to this scientific field (15%). This is probably due to the constant increase in the humanities student population. The actual number of first-year students in the Faculty of Economics is about 700, while in the faculty of Metallurgy and Technology, the number of students hardly exceeds 50 (Uvalic, 2006).

The Ministry of Education and Science adopted a Human Resource Development Programme in 2004, the main instruments of which were 90 scholarships for master studies at home and 15 scholarships for master studies abroad; financial support of 30 PhD students working on basic or applied projects at home, as well as 26 PhD researchers abroad (for 2 to 6 months). Additionally, the Ministry financed 91 participations in scientific conferences including travel and registration costs (Ministry of Education and Science of Montenegro, 2004; Skuletic, 2006). By 2007, the number of master study scholarships at home, unfortunately, was reduced to 60. The number of financed participations in scientific conferences doubled to 198. Also, support was given to 28 PhD students for work on their doctoral thesis (Knezevic, 2008).

One of the human-resources development support measures in 2007 was employment of young researchers through scientific projects by publishing a call for these types of projects. Nine of these projects for a total number of 10 new employees was approved (total amount allocated is EUR 156,000) (Knezevic, 2008).

Human resources play a key role when it comes to knowledge production and, subsequent, economic and technological development. Availability and quality of human resources (being both producers and diffusers of knowledge) in S&T, forms a crucial element on the path towards a knowledge society (Fischer, 2006). It is quite obvious though that the recent trend regarding human resources in countries of the Western Balkans has been extremely variable. In some countries, the number of researchers and scientists has been increasing (for example, in Albania and Croatia), while in others (for example, in the FYR of Macedonia, Montenegro and Serbia) it has been stagnating or declining (Uvalic, 2006). In 2003, Serbia and Montenegro reported 3.5 researchers per 1,000 labour force, which was on a par with some of the EU-15

countries (for example, Greece and Portugal), but still well below the EU-15 average (5.4 researchers per 1,000 labour force) (Fischer, 2006). There is, however, no precise data on how many of these researchers actually came from Montenegro (as compared to Serbia).

According to the national statistics reported by Kutlača (Kutlača, 2005c), the total number of researchers in Montenegro in the last decade has been more or less constant. There were about 642 researchers in the year 2000, almost 100 more compared to 1990. However, after the year 2000, a slight downward trend was registered, with 626 researchers reported in 2001 (Kutlača, 2005c).

Table 3.7: R&D Personnel in Total, FTE and HC (Kutlača, 2005c)

| | 1990 | 1999 | 2000 | 2001 |
|---|-------|-------|-------|-------|
| R&D personnel (fulltime equivalence, FTE) | 852 | 775 | 806 | 768 |
| R&D personnel (headcounts, HC) | 1,082 | 1,128 | 1,217 | 1,223 |

Of total R&D personnel in 2001, 57.7% were engaged in the higher education sector, 35.5% in the government sector and 6.8% in the business sector (Kutlača, 2005c) as illustrated in the table below.

Table 3.8: R&D Personnel, Distribution by Sectors, in absolute numbers - FTE (Kutlača, 2005c)

| | 1990 | 1999 | 2000 | 2001 |
|-------------------------|------|------|------|------|
| Government sector | 374 | 302 | 265 | 273 |
| Business sector | 193 | 23 | 60 | 52 |
| Higher education sector | 285 | 450 | 481 | 443 |

Human resource potentials in S&T can also be increased by producing Science and Engineering (S&E) graduates. Degrees in S&E fields of study formally qualify their holders for employment as researchers, scientists and engineers. In this respect, the State Union of Serbia and Montenegro demonstrated a positive trend, having the highest proportion of students enrolled in S&E within the region. However, the exact proportion of S&T students solely in Montenegro was uncertain. Furthermore, a negative growth rate of 1.2% has been registered in the period between 1997-2001 (Fischer, 2006).

In order to improve the alarming situation in the country, UNESCO (in cooperation with Hewlett-Packard) has devised project to alleviate the brain drain in the Western Balkans region. The project's general aims for Montenegro were laid out under the following objectives (UNESCO & Hewlett Packard, 2003):

- promoting successful mechanisms to alleviate brain drain
- attempting to stop mass emigration of young intellectuals
- strengthening intellectual and scientific capacities
- establishing a website to identify young scientists who have left Montenegro in last 10 to 15 years
- creating a database of experts in the identified disciplines who have left the country and have expressed an interest in contributing to the project
- maintaining effective two-way communication between young professional people who have left Montenegro and their colleagues who have remained in the country
- developing mechanisms to promote contacts and offer opportunities for shorter and longer-term positions for returning experts as well as for their "virtual presence" and continued contribution to cultural, scientific and economic life

- opening visiting positions, organising meetings and fostering possibilities for experts within the Diaspora to serve as mentors for advanced home students in corresponding fields, as well as organising multidisciplinary master class courses, distance education, an alumni organisation network, etc.
- creating a network of highly qualified experts in specific fields world-wide, creating opportunities for them to take part in shorter-term or longer-term assignments in their countries of origin
- creating virtual links with experts outside the country
- publishing joint scientific and technical papers and reports
- carrying out common work on scientific and technical projects etc.

The project was divided into two sub-projects, according to areas of expertise: (1) Electrical Engineering and Information Technology and (2) Physics. Phase III of the project was due to finish in December 2004 (the University of Montenegro's proposed budget for that year was EUR 15,000). Sreten Škuletić, president of the Montenegrin Commission for Scientific Activity and International Co-operation at the Ministry of Education and Science and the coordinator of this project in Montenegro, has considered the project as very successful. Many foreign professors and eminent scientists have been involved in the project, along with intellectuals of Montenegrin origin living and working abroad. The project itself was responsible for the creation of a database which re-established the connection between the scientific diaspora and the University of Montenegro. Škuletić expressed great satisfaction with the response received, stating that all contacted scientists proved ready to participate in future projects. Although established merely as a pilot-project for the duration of one year, the overall assessment was very positive, leaving the University of Montenegro with valuable computer and communication equipment and a functioning database to help maintain, broaden and deepen the connections with the scientific community abroad (Prosvjetni rad, 2006). This project and its achievements were also regarded as very successful by both UNESCO and HP representatives.

According to Fischer, the results obtained in his survey suggest that the future outlook is optimistic, especially with respect to the fact that a greater percentage of young people are becoming more highly qualified, offering potential relief to the shortages created by the transition to a knowledge-based economy. However, the author fears that investment in R&D is not the only prerequisite for achieving these goals. Rather, there are multiple components to investment (such as productivity, good performance in science and technology, efficient use of information infrastructure and an effective education system (Fischer, 2006)), all of which need to produce successful results in order to achieve a smooth transition to a knowledge-based economy (Fischer, 2006).

It is important to help Montenegrin researchers in networking and joining their capacities at both national and international levels, as well as connecting different sectors. The concept of mobility of researchers needs to be examined and enhanced through adequate policies and organisational structures. Montenegrin researchers are under great pressure. In addition to their teaching and research commitments, they try to successfully cope with poor funding and lack of human resources, keep abreast of participation in international projects etc. They need strong support and more favourable environment to be able to fully contribute to the development of Montenegrin and European societies (Knezevic, 2007).

4 The Output Side of the National Innovation Systems

The output of an innovation system is manifested through the new knowledge, new products and processes which are produced. Whereas indicators such as the Gross Expenditure on

Research and Development and the number of researchers involved provide a measure of the resources potentially allocated to innovation, this chapter focuses on the results of the innovation processes and their output indicators (Uvalic, 2006).

4.1 Patenting Activities in Montenegro

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

European inventors today have a choice between two alternatives when seeking patent protection for their inventions: the European Patent Office (EPO) and national patent offices. The EPO was set up to provide patent protection through a single procedure, defining the granting of patents in some or all of the contracting states of the European Patent Convention (EPC). The procedure for obtaining a patent at the EPO consists of two phases and sometimes a third phase dealing with possible objections. In contrast to national patents that are valid in only one country, a European patent gives its proprietor equivalent rights to a national patent in each member state. Moreover, European patents may also be effective in some countries, including Montenegro, that have not yet acceded to the EPC. Serbia and Montenegro have held a so-called 'extension state' status at the EPO since 1st November 2004. This means that although the State Union recognised European patents, it was not formally a member of the organisation (European Patent Office, 2006).

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

The situation regarding Intellectual Property (IP) protection in Montenegro has been quite difficult to comprehend, even prior to the separation from the State Union of Serbia and Montenegro. According to Kathryn Szymczyk, director of the Montenegrin branch of an international legal office specialising in IP protection, both states had their own legislatures and, to some extent, different laws and institutions. In 2005, Montenegro adopted its own "Law on the Enforcement of Intellectual Property Rights" (Official Gazette of Montenegro No.45/2005), but nevertheless continued to enforce the same laws as Serbia with respect to IP rights generally (SD Petosevic, 2006). After its separation from Serbia in June 2006, the Montenegrin Ministry of International Economic Relations and European Integrations took the stance that applicable laws that were in force in the union of Serbia and Montenegro would retain legal continuance until suitable laws are passed in the Montenegro. According to legal experts, this means that until a new Patents and Trademarks Office (PTO) is established, all IP rights validly registered in Serbia, both before and after the dissolution of the Union, will also be enforceable in Montenegro. Furthermore, a likely outcome is that once a Montenegrin PTO is established, a revalidation period will be permitted whereby holders of IP rights in Serbia will have 6 to 12 months to revalidate their existing IP rights in Montenegro. It must be stressed, however, that the Republic of Montenegro does have its own Law on Enforcement of the Legislation that Regulates Intellectual Property Rights which gives various government agencies, such as Customs and Market Inspectorate, the authority to detain and seize

infringing goods. This means that applications for the enforcement of IP rights must still be made separately for Montenegro, even though such applications will have to be based on IP rights registered in Serbia (SD Petosevic, 2006).

The Montenegro Government has recently adopted a Decree which provides for the establishment of a national IP Office. The Decree came into force on 19th May 2007 (8 days after it was published in the Official Gazette No. 25/2007), and stipulates that the IP Office would start operating within the following 60 days (IMPACT, 2007). It is also going to act as the national Patent Office.

Patent applications originating from Montenegro have so far been submitted to the Federal Institute for Patents in Belgrade, which was in charge of patents in the State Union. Until the national IP office becomes fully operational, the patent applications are still going to be submitted in Belgrade (Knezevic, 2008)

The number of patents administered in Montenegro, as reported by the Federal Institute for Patents, has been relatively low in recent years: 4 in 2002, and 1 in 2003 (Uvalic, 2006). As for patents granted by the EPO, it is obvious that even Croatia, the best performing country in the Western Balkan region (with 15 patents in 2003), plays a very limited role as an applicant country for EPO patents. In 2003, a total of 62,873 patents were granted by the EPO, of which, 31,027 were granted to EU countries, and only 4 to Serbia and Montenegro (Hörlesberger, 2006).

As of 4th December 2006, Montenegro is a member of the World Intellectual Property Rights Organization (WIPO), and since then, all conventions and protocols from the field of intellectual property that the State Union was a signatory of, are being enforced by Montenegro. In addition, a regulation on the recognition of Intellectual Property Rights (IPR), as adopted by the Patent office of the State Union has been adopted. This regulation also refers to the status of applications and approved IPR given by the Belgrade office before national IP Office starts with work (Knezevic, 2008).

4.2 Publication Activity in Montenegro

Publishing activities in Montenegro are difficult to estimate due to the absence of a mutual categorisation system among libraries. This results in a lack of categorisation of scientific publications (except for Masters and Doctoral theses and some monographs). Most monographs are in the field of humanities, with around 95% of all published monographs in the disciplines of Economics, Law and National History, while less than 5% of catalogued publications are in the fields of Engineering and Natural Sciences. However, although the engineering faculties are among the oldest in Montenegro, a large number of their publications are not catalogued for the reasons mentioned above.

The VIRTUALNA BIBLIOTEKA CRNE GORE (VBCG, Virtual Library of Montenegro) project has been introduced as a means of joining Montenegrin libraries in a uniform information system, with the ultimate aim of enabling library users to access, in an organised and rational way, online information and documents, created in the autonomous system of Montenegro, or the COBIB union catalogue database, or specialised information in many internet databases. Montenegrin libraries are relatively small, with inadequate technological equipment (obsolete, or even no computer and communications equipment), inadequate staff structure, insufficient specialised knowledge, etc (COBISS.CG, 2008).

The VBCG development is limited by the non-existence of the VBCG Centre (Centar VBCG)

as the centre's objectives should be to: represent the system and all its participants active in the realisation of the VBCG project; carry out legal, administrative and similar activities for the realisation of the VBCG project; plan system development and extension, realise the agreements, and co-operate with the software provider; technically maintain the functions of the VBCG Centre, including system and data protection; maintain the online union catalogue and the function of the system; define professional, technical, information and financial conditions for the integration into the system, extend the system and sign agreements on the participation with new members; ensure recurrent training for the work in the system; carry out administration, statistical coverage and supervision of the system and co-operate with other compatible shared cataloguing systems in the region, in Europe and elsewhere (COBISS.CG, 2008).

Recently, a new measure of providing financial incentives to researchers that publish in international scientific papers and journals has been introduced at the University of Montenegro. This measure will provide significant input for creation of a database of all the scientific publications.

Table 4.1: Scientific Output - Number of Books and Brochures in Montenegro, 2001 (MONSTAT according to Uvalic, 2006, p. 77)

| | Books | Brochures |
|---------------------------------------|--------------|------------------|
| General | 3 | - |
| Philosophy, Psychology | 1 | - |
| Religion, Theology | 1 | - |
| Social Science | 38 | 9 |
| Mathematics, Natural Science | 2 | - |
| Applied Science, Medicine, Techniques | 4 | 2 |
| Arts | 9 | 1 |
| Literature | 38 | 2 |
| Geography, Biography, History | 17 | 1 |
| Total | 113 | 15 |

5 National R&D Strategy and Legal Framework

Most S&T policies in the Western Balkans region are characterised by their encouragement of sustainable support for basic research at universities and research institutes, for the development of human resources, and for cooperation within the framework of the European Union's programmes for RTD and joint research programmes with the European Science Foundation and bilateral agreements (Dall, 2006). In technology policy, emphasis is placed on linking research institutions as sources of knowledge with industry and SMEs, and encouraging the establishment and functioning of intermediary institutions - although the practical success of such institutions is still being questioned (Kobal, 2005).

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

5.1 Legal Framework for the National R&D Strategy

A legal framework is indispensable in the organisation of R&D institutes, innovation infrastructure and programmes that provide grants to research organisations and innovative companies. Most commonly, as is the case in Montenegro, S&T and higher education laws are prepared separately, for example, the Montenegrin Law on Higher Education was adopted in October 2003 and the Law on Scientific Research Activities in November 2005 (Dall, 2006).

The Law on Scientific Research Activities has following goals (Koprivica, 2006b):

- Integration into European Research Area and EU Framework Programmes
- Sustainable development of the country
- Introduction of international quality standards
- More investments into scientific and research activities
- Connecting researchers at national and international level.

According to the Law on Scientific Research Activities, the Government should prepare strategy of creation the society based on knowledge, and to define annual budgetary increase as a percentage of GDP, allocated to R&D until 2010. Regulation on Scientific Activities Finance (1995) has been innovated regarding appointment of independent experts, evaluation criteria, detailed description of proposal evaluation and finalization of the evaluation according to the practice in EU countries (BIS-RTD, 2007).

The Law on Higher Education was adopted with objectives of eliminating rigidity from university structure, preventing brain drain, complying with EU standards and enabling full participation in mobility schemes (Dall, 2006). This law was adopted on the basis of the government's Strategic Plan of Education Reform implemented in January 2003, in line with the objectives of the Bologna process. Subsequently, the government announced that it will prepare a strategy to define the annual budgetary increase allocated to R&D up until 2010. The main strategic aim of this statute was to create a legal basis for the future creation of a knowledge-based society and a gradual increase in the R&D budget.

The overall goal of the law is to give higher education institutions in Montenegro maximal autonomy in their activities, particularly in the academic field. Mediation from the state shall be kept to a minimum, except when requested for the purpose of protecting public interest. A further aim is to enable the university to educate young people in compliance with the new European standards, to be citizens in a democratic society and to be a qualified workforce in the European labour market.

The law also prescribed the adoption of a University Statute within a maximum of three months after adoption the law; this was successfully carried out in January 2004. The Statute, contrary to the law, needs to clarify, and specify more thoroughly the organization of the university, the structure of the Board and the Senate etc. The new Statute and other by-laws and regulations have already been approved (Skuletic, 2006).

According to the law, the Ministry of Education and Science is, at the time of writing this report, preparing a draft on the regulation of HE financing. Current discussions are oriented towards the inclusion of a social dimension with regard to tuition fees (Skuletic, 2006).

Table 5.1: Important Laws in the Legal S&T Framework of Montenegro (Dall, 2006)

| | |
|---|--|
| Law on Scientific Research Activities | This new law was adopted in November 2005 and replaced the one adopted in 1992. |
| Law on Higher Education | This law was reformed in 2003 in order to eliminate rigidity from the university structure, prevent brain drain, comply with EU standards and enable full participation in mobility schemes. |
| Laws on IP Protection: Law on Enforcement of IP Rights, Patents Law, Copyrights and Related Rights Law, Trademark Law, Law on the Legal Protection of Designs and Law on the Protection of Integrated Circuit Topographies | Montenegro adopted its own law on the enforcement of IP Rights in 2005. However, applicable laws that were in force in the Union of Serbia and Montenegro have legal continuance until suitable laws are passed in the Republic of Montenegro. This means that until a new PTO is established, all IP rights validly registered in Serbia, both before and after the dissolution of the Union, will also be enforceable in Montenegro. |

Progress has also been made in Montenegro's intellectual property legislation. As mentioned in chapter 5.1, the situation regarding IP protection in Montenegro has been quite difficult to comprehend, as the country has been using in parallel, both its own law (Law on Enforcement of Intellectual Property Rights adopted in 2005), as well as the laws adopted on the federal level, through the Assembly of Serbia and Montenegro (Patents Law, Copyrights and Related Rights Law, Trademark Law, Law on the Legal Protection of Designs and Law on the Protection of Integrated Circuit Topographies, all December 2004). These laws were adopted in order to fully harmonise regulations with the requirements of the World Trade Organisation (WTO) and the TRIPS Agreement (Trade Related Aspects of Intellectual Property Rights), as well as in accordance with related EU regulations. Currently, the laws in question maintain legal continuance in Montenegro until the country adopts its own laws in this field, according to a decision made by the Montenegrin Ministry of International Economic Relations and European Integrations (SD Petosevic, 2006).

Despite the obvious efforts being made, it must be stressed that enforcement of laws dealing with intellectual property is causing many difficulties in practice. Due to disharmony, limited competence and inadequate coordination between the authorities responsible for the enforcement of laws (for example, courts, public prosecutors, police, customs and market inspectors), the protection of intellectual property rights is not efficient enough at present (Yusurvey, 2006).

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

Underdevelopment of S&T governance in Montenegro still represents an important structural problem. There is a certain dynamic present in the government's undertakings, allowing a variety of formal and informal institutions, mechanisms and procedures for managing S&T infrastructure, designing, delivering, selecting and evaluating S&T policy programmes, and specifying and implementing standards. However, differences between the functions described in the laws and the actual implementation can often be found; some institutions do not function properly or merely exist 'on paper'. Innovation should not be limited only to higher education, as is often the case in the Western Balkans region; instead it should penetrate

other relevant policies, such as competition, enterprise, research, finance and taxation policy. Such a shift in focus from science, to a more comprehensive innovation system perspective is still lacking in the country under study, and corresponds to the general situation in the region (Dall, 2006).

The Ministry of Education and Science of Montenegro started the reform on higher education in 2000 as a consequence of various, equally important, factors influencing significant policy changes in society and economy. In 2003, the government of Montenegro adopted the Law on Higher Education, in line with the objectives laid out in the Strategy Plan for Educational Reform. The new Strategy Plan for Educational Reform in Montenegro for the period 2005-2009 was adopted by the Government of Montenegro in 2005. Among other goals, the Strategy Plan envisages the development of educational infrastructure, the introduction of ICT into the education system, curricula modification etc. (Government of the Republic of Montenegro, 2005). Furthermore, in 2003 the Government of Montenegro adopted a strategy for introducing ICT into Montenegro's education system (Ministry of Education and Science of Montenegro, 2003). It is reasonable to expect further adoption of government strategy plans in the near future in order to keep up with the positive dynamics of the work being done so far.

A notable document is also the "Montenegro 2006 Economic and Fiscal Programme", which is the first official document in the recently initiated economic dialogue between the EU and Montenegro, submitted on 1st December 2006. The Economic and Fiscal Programme reflects the overall goal of the Republic of Montenegro planned for the period 2006-08, which is to maintain macroeconomic stability as a prerequisite to faster economic growth and development (Djurovic, 2007).

A new Strategy for S&T is also expected to be completed during the first half of 2008. This Strategy will define the priorities of further S&T development (where participation in all European scientific programmes is the top priority), define feasible mechanisms for increasing annual budgetary allocations for science, which are currently at a very poor level. The draft strategy should be put to public discussion and Government adoption (Knezevic, 2007).

In the Information Society Technology (IST) field, the Montenegro Strategy for Information Society 2004-2007 focuses more on infrastructure development in order to aid poor economic conditions for the country and alleviate the technological gap with the rest of the EU, so only a small part is devoted to IST RTD (INA - Great-IST, 2007).

Under the responsibility of the Secretariat for Development, the "National Strategy for Development of Information Society - the way to knowledge-based society" (on the basis of the common guidelines prepared by the Working Group of the Stability Pact Electronic South Eastern Europe Initiative (eSEE Initiative (Stability Pact for South Eastern Europe, 2003)) was adopted on 17th June 2004. (Secretariat for Development, 2004) This document contains several strategic issues, one of them is 'ICT and Education', which covers all levels of education (including HE) (Knezevic, 2008).

It is based on the "Strategy of Introducing ICT into the Education System of Montenegro – Up to the University Level", which was published by the Ministry of Education and Science in 2003. The general aims of this document were to modernize the entire education system in Montenegro and improve the quality of the education provided so that all pupils of primary and secondary school get fully involved in the information society through achieving computer and information literacy; that all schoolteachers of primary and secondary level, teacher trainers at teacher faculties (Faculty of Philosophy - Nikšić, Faculty of Science - Podgorica and Academies) should develop their skills and the use of ICT for teaching and learning; to provide

Management and Quality Assurance in the Education System of Montenegro and to introduce a Management and Information system based on EU experiences (Ministry of Education and Science of the Republic of Montenegro, 2003).

A couple of other strategic documents deserve to be mentioned, since they all include research and research needs, and they all demonstrate the intention of establishing basis (each in its respective field) for building society based on knowledge. Those are the National Strategy for Sustainable Development (Ministry of Tourism and Environmental Protection of the Republic of Montenegro, 2007), the Strategy for the Development of SMEs (Directorate of Development of Small and Medium-Sized Enterprise, 2007) and draft National Spatial Plan until 2020 (Ministry of Environmental Protection and Physical Planning Republic of Montenegro, 2007; Knezevic, 2008).

5.3 Main Fields of Intervention and Research Priorities

A key challenge for all Western Balkan countries is the process of the transition to a market economy is to create stable and favourable conditions for economic growth. Against this background, innovation policy has to enlarge its scope from the focus on research to a broad productivity agenda (Dall, 2006). As stated by Slavo Radošević, innovation policy as such has only recently re-emerged in the Western Balkans, after having been reduced to a secondary role during the transition process. *“In order to be effective, innovation policies in the CEECs should recognise the structural weaknesses of their individual innovation systems. This will require a search for country-specific solutions, as opposed to the rather imitative mode that has so far prevailed”* (Radosevic, 2005). Investments in R&D and high-tech orientation are regarded as the dominant paradigm in innovation policy.

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

Priority setting in the S&T sector is intended to facilitate the efficient performance of certain identified S&T fields through a predictable allocation of critical-size funds. The need to define thematic S&T disciplines and fields has been recognised by all countries. Research priorities in general are principally Information and Communication Technologies, Life Sciences, research on Agribusiness and Biotechnology, Genomic research, Environmental and Materials research, and research on renewable energies and sustainable development as well as water management, transport, aerospace research, humanities and social sciences, and research in SMEs. The level of specification varies from country to country. A great deal has been achieved in terms of institution and strategy development. However, some papers remain generally superficial, and many statements have more to do with paying lip service than real policy implementation and related operations. The level of aggregation seems too broad and thus, goal-oriented interventions will be difficult to identify and are unlikely to generate the expected benefit. Much remains to be done, including the implementation of national foresight studies in order to support the prioritisation process. It would also be worth considering a complementary regional comparative foresight exercise to assist the diverse

national attempts (Uvalic, 2006).

According to the SBRA-Great-IST Report, in Montenegro the key steps to be taken simultaneously in the IST field are first to improve the coordination of legislation for IST related research and development. Secondly, a truly meaningful policy and normative work requires recognition and greater collaboration between all actors and stakeholders, starting with SMEs and research organisations, but also reaching out towards civil society (including various professional associations).

The Ministry of Education and Science needs to continue the development of the Montenegrin Education Information System as a basic component for strengthening of ICT in education and research. The Government should also continue the eGovernment project it has started, which aims to connect governments at all levels into a single secure broadband internet based network, to connect educational and health institutions to the internet and to create public access points in all towns and villages with more than 500 citizens by 2008. Additionally, the government needs to deal with the lack of ICT leaders and strategic institutional organisations, even though the country has a significant human potential. The government should also create a realistic strategy to raise internet penetration, especially to the general. The majority of internet users are still dial-up, broadband infrastructure needs to be developed - especially outside of the capital (SBRA-Great-IST, 2007).

The SBRA-Great-IST Report has stated some weaknesses and threats for Montenegro, especially in the IST field: poverty of business climate in the ICT sector; lowering share of RTD funding as percentage of government budget, very modest participation in FP6 (no project were won in the IST area); insufficient broadband infrastructure and access; lack of official statistics on IT and IST RTD; dominance of tycoons over smaller entrepreneurs and the continuous lack of resources and state assistance (and interest) to build the capacity in these sectors (SBRA-Great-IST, 2007).

In Montenegro, the main orientation of R&D policy is supporting basic scientific research and applied research. The priority tasks of the Ministry of Education and Science in the field of research are (Ministry of Education and Science of Montenegro, 2004):

- increasing stability in financing the existing research potential, paying special attention to research at higher education institutions (universities)
- professional assessing research groups
- modernising research equipment and other infrastructure
- increasing international cooperation in science
- ensuring that a higher percentage of the population receive higher education
- increasing post-graduate education of junior researchers with emphasis on PhD students
- providing scientific publications and participating in conferences

The Ministry of Education and Science uses two main programmes: the Human Resource Development Programme and the Scientific Research Programme. The main priorities of the Scientific Research Programme include biotechnology, marine biology, tourism, energy efficiency, telecommunications, computerisation and research on environmental protection, materials-related technologies and health care (Uvalic, 2006). Due to its position as the dominant institution, the University of Montenegro is the prime target of the reform process. However, the stimulation of enterprises and the creation of favourable environments for industry and SMEs are also considered to be crucial. In order to steer the changes in a synergetic way, a system of priorities, supported by adequate and sound economic policy measures, needs to be developed (Ministry of Education and Science of Montenegro, 2005).

Thematic Priorities in Montenegro according to the Ministry of Education and Science of Montenegro, 2005 (Dall, 2006):

General research priorities focus on:

- improvement of the quality of life and communication infrastructure,
- Information and Communication Technologies (ICT),
- environmental technologies and water management,
- materials research,
- research on agribusiness and biotechnology.

In addition, it would be recommendable for the country to develop a sustainable strategy, also taking into account regional and European dimensions. Although the last document related to R&D strategy adopted by the government dates back to 1995 and is no longer effective, the new Law on Scientific-Research Activities (2005) does envisage the preparation of an R&D strategy regarding the creation of a knowledge-based society (Uvalic, 2006). Furthermore, foresight and the identification of innovation capacities will help to develop policies and a long-term strategy in a regional context. Continuously increasing awareness among the public and politicians about the relevance of RTD is also important, and a dialogue between the economy, academia and the administration will provide the basis for developing a science policy that is in line with economic policies and priorities. Benchmarking and evaluation can also help to improve the performance of research institutions and to concentrate capacities in priority areas in coherence with regional development and European integration. A close dialogue with important foreign stakeholders with shared experiences is inevitable, but since there are no ready-made solutions, simply imitating policy approaches is unlikely to produce the desired results (Dall, 2006).

6 Summary and Draft Conclusions

After the dissolution of the Socialist Federal Republic of Yugoslavia (SFRY), Montenegro faced a turbulent political decade, followed by a long period of international sanctions and isolation, which prevented any significant progress in the country. Finally, on 3rd June 2006, Montenegro decided to hold a referendum of independence from the State Union of Serbia and Montenegro, taking on responsibility for its future status and reputation in the international political arena. The European Union recognised the legitimacy of the whole process and instantly commenced a procedure to continue separate negotiations with Montenegro on the Stabilisation and Association Agreement, which were temporarily terminated in the previous year.

There is a general conviction that in the 1990s, the SFRY had a more favourable starting position in terms of matching Western European standards than the former state socialist countries under communist hegemony in Central and Southeast Europe. The scientific and technological trajectories of the former SFRY seemed close to Western European developments and interaction between these two politically contrasting regions continued, both in terms of personal mobility and institutional cooperation. Unfortunately, the collapse of the SFRY and the resulting armed and civil conflicts hindered the necessary modernisation of S&T in the countries of the former SFRY (with the exception of Slovenia) in 1990s. All of these complex reasons have contributed to the loss of comparative advantage of the new countries (successors of the SFRY), which have missed the opportunity to carry out necessary adaptations and fine-tuning. The current situation can be described as critical, which is unequivocally demonstrated by the input and output figures of the national innovation systems. R&D was one element of the system which was most negatively affected during the transition and crisis period of the last 15 years. The research budgets in some of the

countries in the region (including Montenegro) are below critical threshold or have decreased significantly. Modernisation of the institutional and structural set-up of the national innovation system is long overdue, although a number of attempts have been initiated since the turn of the millennium. Links to other subsystems, such as education, the regional economy, and the financial and banking system, are generally still underdeveloped (Schuch, 2006).

International cooperation has been of tremendous importance and value to Montenegro. Serious efforts by the European Commission, Austria, France, Germany, Greece, Slovenia and others have been initiated to overcome the critical situation caused by the decade of isolation and underdevelopment. In this respect we can highlight the EU's "Balkan Countries Action Plan in S&T", formulated under the Greek EU Presidency in 2003, the establishment of the Southeast European ERA.NET initiated by Austria in 2004, and the implementation of a 'Steering Platform' for the Western Balkan countries under Austria's Presidency of the EU in 2006, as projects with the highest relevancy in the recovery of the RTD sector in the region, including Montenegro (Schuch, 2006).

One of the positive features in the countries of the Western Balkans, in comparison with some other developing regions, is a fairly sound human capital base, with an absorptive capacity central for learning, assimilating and using knowledge developed elsewhere. At the same time, however, the relative loss in quality at all levels of the education system is worrying. Development and higher education cooperation policies have recognised this threat and contributed material and immaterial resources to safeguard this vital source of economic and social development. Smaller countries, like Montenegro, are particularly dependent on technological and organisational knowledge and know-how generated abroad, however they can only access it using internationally up-to-date expertise which enables them not only to acquire, but also to generate and apply the knowledge and know-how themselves. Innovation is thus a process that involves more than just capable individuals. Bridging activities between companies and organisations of different sub-sectors of the innovation systems (such as education, regional development policy, S&T, and financial and regulatory systems) are of the utmost importance, as are bridging activities between more developed and less developed regions of knowledge. Interaction and interdependence are the most fundamental characteristics of this approach (Schuch, 2006).

Although the general assessment shows that the research system in Montenegro has substantial potential, it is still troubled by the inappropriate treatment of the research institutions, an unfavourable structure, weak interaction with the business sector and insufficient linkages with the education and research systems of other countries. Over the course of time, science, scientists and scientific research have been marginalised, while R&D has not been among the key priorities and a clear longer-term strategy in this area is still absent. According to Milica Uvalić, the links between business enterprises, universities and research institutes need to be improved and efforts should be made to accelerate the implementation of laws and related measures (Uvalic, 2006).

In addressing these complex issues, the government will have to face the challenge of finding the right balance between restrictive economic policy, which is clearly necessary for macroeconomic stabilisation purposes, and other types of policies with long-term effects, which can contribute to raising economic competitiveness, for example, through increased investment in human capital, and increased spending on R&D and on education. It would also be desirable to address the issue of a longer-term strategy of R&D for all Western Balkan countries in a regional context. Furthermore, there is a need to attract more Foreign Direct Investment (FDI) by further improving the business environment and thus decreasing the risk associated with investment, which also ought to facilitate the transfer of modern technologies

and know-how (Uvalic, 2006).

Sreten Škuletić, president of the Commission for scientific-research activities and international cooperation at the Montenegrin Ministry of Education and Science has assessed the overall situation in the country regarding RTD as a reflection of the general situation in society at this moment. The current economic situation, accompanied by severe under-financing of science gives little hope for any significant improvements in the near future. Allocated financial sources are hardly sufficient to cover basic survival needs, let alone create a platform for further development. Nevertheless, he believes that the situation could gradually improve by pursuing continuous efforts and investments in the RTD sector, accompanied by reforms in the field of higher education in line with the Bologna objectives and following processes (Prosvjetni rad, 2006). This is also a general assessment by the Montenegrin scientific Diaspora, who wants to see the positive changes in the country continue with an accelerated pace, but also reminds us that the most significant change required, is a change in the way science is viewed by society, in particular, the need for a greater awareness of the importance of science for the existence and development of society as a whole.

7 References

- Bacovic, M. (2007): Development of Scientific-Research activities statistics in Montenegro. Available from: http://www.uis.unesco.org/TEMPLATE/pdf/S&T/Workshops/Skopje/032007_13.pdf, as accessed 27.03.2008.
- BIS-RTD (2007): Final Country Report - Republic of Montenegro. Building and Improving Support for RTD, Policy and Public Spending BIS-RTD, Contract No.: FP6-042982, 6. Framework Programme.
- Bonas, G. (2006): Update on IPA Initiative. "see-science.eu" eJournal (issue fall 2006). Available from: <http://www.see-science.eu/news/332.html>, as accessed 27.03.2008.
- COBISS.CG (2008): The VBCG project. Available from: http://vbcghome.cnb.cg.ac.yu/cg/vbcg_project-EN.htm, as accessed 27.03.2008.
- CORDIS (2003a): Action Plan of EU - Balkan countries in the sector of Research and Technological Development (RTD). Available from: <http://cordis.europa.eu/greece/press45.htm>, as accessed 12.09.2006.
- CORDIS (2003b): Shared Vision of the EU: "Balkan countries Cooperation in Science and Technology". Available from: ftp://ftp.cordis.europa.eu/pub/greece/docs/eu_balkan_sharedvision_030627.pdf, as accessed 12.09.2006.
- Dall, E. (2006): National R&D Strategies of the Various Countries in Focus. In: Research and Development in South East Europe. Gesellschaft zur Förderung der Forschung.
- Directorate of Development of Small and Medium-Sized Enterprise, M. (2007): Strategy of development of small and medium size enterprises 2007-2010. Available from: <http://www.nasme.cg.yu/eng/infocus.php?a=sh&aid=102>, as accessed 27.03.2008.
- Djurovic, G. (2007): Promoting Main Principles of European Integration in Western Balkan Region through Regatta Approach - View from Montenegro. Available from: http://www.see-science.eu/attach/DPMDJUROVIC_Montenegro_PaperforAlpbach2007.pdf, as accessed 17.09.2007.
- European Commission (2004): Joint Research Centre. Available from: http://www.jrc.cec.eu.int/default.asp@sidstz=more_information&sidstsz=searchjrc.htm, as accessed 12.09.2006.
- European Commission (2006): Political Profile of Montenegro. Available from: http://www.ec.europa.eu/enlargement/montenegro/political_profile_en.htm, as accessed 06.09.2006.
- European Commission (2007): Candidate and Pre-accession Countries Economies Quarterly. Available from: http://www.esiweb.org/pdf/montenegro_EC-preaccession%20economic%20quarterly-jul2007.pdf, as accessed 20.03.2008.

European Patent Office (2006): How to get a European Patent. Guide for applicants. Available from: http://www-european-patent-office.org/legal/guiapp1/pdf/g1en_net.pdf, as accessed 24.07.2006.

Fischer, M. (2006): The Input Side of the National Innovation Systems. In: Research and Development in South East Europe. Gesellschaft zur Förderung der Forschung.

Government of the Republic of Montenegro (2005): Strategy Plan for the Educational Reform in Montenegro for the period 2005-2009. Available from: <http://www.gom.cg.yu/files/1147963662.pdf>, as accessed 28.03.2008.

Government of the Republic of Montenegro (2007): Agency for International Scientific, Educational, Cultural and Technical Co-operation of Montenegro. Available from: <http://www.vlada.cg.yu/eng/zamtes/index.php?akcija=vijesti&id=624>, as accessed 28.02.2008.

Hörlesberger, M. (2006): The Output Side of the National Innovation Systems. In: Research and Development in South East Europe. Gesellschaft zur Förderung der Forschung.

IMPACT (2007): Montenegro establishes Intellectual Property Office. Available from: http://impact.freethcartwright.com/2007/05/montenegro_esta.html#more, as accessed 28.03.2008.

INA - Great-IST (2007): The Great-IST Final Report. Available from: <http://www.great-ist.org/docs/GREAT-IST%20Deliverable%20D6.4%20Final%20Report.pdf>, as accessed 25.03.2008.

Internet World Stats (2007): Internet User Statistics & Population for 52 European countries and regions. Available from: <http://www.internetworldstats.com/stats4.htm>, as accessed 25.03.2008.

Knezevic, T. (2008): Review of the S&T Report in February 2008 for see-science.eu.

Knezevic, T., Zizic, B. (2007): S&T in Montenegro. Available from: <http://www.see-science.eu/ejournal/view?id=2222>, as accessed 17.09.2007.

Kobal, E. (2005): Elements of National Science and Technology Policy. In: Modernisation of Science Policy and Management Approaches in Central and South East Europe. E. Kobal and S. Radosevic, IOS Press: 13-18.

Koprivica, S. (2006a): Bologna Process - Template for National Reports:2005-2007. Available from: <http://www.dfes.gov.uk/bologna/index.cfm?fuseaction=docs.list&DocCategoryID=17&StartRow=41>, as accessed 01.06.2007.

Koprivica, S. (2006b): Integration of EU Enlargement Countries to ERA Participation in EU FP7.

Kutlaca, D. (1998): The Science and Technology System in the Federal Republic of Yugoslavia. Available from: <http://www.sussex.ac.uk/Units/spru/publications/imprint/steepdps/43/steep43.html>, as accessed 28.03.2008.

Kutlaca, D. (2005a): Science and Technology in Serbia and Montenegro. In: Modernisation of Science Policy and Management Approaches in Central and South East Europe. E. Kobal and S. Radosevic, IOS Press: 52-60.

Kutlaca, D. (2005b): Statistical Bulletins : Institutions of Scientific-Technological Development, Montenegro.

Kutlaca, D. (2005c): Statistical Bulletins: Institutions of Scientific - Technological Development, Serbia.

Machacova, J., Dall, E. (2007): Thematic Report on Innovation Infrastructures in the Western Balkan Countries: Montenegro.

Ministry of Education and Science of Montenegro (2003): Recommending a Strategy on Education reform in Montenegro. Available from: http://www.see-educoop.net/education_in/pdf/support-edu-monte-5-yug-mon-enl-t05.htm, as accessed 11.09.2006.

Ministry of Education and Science of Montenegro (2004): Montenegro in Europe. Available from: <http://www.jrc.cec.eu.int/enlargement/events/20041026/presentations/koprivica-s&t-montenegro.pdf>, as accessed 12.09.2006.

Ministry of Education and Science of Montenegro (2005): Questionnaire for SEE-ERA.NET - Montenegro.

Ministry of Education and Science of Montenegro (2006): Announcement of the Pilot Joint Call SEE-ERA.NET. Available from: <http://www.vlada.cg.yu/minprosv/index.php?akcija=vijesti&id=17528>, as accessed 28.03.2008.

Ministry of Education and Science of Montenegro (2007): ENIC mreza (Evropska mreza nacionalnih informacionih centara o akademskoj mobilnosti i priznavanju). Available from: <http://www.mpin.vlada.cg.yu/vijesti.php?akcija=rubrika&rubrika=161>, as accessed 28.03.2008.

Ministry of Education and Science of the Republic of Montenegro (2003): Strategy of Introducing ICT into the Education System of Montenegro - Up to the University Level. Available from: http://www.seerecon.org/serbiamontenegro/documents/progress_report_montenegro/ict_strategy_education_montenegro.pdf, as accessed 27.03.2008.

Ministry of Environmental Protection and Physical Planning Republic of Montenegro (2007): National Spatial Plan of the Republic of Montenegro until 2020. - Draft. Available from: <http://www.prostorniplan.vlada.cg.yu/files/1181072384.pdf>, as accessed 27.03.2008.

Ministry of Tourism and Environmental Protection of the Republic of Montenegro (2007): National Strategy for Sustainable Development. Available from: <http://www.gom.cg.yu/files/1197369504.pdf>, as accessed 27.03.2008.

Montenegrin Academy of Sciences and Arts (2005): Montenegrin Academy of Sciences and Arts. Available from: www.canu.cg.yu/opste.htm, as accessed 08.09.2006.

Prosvjetni rad (2006): Interview with Sreten Skuletic: Less Money, Less Science. Available from: http://www.prosvjetnirad.cg.yu/broj3-4_06g/02.htm, as accessed 06.09.2006

Radosevic, S. (2005): Transformation of Research and Innovation Policy in New EU Member and Candidate Countries: What Can We Learn from It? In: *Modernisation of Science Policy and Management Approaches in Central and South East Europe*. E. Kobal and S. Radosevic, IOS Press: 29-38.

Roland Berger Market Research (2004): Study on the Cost of Patenting in Europe, on behalf of the European Patent Office.

SBRA-Great-IST (2007): Links between IST research and business: impact assessment and recommendations. Available from: <http://www.great-ist.org/docs/GREAT-IST%20D5.2%20final.pdf>, as accessed 20.03.2008.

Schuch, K. (2006): Conclusions and Recommendations for Policy Interventions. In: *Research and Development in South East Europe*. Gesellschaft zur Förderung der Forschung.

SD Petosevic (2006): Intellectual Property Protection in Montenegro. Available from: <http://www.petosevic.com/offices/montenegro>, as accessed 27.03.2008.

Secretariat for Development (2004): National Strategy for Development of Information Society - the way to knowledge-based society (Republic of Montenegro). Available from: <http://www.vlada.cg.yu/files/1133178641.pdf>, as accessed 28.03.2008.

see-science (2006): General Info: What is IPA? eJournal of the SEE-science(fall 2006). Available from: <http://www.see-science.eu/ejournal/519.html>, as accessed 31.03.2008.

see-science.eu (2007): EU and Western Balkans Countries sign visa deal. Available from: <http://www.see-science.eu/news/view?id=2300>, as accessed 19.09.2007.

Skuletic, S. (2006): Review of the S&T Report in December 2006. see-science.eu.

Stability Pact for South Eastern Europe and UNDP Regional Support Centre (2003): Electronic South East Europe Initiative: Guidance Note on National e-Strategies. Available from: [http://www.eseeinitiative.org/sadrzaj/RelatedDocuments/sadrzaj/terms/ESEE_FINAL-APRIL\(A4\).pdf](http://www.eseeinitiative.org/sadrzaj/RelatedDocuments/sadrzaj/terms/ESEE_FINAL-APRIL(A4).pdf), as accessed 27.03.2008.

UNESCO & Hewlett Packard (2003): Piloting Solutions for Alleviating Brain-drain in BiH, Croatia, Montenegro and Serbia. Available from: <http://www.unesco-hp.cg.ac.yu>, as accessed 11.09.2006.

University of Montenegro (2006): Bulletin of the University of Montenegro, No. 211, 15.11.2006.

USAID (2005): Strategy Statement - The Republic of Montenegro. Available from: http://www.usaid.org.yu/upload/documents/Budget/USAID_Strategy_for_Montenegro_Public_English.pdf, as accessed 27.03.2008.

U.S. Department of State (2007): Montenegro Profile. Available from: <http://www.state.gov/r/pa/ei/bgn/70949.htm>, as accessed 27.03.2008.

Uvalic, M. (2005): Science, Technology and Economic Development in South Eastern Europe. UNESCO Science Policy Series n. 1. Available from: <http://unesdoc.unesco.org/images/0014/001414/141495e.pdf>, as accessed 27.03.2008.

Uvalic, M. (2006): National Systems of Research and Development in the Western Balkan Countries. Available from: <http://www.see-science.eu/doc/1546.html>, as accessed 20.03.2008.

Vukcevic, M. (2007): State Of The Art And The Strategy Of RD&I Development In Montenegro. Available from: <http://209.85.129.104/search?q=cache:M7ga0xz0gYAJ:www.investsciencesee.info/Vukcevic.ppt+Montenegro+research+and+education+electronic+network&hl=de&ct=clnk&cd=10&gl=at>, as accessed 27.03.2008.

WUS Austria (2006): What is WUS Austria. Available from: <http://www.wus-austria.org>, as accessed 28.03.2008.

Yusurvey (2006): Protection of Intellectual Property in Serbia & Montenegro. Available from: <http://www.yusurvey.co.yu/products/ys/showSummaryArticle.php?prodId=2060&groupId=6258>, as accessed 27.03.2008.

8 List of Acronyms

| | |
|---------|--|
| BERD | Business Sector Expenditure on R&D |
| CARDS | Community Assistance for Reconstruction, Development and Stabilisation |
| CANU | Montenegrin Academy of Sciences and Arts |
| CEEC | Central and Eastern European Countries |
| CEI | Central European Initiative |
| CERN | European Organisation for Nuclear Research |
| CEP | Centre of Excellence Projects |
| CG | <i>Crna Gora</i> - Montenegro |
| CIP | Competitiveness and Innovation Framework Programme |
| CIS | Centre of Information System |
| COBISS | Co-operative Online Bibliographic System & Services |
| CORDIS | Community Research & Development Information Service |
| COST | Co-operation in Science and Technology |
| DAAD | German Institute for Academic Mobility |
| DG | Directorate General (in the European Commission) |
| EC | European Commission |
| ECTS | European Credit Transfer System |
| EIP | Entrepreneurship and Innovation Programme |
| ERA | European Research Area |
| ERA-NET | European Research Area Network |
| EU | European Union |
| FP | Framework Programmes |
| FP6 | Sixth EU Framework Programme for R&D |
| FP7 | Seventh EU Framework Programme for R&D |
| FTE | Full Time Equivalent |
| EPC | European Patent Convention |
| EPO | European Patent Office |
| FDI | Foreign Direct Investment |
| FRY | Federal Republic of Yugoslavia |

| | |
|----------------|--|
| GEANT | multi-gigabit pan-European data communications network |
| GERD | General Expenditure on R&D |
| GDP | Gross Domestic Product |
| GOVERD | Government Sector Expenditure on R&D |
| HC | Head-Count |
| HE | Higher Education |
| HERD | Higher Education Sector Expenditure on R&D |
| HP | Hewlett Packard |
| IAEA | International Atomic Energy Agency |
| ICT | Information and Communication Technology |
| ICTY | United Nations International Criminal Tribunal for the former Yugoslavia |
| INCO | International S&T cooperation of the European Union |
| IP | Intellectual Property |
| IPA | Instrument for Pre-Accession Assistance |
| ISSP | Institute for Strategic Studies and Prognoses |
| IS2WEB | FP6 project "Extending Information Society Networks to the Western Balkan Region" |
| IST | Information Society Technologies (Sub-Programme in FP6) |
| JRC | Joint Research Centre |
| MEIS | Montenegrin Educational Information System |
| MoES | Ministry of Education and Science |
| MONSTAT | Statistical Office of the Republic of Montenegro |
| MREN | Montenegrin Research and Education Network |
| NATO | North Atlantic Treaty Organisation |
| NIP | Networking Infrastructure Projects |
| PJC | Pilot Joint Call of the SEE-ERA.NET project |
| PTO | Patents and Trademarks Office |
| R&D | Research and Development |
| RTD | Research and Technological Development |
| SAA | Stabilisation and Association Agreement |
| SAP | Stabilisation and Association Process |
| S&E | Science and Engineering |
| SEE | South East Europe |
| SEE-ERA.NET | FP6 project "Southeast European Era-Net" |
| SEE-INNOVATION | FP6 project "Facilitating Innovation for ICT SMEs in South Eastern Europe" |
| SEE-SCIENCE.EU | FP6 project "Information Office of the Steering Platform on Research for Western Balkan Countries" |
| SEEREN | FP6 project "South Eastern European research and education networking" |
| SFRY | Socialist Federal Republic of Yugoslavia |
| SME | Small and Medium Size Enterprise |
| S&T | Science and Technology |
| TEMPUS | Trans-European Mobility Scheme for University Studies |
| TRIPS | Trade Related Aspects of Intellectual Property Rights |
| UN | United Nations |
| UNDP | United Nations Development Programme |
| UNECE | United Nations Economic Commission for Europe |
| UNESCO | United Nations Educational, Scientific and Cultural Organisation |
| UNIDO | United Nations Industrial Development Organisation |
| USAID | United States Aid |

| | |
|--------|---|
| UoM | University of Montenegro |
| WB | Western Balkans |
| WBC | Western Balkan country/countries |
| WTO | World Trade Organisation |
| WUS | World University Service |
| ZAMTES | Republic Agency for International Scientific, Educational, Cultural and Technical Co-operation of Montenegro |
| ZSI | Zentrum für Soziale Innovation (Centre for Social Innovation) |