



GUIDELINES FOR A SCIENCE AND TECHNOLOGY POLICY IN BOSNIA & HERZEGOVINA

REPORT OF A UNESCO-ROSTE EXPERT MISSION

**1ST DRAFT
7 OCTOBER 2005**

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FOREWORD

The UNESCO Regional Bureau for Science in Europe (ROSTE) has been involved for a number of years in reflections on the reconstruction of scientific cooperation in South East Europe involving many experts from EU and non-EU countries. A conference held in Venice on 24-27 March 2001 and organized by ROSTE launched the process. Since then, ROSTE has taken several initiatives, and decided, in 2004, to organize an expert mission in Bosnia & Herzegovina with two main objectives: to assess the scientific potential (and in particular the research infrastructures) of the country; and to make recommendations for its future development and integration into the international and European research communities. ROSTE felt, indeed, that it was its duty to contribute to the reconstruction of the scientific potential of a country which has been severely damaged during a war and to the development of international cooperation for this purpose. This initiative was fully endorsed by the BiH political authorities and received the personal support of Dr Safet Halilovic, Minister of Civil Affairs of Bosnia & Herzegovina, and Mrs Zeljana Zovko, Ambassador of BiH to France and Ambassador, Permanent Delegate to UNESCO.

Accordingly, we carried out three mission in the country, all of which took place in 2005 (14-19 March, 16-21 May, 30 June-1 July); during these missions we visited Sarajevo (twice), Banja Luka (twice), Mostar and Zenica, and were able to meet political authorities in the country at various levels, diplomats, representatives of the scientific community (universities, research institutes) and industrialists. We also visited laboratories and companies. Our mission was greatly helped by the support of local authorities and by the UNESCO-ROSTE Office in Venice and its Project Office in Sarajevo. A list of all institutions visited, and a summary of views aired there, may be found in the Annex

In this Report, after a brief introduction describing the present situation of the country ten years after the signature of the Dayton Peace Agreement, we shall present our conclusions concerning the present situation of the scientific potential of the country and the role of the various institutions, as well as propose objectives and guidelines for a future national science and technology policy.

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EXECUTIVE SUMMARY

UNESCO-ROSTE commissioned an expert mission in Bosnia and Herzegovina with two main objectives: to assess the scientific potential (in particular research infrastructures) of the country; and to make recommendations for its future development and integration into the international and the European research communities. This initiative was fully approved by the BiH political authorities and in particular by Dr Safet Halilovic, Minister of Civil Affairs of Bosnia & Herzegovina, and H.E. Ms Zeljana Zovko, Ambassador of BiH to France and Ambassador, Permanent Delegate to UNESCO. Three missions were undertaken in the country in 2005 (14-19 March, 16-21 May, 30 June-1 July), during which meetings were organized with political authorities; universities, laboratories and companies were also visited. This report presents our conclusions and recommendations.

Ten years after the Dayton Peace Agreement (signed in 1995) which put an end to the war, BiH still faces a very difficult situation: the unemployment rate is high (40% of the active population), large sectors of the economy have collapsed, and a large fraction of infrastructures has not been reconstructed. Furthermore, the division of political and administrative responsibilities between the three levels of political government inherited from the Dayton Accord (the State of BiH, the Republika Srpska, and the Federation of BiH and its ten cantons) is a serious obstacle for defining and implementing policies at country level and in particular a science and technology policy.

Although BiH had inherited from Yugoslavia a strong scientific and technological tradition (in 1991, before the war, it invested 1.5% of its GDP in R&D activities) and a strong industrial basis, its research system is currently not able to work properly according to international standards. BiH has maintained a science and technology system with 8 universities, several public mission-oriented research institutes (for example, in metallurgy and agriculture) with various legal (and often undefined) statutes, as well as a limited number of industrial laboratories (performing mainly development tasks). But, the present funding of R&D activities in the country (around 0.05 per cent of GDP according to official figures) is very low; most of the research infrastructure is obsolete; many laboratories, if not all, are lacking operating funds; libraries are not able to pay subscription costs to journals and the connexion to the international communication system is not working rapidly; the young generation in universities has no means to be trained in research activities; and most of industrial research has been dismantled.

This means that BiH is not able to prepare its own future which, in modern societies, relies on the capacity of countries to mobilize scientific and technical expertise. Confronted by this situation, there exist neither mechanisms nor resources at the State level to define and implement a policy to begin the reconstruction of the research potential of the country. Political and administrative barriers resulting from the post-war situation are a very serious obstacle to this process. Furthermore, the privatisation of the economy which has been engaged does not take into account the necessity of preserving the technical capital of industrial companies which, in some sectors (energy and metallurgy for example), remains valuable. Although the situation is serious, it is not completely black. In many sectors there is a consciousness that solutions to problems are urgent, and researchers in difficult situations have found means to restart activities and cooperation with partners inside the country despite numerous barriers.

Rebuilding the scientific and technological potential of BiH requires the adoption of a “road-map” with three general mid-term objectives (2005-2015):

- Training of a new generation of scientists in BiH universities or abroad.
- Developing in the country a network of research infrastructures (experimental equipment, computers, information networks and libraries) of international standard.
- Reinvesting in industrial research in a limited number of sectors (as a priority those that export a large percentage of their production).

Although basic research should be necessarily developed in several disciplines to lay the ground for the future, resources being limited and needs of BiH for its social and economic development being very great, a limited number of priorities will have to be defined such as: health, environment, metallurgy, energy, agriculture, forest and the food industry. Projects in these domains, as in others, should be funded only following appropriate evaluation.

The definition of a science and technology policy at the State level of BiH is an absolute prerequisite for rebuilding a recognized effective competence in science and technology in the country and to develop research activities that may address the needs of BiH as part of its development. This State policy might be complemented by actions supported at the level of other politico-administrative entities as the Republika Srpska, the Federation of BiH and some of the latter’s cantons, as a function of their respective needs and financial means. The future integration of BiH into the European Union would suppose negotiation at the level of the BiH State of the participation of BiH in the research Framework Programme, which would thus entitle the country to be a member of the European Research Area.

A State science and technology policy also requires that a legal framework be in place. This is the role of the two Laws on Higher Education and Science which have been drafted and are presently being debated. The adoption of these laws is urgent.

We strongly recommend that the drafting of the science law should involve, in a preliminary phase, the main stakeholders of the present research system in BiH (ministries and administrations in charge of science and innovation in the politico-administrative entities of the country, the Academy, the universities and institutes, representatives of the economic sectors).

The Science Law should define, in a limited number of articles:

- The responsibility of the BiH State in the definition of a science and technology policy with the legal framework to implement it.
- The role and means of a State institution to be created to implement this policy as those of other politico-administrative entities of the country.

Funding of R&D should be tripartite: the State of BiH; the politico-administrative entities such as the Republika Srpska, the BiH Federation and some cantons (that support universities); and the private sector (industry and services). For the mid-term (2012) we propose an urgent financial plan that would aim at a global expenditure by public entities (State and other entities) of approximately 25 million euros per year, which should be complemented by EU investments and loans (from the European Investment Bank and the World Bank, for example). During the same period industry should also increase its own

R&D investment, which might represent by 2012, one third of total R&D expenditure of the country. For the long term BiH should invest 2 % of its GDP in R&D, as recommended by the Academy of Sciences and Arts of BiH.

The creation of State institutions to define and implement such a policy is the major objective of the Law on Science being drafted. Our main recommendations are as follows:

- A **Ministry** should have the political responsibility of the science and technology policy of BiH. It could be either an existing ministry (the present Ministry for Civil Affairs, for example) or an *ad hoc* ministry created for the purpose, the former solution being the simplest one.
- Under its responsibility an **Agency (or Council) for Science and Technology Policy** should be established, with the following missions : assessing needs for research activities; defining priorities for the country; proposing to the Government the means to implement these priorities; establishing cooperation with the European Commission with a view to the participation of BiH in Framework Programme activities and other international programmes; and collecting statistical R&D data (with the support of a specific observatory).
- To define the main guidelines and priorities of the research policy at the State level, the Prime Minister would chair, periodically, an **Interministerial Committee for S&T Activities in BiH**. The Agency would act as a secretary for this Committee.
- A **State Fund for R&D in BiH** should be created (under the responsibility of the Council or Agency), with the objective of supporting scientific projects.
- An **Advisory S&T Committee (or Board)** should be established, working with the Agency (or Council) and advising it on establishing priorities.

Science should be considered not only as an asset to rebuild the economy of BiH and a support to public policies, but also as an essential dimension of the culture of the country. It is thus important to enhance the public understanding of science through specific actions.

The BiH scientific community should be able to join the European Research Area and to be involved in international scientific cooperation. We thus recommend that: the BiH scientific community be strongly involved in regional cooperation and with European partners in research projects funded by the European research and technological development Framework Programme; for the duration of the Seventh Framework Programme, the EU should devote funds through an *ad hoc* International Programme for Western Balkan States; and BiH should participate in the COST and Eureka Programmes.

The UNESCO Regional Bureau for Science in Europe (ROSTE) in Venice, which commissioned this Report, has launched several initiatives over the last few years to support the reconstruction of the scientific potential of the South East European countries and particularly those of the Western Balkans. We strongly recommend that this action be continued, since UNESCO can play a catalytic role in the region by contributing to initiatives aiming at the development of regional scientific cooperation (through expertise, training of experts, support to specific actions to rebuild the science potential, etc.).

Scientific and technological research in BiH is in a state of emergency. Actions are urgently needed both at national and international levels. Reconstructing the science and technology potential of the country is a necessity to prepare its future and it is also an important step toward the stabilization of peace in the region.

1 - INTRODUCTION

Bosnia & Herzegovina, which had been, since 1945, one of the six republics of the federal State of Yugoslavia, became an independent State in 1992 and was recognized by the international community (European states and the USA recognized its sovereignty in April 1992). The independence of BiH occurred as part of a series of events that took place when Yugoslavia collapsed as a federal State and in the middle of great turmoil. The new BiH State had to pay a high price for its independence, as the country was going through a war which lasted more than three years, between 1992 and 1995. This war caused very severe destruction throughout the country and was marked by massive killings of the civilian population (the total number of victims is estimated to have been about 250,000 people). The siege of Sarajevo and the resistance of its population were symbolic of the will of the city to withstand adversity and to maintain the historical heritage of the country (the series of events which led to the war is well analysed in Noel Malcom's book *Bosnia: a short history*). As it has been highlighted in several books and articles, BiH's historical experience is indeed deeply rooted in the political and cultural past of the Balkans countries with a multinational and multiethnic dimension that characterizes the country. This is certainly an asset for Bosnia & Herzegovina as it has been a bridge between different worlds in Europe.

The war was put to an end, under strong military and political pressure from the international community, when a "general framework agreement for peace in Bosnia & Herzegovina" was initialled in Dayton (USA) on 21 November 1995 and signed as a treaty in Paris on 14 December 1995. This agreement (of 11 articles with 11 annexes) included a territorial settlement, a new constitution, various mechanisms for the protection of human rights, the return of refugees and the reconstruction of the economy. An international force, under NATO leadership, was deployed within the country to supervise the application on the ground of the agreement and the end of hostilities. A civilian "High Representative" was nominated by the UN to monitor and coordinate the whole political process implementing the Dayton Accord.

According to the Dayton Agreement, BiH is a sovereign State which "shall consist of the two entities, the Federation of BiH and the Republika Srpska" (Article 1). The Federation itself is divided into ten cantons which have a rather high degree of autonomy (universities, for example are under their tutorship). The Dayton Agreement also defines the responsibilities of the institutions of Bosnian State and of the entities (Article 4). Thus, foreign policy, foreign trade policy, customs, monetary and immigration policies, and the operation of common and international communications facilities are among the main policy functions of the BiH State. According to the constitutional arrangements of the Dayton Accord, a central government with a parliament, a Council of Ministers and a three-person Presidency was established; and elections were organized in the country. Many areas of policy and law were left to the "entities" and one must stress, for example, that neither education nor scientific research are considered as responsibilities of the BiH State.

Coming back to the pre-war situation one must observe that BiH, although not among the wealthiest republics of Yugoslavia, had been able to establish a network of public infrastructures and an important industrial basis. BiH had, and still has, relatively important

resources: coal and iron ores mines, a forest that has long been exploited, and water resources that can provide hydroelectricity. Heavy industries (steel and aluminium) were developed after World War II and half of the Yugoslav defence industry had been settled in BiH.

In 1949 the University of Sarajevo was officially established (although some faculties had existed before) and scientific research was developed in academic laboratories, in local branches of Sarajevo University as well as autonomous institutes dedicated to applied research (in Zenica and Mostar for metallurgy, and Tuzla for mining, for example). Industry developed its own research quite intensively during this period, often in cooperation with academic research. A company as Energoinvest which produced machines (in particular for the energy sector), various electronic equipment and components was the largest enterprise of this type in former Yugoslavia and exported most of its production. Energoinvest was thus much involved in research with PhD's, MSc's and several hundreds of engineers and technicians working in its own laboratories; food and pharmaceutical industries were also able to develop their own research and development (R&D) activities.

Intellectual life thus flourished in the country, with a living artistic and literary creation and very active scientific research that had earned a well internationally recognized reputation. Most of these assets (higher education, research and industry) collapsed during the 1992-1995 war and its aftermath. Major damage was inflicted on industrial and research facilities during the hostilities. Scientific research almost came to a stop due to destruction of buildings and for lack of funding. Furthermore, a large percentage of the elites in universities and industrial laboratories emigrated to foreign countries, a situation which contributed to the weakening of the intellectual base needed for the reconstruction of the country.

Ten years after the signature of the Dayton Peace Agreement, many observers of the BiH situation (both inside and outside the country) have stressed three of its characteristics. Firstly, although the Agreement had the great merit of putting the war to an end and of laying the basis for establishing the conditions for the democratic life of the country, it appears that Bosnia & Herzegovina is not yet a united country, since the central and common organs for the government of the country remain weak. The weakness of the BiH State and the partition of the country into two entities (the Republika Srpska being largely centralized while the Federation is decentralized with ten autonomous cantons) is certainly a very serious obstacle to the reconstruction of the country and its intellectual and economic development (for example, three independent companies have responsibility for electricity production) which should be based, as in all modern countries, on its ability to mobilize scientific and technological expertise. Secondly, one must observe that the social and economic situation in BiH remains precarious. Although basic infrastructures (roads, bridges, schools, etc.) have been reconstructed, many of them remain in poor condition. In 2004, the BiH national product (8 billion €) represented 56% of its pre-war level, while, according to official figures: unemployment rate remained at a very high level (40% of the active population), and 20% of the population was below the poverty line. BiH suffers also from a large trade deficit, with exports covering only 30% of imports, and the rate of savings of the country is low. The picture is not, however, completely black: inflation has been mastered and is standing at a low level, which contributes to monetary stability; a tax reform has been adopted which will be applied in principle in 2006 (a value added tax should be introduced); a large number of economic reforms have been introduced; and industrial production is increasing. BiH development remains difficult in these conditions and one should not be surprised that, according to an opinion poll, 60% of young people expects their future to lie abroad and not in their country. Lastly, and by no means least, the sad events and considerable suffering that people have experienced throughout the country remain deeply etched on their memories.

Although many believe in the future of Bosnia & Herzegovina, which has already gone through very difficult periods in its history, the country is not totally reunified in people's mind.

Education and scientific research are, without doubt, effective tools for preparing the future of a country and this was the main motivation behind the decision taken by UNESCO-ROSTE to commission this study to assess the situation of research in BiH and to propose recommendations for the rebuilding of the scientific and technological potential of the country.

2 - ASSESSMENT OF BIH RESEARCH POTENTIAL: THE ROLE OF INSTITUTIONS

2.1 - Research activities

Although we were not able to visit every university and laboratory during our three missions in BiH, we nevertheless have the feeling that only few centres have been able to maintain research activities corresponding to international standards. There are several reasons for this. First, the war caused severe damage to buildings and thus to equipment in universities, institutes and industrial laboratories. Second, a sizeable percentage of the scientific manpower has emigrated to other countries (this is probably the case for the great majority of researchers of industrial laboratories as those of Energoinvest, which lost three-quarters of its R&D manpower, which represented 1600 persons in 1992). Lastly, after the war, severe budgetary constraints have prevented laboratories from buying new equipment, and thus the majority of BiH research infrastructure is either out-dated or in need of repair.

Reconstruction of the science and technology potential has not been considered a priority by political authorities and by the international community (primary and secondary education were a priority). Only a limited number of laboratories have been able to maintain research activity of an international standard; in the face of so many difficulties their merit is thus very great (this is the case, for example, of the Institutes of Agriculture in Banja Luka, of Genetic Engineering and Biotechnology in Sarajevo, and of the two Agro-Mediterranean Institutes in Mostar). In general, the eight existing universities (Sarajevo, Bihac, Tuzla, Zenica and the two universities of Mostar for the BiH Federation; East Sarajevo and Banja Luka for the Republika Srpska) have maintained research activities: in social sciences (economics, sociology) and humanities (history, political science); and in a few areas of engineering and physical sciences through contracts with a limited number of industrial companies. By and large, the universities have lost their critical mass in science (few of them have PhD programmes with a sizeable number of students, mostly in the social sciences and humanities). Meanwhile, some research institutes have succeeded in keeping a critical mass through continuous efforts of cooperation with the industrial sector (mostly on very short term objectives) which have enabled them to gain contacts and thus to renew their scientific equipment. One must also stress that access to important research infrastructures such as libraries (and in particular the National Library of BiH and the National and University Library of the Republika Srpska) which contain rare books and manuscripts is very difficult. Collections of rare manuscripts of the National Library in Sarajevo have thus been stored in difficult conditions since the destruction of the library building during the Sarajevo siege.

Access to internet is also difficult due to bad telecommunication connexion, and the Academic networks are not working properly despite recent efforts of ministerial authorities, particularly in the Sarajevo canton. One may also observe that, according to figures from the Academy of sciences arts (cf. annex III), the number of internet hosts is rather small in BiH (950 per million people with 30 PC's per 1 000 people, figures for 2000).

As far as industrial research is concerned, although BiH had established an excellent reputation in several technical sectors (mechanical and electrical engineering, metallurgy, food industry, pharmaceuticals) before the break-up of Yugoslavia, this technological asset has almost completely vanished. Large companies have disappeared and few of those still

remaining have been able to maintain a minimum of technical expertise in development laboratories. There exist, meanwhile, a few exceptions: the Aluminij Company in Mostar, and the Bosnalijek pharmaceutical company in Sarajevo being a examples of companies that have invested to maintain their technical competence. Furthermore, the difficult situation of most academic laboratories (particularly in faculties of engineering) is a serious obstacle to cooperation with industry.

The *Observatoire des Sciences et des Techniques* (OST) in Paris has recently produced science indicators for BiH (see Annex III). They reveal that although the evolution of the scientific production during the period 1993-2001 has been positive, the absolute number of scientific papers published in international journal nevertheless remains weak (a total of 30 papers in 2001). It also appears that BiH is relatively strong in medicine (40 % of papers published in international journals), engineering sciences (20 %) and physics (18 %).

2.2 - Funding of the research effort

In the absence of overall statistics for research and development activities in BiH, it is difficult to come up with an exact evaluation of the public funding of these activities (including manpower). As far as manpower is concerned (teachers and advisers), according to official statistics for the Federation of BiH (*Statistical data on economic and other trends*, January 2005), there were 2 125 teachers and advisers in the six universities of the Federation (among them 1 044 professors and 903 doctors) and 58 000 students. According to statistics prepared for the SEE Eranet network by the BiH coordinator, there were, in 2003, 1226 permanent professors and assistants in the 8 BiH universities, figures which are coherent with those for the Federation.

Several science and education (or science and technology) ministries at the level of the BiH Federation and of some of its cantons (Sarajevo Canton in particular), and of Republika Srpska have recently established research funds to support projects. There does not yet exist any funding at the level of BiH State. By and large, public funding of research activities (excluding salaries of university staff) amounts to approximately 8 million KM (4 million euros) at most. These funds are usually used to buy equipment and to allow basic operation of research institutes. One must also take into account salaries of university staff that are met through university budgets (budget allocated by ministries, and probably a percentage of student fees complementing the university budgets).

As far as industry is concerned, no figures exist on research budgets and manpower; one may estimate that research staff in remaining industrial laboratories in the country (which are mainly performing development or testing) are 100 persons at most.

According to statistics often cited by official reports (the report of the Academy of Sciences and Arts of BiH and the report prepared for the SEE Eranet network, for example) the ratio of national expenditure in BiH to the Gross Domestic Product (GDP) could amount to 0.05 % as compared with 1.5 % in 1990. It is difficult to agree on exact figures in this domain but this ratio is probably underestimated. With the GDP of BiH amounting approximately to 8 billion euros in 2003, a ratio of 0.05 % would represent 4 million euros, i.e. the research funding granted by various ministerial entities; it thus does not probably take into account the percentage of salaries of academics corresponding to research activities according the Frascati standards and of full-time researchers in institutes and industry, and must thus be corrected probably by a factor of 3. Even with this correction, it appears that the ratio of BiH R&D expenditure to GDP (0.15 % maximum) is far below international standards (in excess of 1%

in most EU countries) and corresponds to the situation of a country which is not able to reach the critical mass to maintain or initiate research activities on a competitive basis.

2.3 - Research and the economy

BiH had, prior to 1990, an economy in which industry was significant, with important industrial companies that had established their international competitiveness on a technological basis (EnergoInvest was the most prestigious and important). These companies had created and developed large research laboratories with several hundred researchers. Almost all this technical expertise disappeared during and after the war and only a few companies have been able to maintain a minimum of research activity in metallurgy (steel and aluminium), electricity production (BiH exports electricity), pharmaceuticals and food production. BiH has retained a mining industry (iron ore and coal) and agricultural resources and forests represent an important asset (BiH exports wood). The economic development of BiH, where unemployment is at a very high level (the unemployment rate is around 40 % of the active population), requires a minimum base of technological research, which the country is presently unable to perform either in public or in private laboratories for lack of resources and manpower. This is without doubt a most severe handicap for the future. Several of our interlocutors did agree with this judgment (in particular the Academy of Sciences and Arts of BiH, the BiH Chamber of Commerce and all industry managers that we met).

The BiH State Unit for Economic Policy Planning has published a Plan for a “Medium-term Development Strategy” (2004-2007), which devotes several chapters to the industrial development of the country, although it must be noted that scientific and technological research is almost completely absent from the document (references to the importance of research are made for some industrial sectors such as metallurgy and electricity production, for example, but without detail and objectives). No expert group (or round table) was specifically dedicated to those issues during the preparation of the Plan; and research equipment is not considered as a basic infrastructure of the country. This is an indication that governmental authorities are not yet conscious of the importance of these activities for the future of the country’s economy. Furthermore, one must stress that the privatization process of the economy, which has been recently launched, does not take into proper consideration the need for preserving the technical capital of BiH industrial companies that remains and which is still, in a few sectors, an asset for the country. The privatization process is therefore likely to achieve the dismantlement of the technical research of the country. International authorities, and in particular the World Bank, have failed to pay attention to this important issue.

One must also emphasize that, while foreign assistance has been significant since 1996 (through grants and loans), most of it was focused on public infrastructures, education, demining operations, administration and economy; research activities as such were almost absent. Thus, according to a report prepared with the support of UNDP, *International assistance to BiH, 1996-2002*, the combined sector of culture and science received 13 million dollars of assistance (of a total of 2.5 billion dollars), and it appears that, probably, most of these funds were devoted to the reconstruction of historical monuments that are attracting growing international interest.

Lastly, one must stress the fact that BiH has not been able to organize a patent system which would allow the protection of the intellectual property rights of researchers and companies. This is certainly a handicap for the future.

2.4 - The institutions for science and technology policy

The dislocation of Yugoslavia and the application of the Dayton Peace Agreement (1995) have had a serious impact on BiH research institutions. Let recall that there presently exist three levels of political and administrative competences in BiH: the State, the BiH Federation and the Republika Srpska (RS), and the ten cantons of the BiH Federation. For the time being, the State of BiH has no recognized competence in science and technology (for example through a ministry) while this is not the case for the Federation and the RS. Both entities have a ministry in charge of science. Furthermore, the universities are under the tutorship of the cantons in the Federation and of the Ministry of Culture and Education for the RS. The universities are funded by the cantons of the Federation. For various reasons (some of them political) the university system of BiH is organized into eight universities (Universities of Sarajevo, East Sarajevo, Banja Luka, Zenica, Bihac, Tuzla, Dzemal Bijedic-Mostar, Mostar) over the country without any real coordination of investment for the development of their research activities. It does not appear that the Rectors' Conference of these universities has taken any initiative regarding research activities. One must also note that, at least to our knowledge, only the Sarajevo Canton and the RS have passed legislation on the organization of scientific research, the latter having also published an official document defining a R&D strategy.

Under such conditions, one must not be too surprised to learn that there is no research policy at the level of BiH, since there exists no responsible body capable of assessing the situation and the needs (manpower and infrastructures), defining priorities, organizing the coordination of activities within the country, mobilizing funding for research activities, and stimulating international cooperation. There is as yet no "voice" for BiH science and technology. The present situation, with the handicaps it represents, has meanwhile been recognized in several documents (in particular a report by the Academy of Arts and Science of BiH and a report prepared for the SEE Eranet network) that address these issues.

In this dim picture, one must, however, acknowledge the existence of a few research institutes that operate at the scale of the country in cooperation with partners in several regions and even abroad (this is the case, for example, of the Agriculture Institute in Banja Luka). This clearly shows that the possibility of undertaking joint tasks at the level of the country does remain, despite the difficulties of the time. One must also emphasize the fact that most of remaining research institutes created outside university campuses at the time of Yugoslavia, have an "undefined" legal statute which is proving a supplementary handicap for their activities.

BiH has thus created a research system *à la Suisse*, but, above all, without a State to set up common objectives and mobilize financial means to operate it, as is the case in a federal country such as Switzerland. The absence of State institutions to define and implement a research and technology policy is a major obstacle to reconstructing a research activity with a critical mass in BiH.

In this context, governmental authorities rightly decided, in 2004, to draft two laws: the first one for higher education, the second for science. The Law on Higher Education gives guidelines for the operation of universities in accordance with the Bologna principles and sets standards and criteria for the accreditation of diplomas. The Law was drafted in 2004 but the BiH Parliament has so far failed to adopt it mainly for political reasons. The Law on Science is in a less advanced stage (the first draft was circulated at the beginning of 2005) and its drafting is under the responsibility of the BiH Ministry of Civil Affairs. The Science Law will, in principle, define the general objectives of a BiH science policy and will provide the

legal framework in which the research system will operate, with guidelines and institutional means for defining priorities and funding research activities at the State level. We consider that the adoption of such a Law is a first step in the reconstruction of the BiH research system. One must note that although the Higher Education Law has been widely discussed within universities, it appears that the great majority of actors of the research system seems to be unaware of the Law's existence or its objectives. This means that the drafting of this law has not yet been used as a process to mobilize the scientific community and its economic partners into rebuilding the BiH research system. Lastly, one must stress that neither the Office of the High Representative (OHR) nor the OSCE have used their influence and also potential expertise to advise the BiH political authorities on these matters, although the training of a workforce in universities and the development of research activities must be considered as a critical issue for the future of the country. The World Bank itself has meanwhile agreed to grant funds to universities to contribute to the modernization of their operation, which is a positive step.

2.5 - Cooperation between the actors

In a country in which war has had a deep and lasting impact on people's minds and where short-term considerations tend to dominate (the day-to-day operation of laboratories, for example), one cannot be surprised that cooperation between the research actors (academics and researchers of various institutions) and between researchers and industry is not considered a priority. The almost non-existence of competitive research infrastructures is also a factor which inhibits cooperation on projects between laboratories and between industry and research institutes. However, the picture is not completely grim. Cooperation between universities, research laboratories and occasionally between local firms and research institutes, even at the national level, does exist, which means that there is awareness of the importance of cooperation. Most of the actors in the economic sectors (and particularly the BiH Chamber of Commerce) are also pleading for the development of cooperation between the academic community and its industrial partners.

At the international level, the BiH scientific community has maintained links with partners abroad (in some cases through former colleagues who have emigrated), which has prevented them from being isolated. Programmes of the EU, such as Tempus, have also contributed to cooperation with European universities. A few laboratories have sought to participate in either integrated programmes or excellence networks of the Sixth Research Framework Programme of the EU but, to our knowledge, none has yet succeeded. One must also emphasize that, probably due to the lack of a national authority for research policy, BiH institutions have not benefited from the support of the "Western Balkans" Programme of the Sixth Framework Programme of the European Union.

2.6 – In summary...

BiH scientific and technological potential is in a critical state: the training of a new generation of researchers is not being undertaken, most of the research infrastructures are obsolete or in need of repair, industrial research is almost non-existent, and there exists neither expertise nor tools at the State level to define and implement a research policy. This situation, if not rapidly corrected, may condemn any effort to reconstruct the scientific and technological basis of the country's development.

3 - RECOMMENDATIONS

3.1 - Why is research so important for BiH?

Since the Second World War almost all developed countries have considered that research activities had become an important dimension of public policies in modern States and a basis for their industrial development. After the War, the former Republic of Yugoslavia had thus supported R&D at the federal level and, in this context, BiH succeeded in gaining and developing a well recognized competence in science and technology in universities, national institutes and large industrial companies that successfully exported technology.

More recently, Member States of the European Union adopted the so-called Lisbon Strategy (in March 2000) which stressed the importance of scientific research to build a “knowledge-based economy”. Building a European Research Area is considered by the EU an important objective to be achieved during the coming years.

One should thus consider that BiH will not have a future if it is not capable of rebuilding a scientific and technical expertise through research activities at various levels.

Scientific and technological research is important, as it would:

- offer a perspective for the creation of new knowledge in academic science and thus help eradicating the massive brain drain of scientific manpower and elites from which the country is suffering (both in universities and industry); and also, at least in the long term, giving possibilities of even a partial return of the BiH scientific diaspora with its acquired know-how (China has been putting a major effort in this direction for two decades).
- increase the level of scientific and technological expertise that is necessary for the economic development of the country and the well being of its population; this expertise based on research is necessary, for example, for health and environment public policies, the definition and enforcement of sanitary norms and standards and the exploitation of natural resources.

Furthermore, academic research in the social sciences and humanities is certainly a most important tool to investigate and understand better the wealth of the culture of BiH in all its diversity. Every country needs to understand its origins with the various dimensions of its culture (languages, literature, philosophy, etc.) and research is a key activity to achieve this objective.

For all these reasons rebuilding and developing scientific research is an urgent matter for BiH.

3.2 - Priorities

Research facilities in BiH were severely damaged or destroyed during the war, and one observes a general lack of investment in new equipment and a widespread brain drain of the scientific workforce from universities and industry. Rebuilding the scientific and

technological capacity and workforce of the country requires the adoption of a “road-map”, with objectives to be reached step-by-step and with clear priorities.

Three general objectives have to be achieved in the mid-term (2005-2015):

- Training of a new generation of scientists in BiH universities or abroad and retraining of existing scientists in new experimental techniques.
- Building-up in the country of research infrastructures (technical equipment, computers, information networks, libraries) which should provide the scientific community with the capacity to undertake competitive research activities.
- Reinvesting in industrial research in a limited number of sectors (in priority those which export a large percentage of their production).

A minimum of basic research should be necessarily developed in disciplines such as physical sciences, mathematics, biological sciences and medicine, social sciences and humanities, as this would lay the ground for future technical development (in SMEs, for example) and constitute a means of interacting with the international scientific community. Meanwhile, resources being limited and needs of BiH for its social and economic development being very great, a limited number of priorities will have to be defined.

These priorities should take into account a number of factors:

- The basic social needs of the population: health, education and employment being probably the most important.
- The availability of resources in the country: mining, agriculture and forestry being important.
- The technical needs of industry in several important sectors: metallurgy (steel and aluminium in particular), energy, pharmaceuticals and food.

Within this framework, a limited number of research priorities might be defined (this would be the task of the State research institution to be created). We propose:

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

In all these sectors the contribution of the social sciences will be important (sociology and economics, for example). Research activities in those sectors should help understand the conditions for economic development and the international context, as well as the evolution of living and working conditions in the country.

The priorities should be clearly defined and integrated into all future strategic development plans for BiH, which is not yet the case. These plans should forecast adequate means (including finances) to implement them and define the role of the various actors.

3.3 - The need for a State science and technology policy

In all countries science and technology policy is a “State function”. This means that, taking into account its importance and the level of resources that this policy should mobilize, it must be supported at the State level. We have described in the introductory part of the report the complex politico-administrative situation of BiH which is the result of the Dayton Peace Agreement signed in 1995. For the time being, in 2005, there is no political entity (i.e. a ministry) at the State level that has responsibility for higher education, research and even industry. The Ministry of Civil Affairs of the BiH State has, in principle, a general responsibility in these domains but is without any legal framework to undertake action and has no funding to support research activities.

We are convinced that the definition of a science and technology policy at the State level of BiH is an absolute prerequisite for rebuilding a recognized effective national competence in science and technology, and to develop research activities that may address the needs of BiH on its road to development. We must also stress that this State policy might be complemented by actions supported at the level of other politico-administrative entities, such as the Republika Srpska, the Federation of BiH and some of the latter’s cantons, as a function of their respective needs and financial means. The State science and technology policy would define the framework for mobilizing the scientific and technical competences of the main common actors throughout the country (universities, institutes, companies and so on).

The situation of Switzerland has often been put forward in the recent past, and even during our mission, as a political “model” for BiH. For several reasons this comparison can be misleading. Let us simply recall that in Switzerland (7 million inhabitants and a wealthy country), responsibilities for research and higher education are shared between the central State (the Confederation) and the regional authorities (the cantons). The state is responsible for the two federal institutes of technology in Zurich and Lausanne, while 10 cantons (out of 26) support universities. The State has an overall responsibility for the coordination of science policy in the country and it finances research activities through the Swiss National Science Foundation which supports mainly academic research, and also several important federal research institutes.¹

We must also stress that the future integration of BiH into the EU would suppose negotiations on the participation of BiH in the research Framework Programme, which would thus entitle the country to be a member of the European Research Area. These negotiations will necessarily take place at the level of the BiH State.

Defining a State research policy with clear objectives at the level of the whole of BiH is thus an urgent requirement, and the means of implementing it in terms of funding needs to be addressed. This supposes that the fiscal and financial power of the BiH state should be clearly and rapidly defined, in particular in the perspective of the creation of a national Value Added Tax.

A State science and technology policy also requires that a legal framework be put in place. This is the role of the Laws on Higher Education and Science which have been drafted and are presently being debated. The adoption of these laws is urgent, but we must stress that, even if higher education and research, the two main missions of universities, have a clear connection, the two laws could be treated and adopted separately. We must also stress that the Law on

¹ European Network of Indicators Producers, *Country report, Switzerland*, Prime, Paris, 2005.

Science should encompass research activities that go beyond the academic institutions and concern the economy and public policies in sectors such as health and environment. We thus support the idea that the two laws be drafted and adopted separately by the BiH parliament.

We strongly recommend that the drafting of the Law on Science should involve, in a preliminary phase, the main stakeholders of the present research system in BiH (ministries and administrations in charge of science and innovation in the politico-administrative entities of the country, the academy, the universities and institutes, representatives of the economic sectors). These actors should agree on an assessment of the present situation of the BiH research potential, and the complementary roles of the various institutions in charge of science and technology policy in the country.

The Law on Science should define, in a limited number of articles:

- The responsibility of the BiH State in the definition of a science and technology policy.
- The role and means of a State institution to be created to implement this policy as those of other politico-administrative entities of the country.
- The legal framework to implement this policy: statutes of State institutes to be created whenever necessary, statutes of researchers not employed by universities, specific regulations regarding cooperation between research institutions (for example, public and private).
- The means to evaluate projects, programmes and institutes.
- Rules for intellectual property protection.

The definition of research priorities should be left to the future State institution in charge of the science and technology policy.

3.4 - Funding a national BiH research programme

One of the greatest weaknesses of scientific research in BiH is the lack of funding. According to officially available BiH figures, R&D expenditure represented, in 2003, just 0.05 per cent of the country's GDP (8 billion euros). We have the feeling that this figure probably underestimates by a factor of 3 to 4 the actual level of national expenditure, since it appears that estimated spending does not take into account the salaries of scientific manpower in universities, institutes and industry (the actual value being probably closer to 0.15-0.2 per cent).

However, corrected figures would not greatly change the picture of research in BiH, since the funding of R&D activities is without doubt far below the level attained by almost all European countries. Let us make just a few comparisons: the average share of R&D national expenditure in GDP for the EU (25 Member States) is close to 1.9 per cent; within the larger Member States R&D expenditures are equal to or above 2 per cent of GDP (Italy being an exception with a ratio of only 1 per cent); differences between the ten new Member States (R&D expenditure/GDP ratios) are rather significant: Slovenia (1.57 per cent), Czech

Republic (1.30), Hungary (1.0), Poland and Slovakia (0.6), Cyprus and Latvia (< 0.5 per cent).²

Last, let us also record that the EU has recently set itself (in Barcelona, 2002) an ambitious objective for 2010: investment of 3 per cent of GDP of Member States towards R&D activities. Despite the fact that some countries (Finland and Sweden) have already achieved this objective, few experts believe that the Barcelona objective will be reached.

As far as BiH is concerned we consider that there is an absolute urgency for the country to re-invest in scientific and technological research. Launching an ambitious programme to train Ph.D. students, and thus to educate a new generation of scientists, and building-up the country's research infrastructures are the two most urgent tasks for which State funding (complemented by international funds) is necessary. In parallel, salaries of research scientists (in universities and institutes) have to be increased step by step, so that they would be able to invest at least half of their time in research activities; new research positions should also be created in universities, national institutes and industry.

Funding of R&D should be tripartite: the State of BiH; the politico-administrative entities such as the Republika Srpska, the BiH Federation and some cantons (that support universities); and the private sector (industry and services).

As far as public funding is concerned it should be shared between the State and the other politico-administrative entities in proportion to their future relative fiscal and financial powers.

We propose that State funding should be concentrated on: research infrastructures of national interest, a PhD training programme, and support to "national institutes". Most of this funding (with the exception probably of that going to the PhD programme) should be granted on the basis of evaluated project proposals.

The Academy of Sciences and Arts of BiH has proposed that BiH invest 2 per cent of its GDP in R&D activities. This would represent, with the present level of the country's GDP (8 billion euros in 2003), a global expenditure of 160 million euros, compared with the likely present level of 12 million euros at most (according to our own estimation). It is clear that this objective could only be (and should be) achieved step-by-step over the long term (2020?).

For the mid-term (2012) we would propose an urgent financial plan that would aim at a global expenditure by public entities (State and other entities) of approximately 25 million euros per year, which should be complemented by EU investments and loans (the World Bank, for example). *During the same period industry should also increase its own R&D investment, which might represent by 2012, one third of total R&D expenditure of the country.*

3.5 - Tools for a science and technology policy

For the time being no mechanism exists at the State level to define and implement a Science and Technology policy for BiH. The creation of State institutions to define and implement such a policy is the major objective of the Law on Science being drafted. Our main recommendations are as follows:

² Observatoire des Sciences et des Techniques. *Indicateurs de la science et de la technologie*, Paris, Economica, 2005

A **Ministry** should have the political responsibility of the science and technology policy of BiH. It could be either an existing ministry (the present Ministry for Civil Affairs, for example) or an *ad hoc* ministry created for the purpose. It is equally important that, under the responsibility of a Minister, a State institution dealing with research policy should be established by law: an **Agency (or Council) for Science and Technology Policy**.

This institution should have the following missions:

- to assess needs (human resources, research infrastructures, etc.) for research activities;
- to define priorities for the country;
- to propose to the Government the means to implement these priorities;
- to establish, on behalf of the State, cooperation with the European Commission with a view to the participation of BiH in Framework Programme activities and other international programmes. A specific unit might be established within the Agency to address this issue (probably in partnership with the Ministry of Foreign Affairs).
- to collect statistical data regarding R&D activities in the country, and prepare reports for the Council of Ministers.

A **State Fund for R&D in BiH** should be created (under the responsibility of the Council or Agency) with the objective of supporting scientific projects, following their evaluation, and contributing to the provision of equipment in laboratories. Special attention would be paid to rebuilding basic infrastructures (premises, scientific equipment, libraries, etc.) that have been seriously damaged or are obsolete. Universities, institutes and industrial laboratories would be eligible for support from the Fund.

An **Advisory S&T Committee (or Board)** should be established. It would work with the Agency (or Council) and advise it on establishing priorities. It would assess the main scientific projects of major importance and supported by the State Fund for R&D. The BiH Academy of Sciences and Arts could carry out the functions of this committee, or at least provide its secretariat. Care should be taken over the nomination of several young scientists to this Committee and to a fair representation of disciplines (natural sciences, medicine, engineering, social sciences, humanities, etc.).

A **Unit (or Observatory) for Science and Technology Indicators** should be established, whose main mission would consist of producing:

- basic indicators (statistics) on human resources and the funding of R&D activities
- indicators on publications in various disciplines (from international data banks)
- indicators for patents in the main industrial sectors

as well as registering :

- basic figures for research institutions in BiH
- basic data concerning researchers in BiH (publications, books, name of their laboratory).

This Unit should work closely with the BiH State Agency for Statistics. It would assist the Council for S&T Policy in its work

An **Inter-ministerial Committee for S&T activities in BiH** might be established at the State level. Chaired by the Prime Minister, its membership would consist of all Ministers whose portfolios need to be supported by scientific expertise (health, transport and industry, for example). The Inter-ministerial Committee would adopt guidelines and priorities for the research activities of the country. The Agency (or Council) for Science and Technology Policy would act as the Secretariat to this Committee

The Agency (or Council) for Science and Technology Policy should provide advice to the Government during the process of privatization of companies (in particular large companies) or State services in order to preserve the technological interests of BiH (for large companies new shareholder investment should provide the means by which in-house research activities can be developed in cooperation with public laboratories).

Partial tax exemption (or other incentives such as loans) for companies investing in research activities (whether in-house or in cooperation with universities) should be adopted (one-half of investment in research activities being tax deductible, for example). This exemption should apply at each level of taxation.

The creation of a national system for patenting should be established in accordance with European Union law. It could be managed by a national agency for norms, trade marks and patents.

In many countries various mechanisms have been created over time to encourage and facilitate cooperation between public institutes or laboratories, and between public and private laboratories. Legislation has often been drafted to allow the creation of entities promoting this cooperation. The Law on Science should thus give a simple legal basis to create (either on a permanent or on a temporary basis) the equivalent of “joint ventures” between various types of scientific and technical institutions within the country. This would, for example, entitle several institutes, academic laboratories or private laboratories to undertake joint research programmes over a long period of time and to eventually share important research infrastructures.

3.6 - Specific mechanisms

Access to competitive research infrastructures (experimental equipment such as electron microscopes, various types of spectrometers, lasers, etc.) is for BiH researchers a condition to undertake challenging projects, whatever their orientation. Funds should thus be available to purchase such equipment and also to cover its maintenance and operational costs. A first list of priority research infrastructure was established in 2003 by the UNESCO-ROSTE expert group on Research Infrastructure, but this list must certainly be up-dated.

The necessity of allowing access to basic research infrastructures to various scientific communities in BiH leads us to suggest that, at least on a temporary basis, a network of the major facilities (for example, electron microscopes, NMR and mass spectrometers) should be created so as to “pool” resources and grant access to laboratories all over the country to these infrastructures (for example, electron microscopes might be used by biologists, material scientists, metallurgists, etc., working in various universities and even companies in different towns). This “Research Infrastructure Network for BiH” could thus cover step-by-step most of the needs of the scientific community.

A similar scheme could be envisaged for the main university libraries, which could be operated as an academic network. In particular, the situation of the National Library of BiH

should be addressed, so that access to the important and rare collections of manuscripts that it has preserved, despite severe difficulties, could be provided to researchers within the country and abroad.

The possibility of accessing scientific information (scientific journals, data banks, etc.) through internet and various electronic systems is also a necessity for researchers in BiH. For the time being this access is not granted widely and with sufficient speed. A scientific information network for BiH should be considered as an important research infrastructure.

A BiH Law on Science would establish the basic principles and legal framework for a national science and technology policy. We recommend that State institutes should be established in the four priority sectors which we have identified. These institutes, supported by State funding (totally or partly), would work in close cooperation with academic laboratories and industry. Each institute would be affiliated to a university with which it would eventually share equipment; they might also constitute a research network with several academic laboratories and, whenever possible, with industrial laboratories. Similar schemes might be adopted, but on a more flexible basis, in the area of social sciences and humanities.

Lastly, we must stress the fact that, since rebuilding the scientific and technological potential of BiH would require a significant effort from the country, it should be accompanied by initiatives explaining the role of science and technology in modern societies and bringing to the public important scientific and technological issues to be addressed. The role of the media (press, radio and television) would be very important in this perspective. Universities should also be mobilized to provide a better public understanding of science and of its challenges for BiH through debates and exhibitions. We suggest that the BiH Academy of Sciences and Arts take initiatives in this direction in close cooperation with universities. The future of scientific research in BiH lies in the hands and brains of a young generation of scientists who have to be attracted by the challenges of a research career either in public laboratories or in industry. Undertaking an effort of information in the direction of the public at large, and of the younger generation in particular, is thus of uppermost importance.

3.7 - Regional and European Cooperation

The BiH scientific community should be able to join the European Research Area and to be involved in international scientific cooperation. A “first circle” of scientific cooperation should be established or re-established on a regional basis (with neighbouring countries from former Yugoslavia, Albania, Bulgaria and Romania). A “second circle” could consist of scientific institutions of several EU Member States which, for various reasons, wish to develop their cooperation with institutions in BiH. The possibility of accessing research infrastructures in neighbouring countries might be granted to researchers in BiH through this cooperation.

Neighbouring institutes from the “first circle” might eventually share important research infrastructures through cooperation. The cooperation in the field of astronomy in the South-East European countries through a network launched and supported by UNESCO-ROSTE is a successful example to which one might refer.

We also recommend that the BiH scientific community be involved with European partners in research projects funded by the European research and technological development Framework Programme. However, a realistic appraisal of the present situation of research laboratories in the country leads us to conclude that the great majority of them would not be able to compete in getting their projects approved and funded since their equipment is often obsolete. This

leads us to recommend that, at least for the duration of the Seventh Framework Programme, the EU should devote funds through an *ad hoc* International Programme for Western Balkan States. These funds should be granted to BiH, for example, on a project basis to finance research infrastructures and partly a PhD training programme (priority sectors could be, for example, chosen).

Lastly, we recommend, in the same spirit, the participation of BiH in the COST and Eureka Programmes, which would entitle both SME and academic laboratories of the country to be involved in research and technological development activities over a wider range than the EU. The BiH Ministry of Foreign Affairs (and in the long term the State Agency for Science and Technology) should fund the participation of BiH in these two programmes.

3.8 - The role of UNESCO

The UNESCO Regional Bureau for Science in Europe (ROSTE) in Venice, which has commissioned this Report, has launched several initiatives over the last few years to support the reconstruction of the scientific potential of the South East European countries and particularly those of the Western Balkans. We strongly recommend that this action be continued, since UNESCO can play a catalytic role in the region by encouraging, through its advice, Governments to build frameworks for science and technology policies and, when possible, contribute to initiatives aiming at the development of regional scientific cooperation.

As far as BiH is concerned we wish to put forward a few suggestions:

- UNESCO-ROSTE might constitute a “platform of expertise” to support by its advice political authorities of the BiH State in their efforts to define and implement a S&T policy whenever they wish it.
- UNESCO-ROSTE could organize regular sessions to train experts from BiH on science management in its various dimensions (management of programmes, finance planning, evaluation, production of indicators, protection of intellectual property, etc.). Participation in such sessions should not be restricted to experts from BiH, but might be extended to other countries of the region. They might be organized regularly in countries of the former Yugoslavia (Dubrovnik, Ljubljana and Sarajevo would be possible locations, having convenient facilities and international transport connexions).
- Several libraries of BiH, and in particular the National Library of BiH in Sarajevo, have saved rare manuscripts and books from destruction during the war. These documents are part of the cultural heritage of BiH and are of great interest to scholars not only in this country but also in Europe. UNESCO-ROSTE should envisage to launch an initiative in cooperation with BiH to provide access with modern means to those rare documents to a large community of scientists in Europe.
- Science should be considered not only as an asset to rebuild the economy of BiH and a support to public policies but also as an essential dimension of the culture of the country. UNESCO-ROSTE could thus support initiatives in BiH in cooperation with other countries to enhance the public understanding of science (organization of debates and exhibitions, cooperation with the media, etc.) and bridge gaps existing between science and other dimensions of culture.

4 - CONCLUSION

Although we have not been able to visit all academic institutions and industrial centres in Bosnia & Herzegovina, we feel that we can propose a valid diagnosis of the situation of scientific and technological research in the country. It is in a critical situation: most of research infrastructures are obsolete, many laboratories, if not all, are lacking operating funds, libraries are not able to pay subscription costs to scientific journals and connection to the international communication system is slow, the younger generation in universities has no means to be trained in research activities, and the majority of industrial research has been dismantled due to war destruction and the collapse of many economic sectors.

Despite the fact that BiH inherited from Yugoslavia a strong scientific and technological tradition, its research system is presently unable to work properly to international standards. Thus, the funding of R&D activities in the country (at around 0.1 per cent of GDP) is far below the levels attained in industrialized countries. This means that BiH is not able to prepare its own future which, in modern societies, relies on the capacity of countries to mobilize scientific and technical expertise. Faced with this situation, there exist neither mechanisms nor resources at the State level to define and implement a policy to start the reconstruction of the research potential of the country. The division of political and administrative responsibilities between the various political entities inherited from the Dayton Peace Agreement is a serious obstacle to defining and implementing a science and technology policy. In a world where scientific and technological competition is severe, such a policy needs to be defined at the State level in close cooperation with all the actors in the science systems (politico-administrative entities, universities, research institutes, industry). Although the situation is serious, it is not completely grim. We can witness that in many sectors there is an awareness that solutions to problems are urgent (our diagnosis is widely shared) and researchers in difficult situation have found a means of restarting activities and even developing cooperation with partners inside the country despite numerous barriers.

To address all these issues, institutional tools have to be established; this would be the mission of a State institution (Agency or Council) which we have proposed to define and implement a science and technology policy. A major financial effort is, of course, necessary at all levels (including industry) to build new infrastructures, decently fund the operational costs of laboratories, and create fellowships to train the young generation of scientists. The voting of the Laws on Higher Education and Science to set guidelines for future policy is also urgent. Although a dialogue between all partners in these domains is important and necessary, it is urgent to make political decisions so as to start the process to rebuild the BiH research system.

Faced with this important task, and taking into account the severe economic and financial constraints which the country is facing, it is clear that BiH needs significant international financial support. For the time being this support is almost inexistent in science and technology. Financial support from the EU (for example through the next research Framework Programme) is thus necessary. Such European support would contribute to catalysing the integration of the BiH scientific community into the European Research Area. UNESCO-ROSTE should also be able to bring its contribution to this effort. We must also emphasize that such integration supposes that there would exist a common voice for BiH science, and thus the existence of an institution able to plead for BiH scientific and technological research.

Rebuilding the science and technology system in BiH is a means to ensuring the cultural and economic future of the country. It will be also a means to stabilizing the peace in a country that has been physically and morally damaged by war. Quoting the famous Yugoslav writer Ivo Andric (Nobel Prize for Literature in 1961), Nikola Kovac, Vice-Rector of Sarajevo University and former Ambassador of BiH to France and to UNESCO, wrote in 1995: “Today’s Bosnia and Herzegovina defends values which rejoin those of modern civilization. To admit and live difference in unity, these are the historical challenges and the manner of being for Bosnia and Herzegovina, the only one State of Balkans whose founding idea is not conceived on only one nationality or a single religion”.³ This was written during dark times for BiH but, ten years afterward, there is no doubt that this idea is even more valid today and that scientific research should also contribute to highlighting what constitutes a common wealth of a country which is at a “cultural crossroad half-way between East and West”.⁴ We deeply feel that the international community, and Europe in particular, should take into account this important message.

³ Nikola Kovac, *Bosnie le prix de la paix*, p. 57, Editions Michalon, Paris 1995.

⁴ *ibid.* p. 45.

ANNEX I

INSTITUTIONAL CONTACTS, MISSIONS I, II AND III

(14-19 FEBRUARY, 16-21 MAY AND 30 JUNE-1 JULY 2005)

[PLUS SUMMARIES OF MAIN ISSUES RAISED DURING DISCUSSIONS]

Sarajevo

Bosnia & Herzegovina, The Council of Ministers, The Ministry of Civil Affairs

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Dr Safet Halilovic, Minister, safet.halilovic@mcp.gov.ba, Ms Esma Hadzagic, assistant to the minister, hadzaga@hotmail.com

The Minister has fully approved the UNESCO mission, which should help BiH have an assessment of the situation of its research potential and benefit from outside expertise to better define a policy. The Ministry of Civil Affairs has competence at the level of the State (in particular, it has responsibility for de-mining, which is still an important task in BiH) but it has only general competence for higher education and science, activities that remains funded at the BiH Federation and its cantons levels, and at the RS level. The ministry has no funds for R&D activities. A policy at the national level is necessary to reconstruct the infrastructures and develop important projects corresponding to identified priorities. The Ministry of Civil Affairs has taken the initiative of drafting a Law on Science, a group of experts chaired by Minister Emir Turkusic (Canton of Sarajevo) has this responsibility, and the expertise of UNESCO-ROSTE in the process is welcome. The OSCE and the OHR are not playing any active role in these domains. The Ministry considers that the reconstruction of the science and technology potential of BiH is vital for its future.

Federation of Bosnia and Herzegovina, Ministry of Education and Science

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Prof. Zijad Pasic, Minister, fmon@bih.net.ba

The Ministry has responsibility for education and research at the level of the Federation. BiH had a very important tradition before the war but presently most of its R&D potential is destroyed or out-dated. After the war, priority was given to education (primary and secondary). Presently, an effort is being made towards improving conditions in higher education by the adoption of national law (that has yet to be voted), as well as the elaboration of a state law for science and technology activities.. The pre-war level for R&D investment should be recovered (1.5% of GDP); this would require an effort from the BiH State, Federation and its cantons and the RS. The Ministry has established a fund (1.9 million KM) to support research projects; a call for tenders has been launched and the evaluation of proposals are under the responsibility of the Academy of Sciences and Arts of BiH. The Ministry is in need of statistics and data on R&D activities (scientific manpower, finances, infrastructures, scientific publications, patents) in the Federation (the problem is the same at the State level). Some kind of observatory should be established to perform such a task.

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Dr. Emir Turkusic, Minister, emirt@ks.gov.ba

The Sarajevo Canton is the only canton within the BiH Federation which has voted a science law to organize research activities within its territory (the Sarajevo region mainly). It has established a research fund (1.5 million KM) to support research projects on the basis of an evaluation of experts under the responsibility of the Academy of Sciences and Arts. Most of the research infrastructures within the country and the cantons are obsolete and a policy at the level of the country is necessary to rebuild its potential. The Minister E. Turkusic has been commissioned by the BiH Ministry for Civil Affairs to draft the Law on Science. The urgent need for the adoption of the law is well recognized and a first draft has been available since the beginning of the year and is under discussion. A new policy will require statistics and indicators (publications, manpower, etc.), which are lacking. The Ministry has recently created a new department of informatics which gives access to an ensemble of 46 scientific journals through Science direct. This is a great progress for access to the international literature by researchers of laboratories in the Sarajevo canton.

The Ministry awaits a vote on the Higher Education Law by Parliament. The urgent need for the adoption of the Law is well recognized.

Academy of Sciences and Arts of BiH

Bistrik 7, Sarajevo, tel. 387 33 206 032, akademija@anubih.ba

Prof. Bozidar Matic, President, bmatic@anubih.ba

The President recalled the main lines of the analysis of the situation of science and technology in BiH that were highlighted in a document prepared by the Academy (he presented them also to a conference at the International Metal Fair Intermetal in Zenica in May 2005 which we attended). One of his major points is the scarcity of funding devoted to R&D in BiH (1.5% of the GDP before the war versus around 0.05% presently). As a former director of R&D within Energoinvest which was the major industrial company in BiH, he pointed out that industrial research is almost inexistent at the moment in the country although it had a strong basis before 1990 (Energoinvest had a workforce of 1600 people before the war in 11 centres but 75 % of them have emigrated). The Academy stresses the necessity of adopting the two Laws on Higher Education and Science at the State level; they should give guidelines for the future science policy and legal rules to implement it. He recommends: a large increase of funding with a fund at the State level; that public funding should be allowed according to the fiscal power of the politico-administrative entities (State, Federation and R.S, cantons); that industry would finance at least one third of the country's R&D effort; and that the country devote in the future 2 per cent of its national product to R&D. Participation to European programmes (Framework Programme Cost, Eureka) is necessary. Reconstructing the scientific and technological potential of BiH is an urgent task.

National and University Library of Bosnia and Herzegovina

Madja od Bosne 8B, 71000 Sarajevo, tel. 387 33 275 312, www.nub.ba

Dr. Enes Kujundzic, Director, nubbih@nub.ba, there is the change of the director

The library was created in 1945. Until 1992 the library possessed 3 million books, journals and rare manuscripts, some of them several centuries old and which are considered an important asset for scholars. The library was completely destroyed during the night of 24/25 August 1992 at the beginning of the Sarajevo siege. Most of the documentary records (including rare manuscripts) were burnt. The library has been moved to a former barrack

building in the city and has presently 2000 m² (instead of 6000 m² formerly). The library has several important functions: as a legal deposit; providing access to documents (350 000 volumes including old and rare manuscripts and books that have been saved); creating and publishing the current bibliography of BiH, research on retrospective bibliography; interlibrary services; and training. It has 69 employees. Although it remains the national library for the BiH State, its legal statute has to be clarified. Funding has been reduced (until 2004 mostly from the BiH Federation, presently partly from the Ministry of Civil Affairs). Funds are needed to support the network of libraries in the country, facilitate access to the documents, and begin the digitalization of rare documents. The library wishes to have the support of UNESCO and NGO for finding normal conditions of working. An important percentage of its documentary collection is part of the national BiH heritage and have a great value for scholars in Europe.

University of Sarajevo

Rectorate Kulina Bana 7/II, www.unsa.ba, info.rektorat@unsa.ba

Professor Mensur Hajro, Vice rector in charge of science and research, mensur.hajro@unsa.ba, Professor Nikola Kovac, Vice rector in charge of international cooperation, Ms Ljiljana Sulentic coordinator for international cooperation, rektoratms@unsa.ba

Established in 1949, the university is organized into 23 faculties with several associated institutes (47 000 students in total). Severely damaged during the war, the university is in the process of reorganization with the objective of taking into account the Bologna rules for higher education. Priority has been given since 1995 to the rebuilding of the teaching capacity. In general, research has greatly suffered from the war and most of faculties are not able to maintain research activity at the international level (programmes do still exist in social sciences and humanities and in some engineering departments). There does not exist funds within the university budget to support R&D (the creation of such a fund is in project). The two Laws on Science and Higher Education are necessary to re-develop research within the country and university.

Faculty of Economics

Trg oslobođenja 1, 71 000 Sarajevo, tel. 387 33 275 916, www.efsa.unsa.ba

Professor Nenad Brkic, vice-dean, nenad.brkic@efsa.unsa.ba

The faculty counts 10 departments (macro-economy and business administration, for example) with 70 professors and assistant professors and 7000 students (a large percentage of them paying tuition fees). No specific fund for research activities presently exists, although the faculty intends to create one; meanwhile there are some on-going research projects in cooperation with external partners. Faculty is undertaking expertise and consultancy with external partners. Although a State agency for statistics has been created, economic statistics are judged insufficient and this situation is considered as a handicap for research.

Faculty of Philosophy

Franje Rackog 1 71 000 Sarajevo , tel. 387 33 253 204

Professor Josip Baotic vice-dean in charge of finances, josip.biotic@ff.unsa.ba

The faculty encompasses 12 departments (philosophy, history, literature, etc.) with 1300 students with an academic staff of approximately 200 persons. An oriental studies institute is affiliated to the faculty (it had a national status), and it is engaged in important international cooperation. Most of the funding is devoted to staff salaries and there is no specific funding

for research. Academics from the faculty publish books and monographs in their domain. The faculty has maintained an important library (300 000 books) but has no funding to maintain subscriptions to journals and it does not receive support from the National Library of BiH.

Faculty of Electrical Engineering

Zmada od Bosne Bb71 000 Sarajevo tel. 387 33 250 759

Prof. Kemo Sokolija, dean, kfsokolija@yahoo.com, Prof. Adnan Salihbegovic, Vice-Dean, adnan.salihbegovic@etf.unsa.ba, Assoc.Prof. Semsudin Masic, semsudin.masic@etf.unsa.ba

The faculty moved into new premises after the war (a former army barracks) which had to be reequipped. Its main activities are in the area of information technology, automation and electricity production process and transmission (which was an important sector before the war with a major company, Energoinvest). It has little equipment (other than computers) as it is facing severe difficulties to buy new research equipment (most equipment is devoted to teaching). The university does not provide specific funding for research; it has received funds from the science ministry of the Sarajevo Canton to support 3-4 projects. Possibilities of cooperation with industry is presently rather difficult, due firstly to a lack of competitive infrastructures in the laboratories and secondly to the almost disappearance of the industrial sector in its area of activity. The faculty is engaged in a cooperative project on Artificial Intelligence with the University of Erlangen (Germany). Presently five students are preparing their PhD in its laboratories. No specific means for the production of its intellectual property through patents are envisaged for the time being. Energy should certainly constitute a national priority for research. A science law is certainly necessary to provide a framework for the R&D policy of the country.

Faculty of Science

Zmadja od Bosne 33 i 35 Srajevo , tel 387 279 871, www.pmf.unsa.ba

Professor Sulejman Redzic, Dean, sredzic@pmf.unsa.ba, Prof. Muharen Avdispahic Vice-dean, mavdispa@pmf.unsa.ba

The faculty has departments of physical sciences, mathematics and biology with presently 100 PhD in the staff. It does not receive any funds from the university for research equipment, and most of its infrastructures are outdated, although there are some ongoing research projects. Priorities should be defined nationally at the State level.

Institute for Genetic Engineering and Biotechnology

Kemalbegova 10, 71 000 Sarajevo, tel. 387 33 220 926, www.ingeb.ba

Dr. Kasim Bajrovic, kasim@ingeb.ba

The Institute was created in 1988 at the time of Yugoslavia. It suffered great losses during the war and a large percentage of its staff left the laboratory and has emigrated. It is presently under the tutorship of Sarajevo Canton and affiliated to the university. Its core activity is genetic engineering and techniques based on it, both basic (3-4 international publications per year) and applied. It is organized around several main areas: - forensic genetics (DNA expertise for the identification of missing people), human genetics (molecular expertise, collaboration with hospitals), molecular biology and genetics applied to biodiversity (fish); and plant genetics and food quality control (identification of foreign DNA). The laboratory has a well recognized expertise in BiH and abroad. It has established a regional database for plants and animals. It has a current staff of 15 persons (3 PhD and 4 PhD candidates) with a budget amounting to approximately 350 000 KM per year (budget provided by the canton, partly by the BiH Federation) which does not permit investment in new equipment (it has almost no access to international journals for lack of funding for subscriptions). It has

established cooperation with the Bosnalijek company and with the agro-mediterranean institutes in Mostar and the University of Banja Luka. The Institute has not yet succeeded in getting an EU contract through the Framework Programme; meanwhile it has established a network of international cooperation (Slovenia, France, Austria Italy, Turkey) and is working for the UN International Commission on Missing Persons. It wishes to be supported at the State level as a national BiH institute and to be considered as a national expert centre for genetics in relationship with hospitals and agro-industry.

University of East Sarajevo

Faculty of Electrical Engineering

1 Vuka Karadzica 71123 East Sarajevo, tel. 387 57 342 788,
Prof. Slobodan Milojkovitch smiljko@ptt.yu, Prof. Zoran Zljuboje, Vice-dean zljubodje@hotmail.com, Prof. Vojislav Suka, Secretary-General of the University, univerzitet@paleol.net

The university comprises 16 faculties in several campuses dispersed on the territory of RS (8 locations, 4 faculties or departments being in Pale). The university is not yet a completely integrated university but changes are now being prepared. The campus in East Sarajevo (4 faculties including electrical and mechanical engineering) is situated on former buildings of the Energoinvest company. Some 12 000 students are presently enrolled at the university, which is wholly funded by the Ministry of Education of RS (with a small contribution from the municipalities). There is no specific funding for research activities in the university budget (also some equipment mainly devoted to student laboratories can be used for research). Some research projects are ongoing (mostly short-term, 30 students engaged in post-graduate studies), in particular in cooperation with SME (in the telecommunication sector for example). The university and the faculty have devoted efforts recently towards distance learning and the use of virtual laboratories (with the support of UNESCO-ROSTE). A sizeable percentage of the university staff and former students have emigrated but they are willing to cooperate with the university department. An effort should certainly be undertaken at the national level to rebuild the research infrastructure; energy and metallurgy should probably be the priorities (with fair potential for electricity production in BiH).

Foreign Trade Chamber of Bosnia & Herzegovina

71000 Sarajevo Branislava Durdeva 10 www.komarabih.com, tel. 387 33 66 36 31,
Milan Lovric, President, presidentoffice@komarahbih.com

The Trade Chamber operates for the whole country (local chambers exist, as well as industrial federations, membership being compulsory). The present economic situation of the country is difficult with a high unemployment rate (around 40 %) and a large trade deficit. Direct foreign investment is rather rare (with the exception of steel with Mittal in Zenica, and aluminium in Mostar). BiH enjoyed a good research tradition before the war, with industries (metallurgy, defense, power with a large company such as Energoinvest) that invested in R&D activities. Now this potential has been almost totally eliminated. Some sectors are exporting (steel, aluminium, wood, textiles leather, electricity power), and they should invest in R&D to prepare the future. Reconstructing the research potential should be a priority, but research priorities are necessary at the national level, probably in those sectors (food industry should be another). The privatization process has not taken into account the necessity of preserving the technical capital of companies. A policy is needed at the BiH level (value added taxes for research might be envisaged). The patent system is non-existent and this is another handicap for BiH industry.

Bulldozer Commission (Buldozer Komisija)

Ilica Zmaja od Bosne 4/IX 71 000 Sarajevo, tel. 387 33 552 460, www.buldozer.com,
Alija-remso Baksic, Secretary-General (and Secretary-General of the Association of wood
and furniture processors, Zmja od Bosne 14c 387 33 711 720) apbuldozer@bih.net.ba

The association is working at the national level with the objective of identifying and eliminating obstacles to economic reforms in the country (50 proposals have thus been made to the authorities. It operates with a central committee on which entrepreneurs are represented (the national commission of BiH entrepreneurs), and with five regional committees which involve companies and in particular SMEs. A privatization process has been launched but conditions are not adequate (capital of companies is often underestimated, technical assets not protected). No comparison has been made with similar on-going privatization processes in foreign and neighbouring countries. Investment in BiH is insufficient, although domestic capital exists but is probably frozen. BiH imports a great deal of foreign technology and national effort is insufficient to support national industry (industrial R&D, although strong before the war, has almost vanished). A national research strategy with priorities is necessary; it should contribute to strengthen the technical basis of industry and it should be included in the BiH plan for development which is not yet the case. Some sectors such as wood are exporting (wood is an important resource for BiH) but they need domestic technical expertise. In general, information on EU programmes, which should be useful for researchers and industry, is not circulating.

Energoinvest, Research and Development, Institute of materials and quality

71 000 Sarajevo Tvornicka 3, Tel. 387 33 62 89 29

Kolakovic Nedzad, Director of the centre, nkolakov@hotmail.com, Zdenko Vavra, Director of the Institute, imq.dir@isinter.net

Energoinvest was the most powerful industrial company at the time of Yugoslavia, with sister companies in several countries in the world (one of them still exists in Mexico). It had established several important research laboratories in the country which were very active and had good connections with academic laboratories. The company, although still existing, has almost completely collapsed and had lost all its assets. Three research institutes were situated in Sarajevo (material sciences, energy in particular) with 628 employees in 1992 (16 PhD and 55 Masters), in 2005 only 27 employees remain (1 PhD only). The facilities were completely destroyed during the Sarajevo siege, but part of the laboratories has been rebuilt (in material sciences), meanwhile scientific and technical equipment is still lacking or outdated. The institute is still the property of Energoinvest (share capital: 36% private and 64% the BiH Federation, with no relation to the State). Privatization will be engaged but a strategic partner is necessary. The institute undertakes mainly contracted work (with the IAEA in Vienna, and the Ministry of Culture of the Federation). It has developed a good expertise in software and systems used for land survey and geographic information systems (dedicated for example to construct images and data banks of historical monuments). The situation of Energoinvest's remaining research laboratories is close to catastrophic, and if nothing is done rapidly the whole technical competence of the company will disappear.

Grizelj company

71210 Sarajevo Ilidza , Nikole Sopa 46 tel. 387 33 542 992, www.grizelj.com

Tomislav Grizelj, President of Employers Association of BiH)

The company was established in 1978 and it is private. It has three sister companies in Austria, Germany and Croatia. Its business is mainly in engineering (thermal energy, heating and cooling, air conditioning, control and monitoring systems). Most of its production is

exported; it has obtained the ISO 9001 certification and several awards. The company has a laboratory in Sarajevo which is mainly devoted to control and calibration and technical expertise to examine new working means. It is not currently performing R&D projects but it has some needs. On some occasions it contracts technical research projects with an academic laboratory in the Faculty of Engineering). It holds only one patent and it does not purchase foreign licences (the cost being too high). A unique economic space is necessary for BiH with a State which would be able to support research activities at the country level, for the time being fragmentation of politico-administrative entities is too strong and this constitutes a handicap for the economy and the technical development of the country. The Association of BiH employers is conscious of the importance of technology for BiH and of the need for reforms; the Bulldozer Commission performs important work in this domain.

Bosnalijek company

71 000 Sarajevo, Jukiceva 53, tel. 387 33 25 44, www.bosnalijek.com

Mrs Seherzada Hadzidecic, Director of development department, seherzada.h@bosnalijek.ba,
Mrs Ljiljana Kamberovic, Executive director for business development,
ljiljana.k@bosnalijek.ba, Nedim Vilogorac, Strategic Marketing, nedim.v@bosnalijek.ba

The company has been established in 1951 and today its main domain of activities consists of the production of generic pharmaceuticals (40 % cardiovascular). Its facilities were severely damaged during the war and they have been completely reconstructed and modernized. In 2004 its sales amounted to 70 million KM (with a 10% yearly progression) and it has 515 employees (40% with a university degree). Some 30% of its capital is public (mainly the BiH Federation), and 52% is owned by individuals. The production processes are highly automated and competitive. The company does carry out research activities but it performs mainly development projects (drug conditioning, for example). It has established good cooperation with faculties of medicine and pharmacy in several universities (students are often staying in the company for projects) and abroad (Basle, for example). The company would need research support from academic laboratories, but their infrastructures are often outdated; a reconstruction of this potential is necessary and important for the future of industry.

State Commission for Cooperation with UNESCO

Trg Bosne I Hercegovine

Prof. Sead Avdic (President of the State Commission for Cooperation with UNESCO and member of BiH Parliament), Mr. Edo Numankadic, tel. 387 33 453-010, Prof. Metka Kraigher-Hozo, Academy of fine arts Sarajevo, Obala Maka Dizdara 3, info@alu.unsa.ba

The Commission was created two years ago, and academic communities from all the country are represented on it. The Commission is pleading for the reconstruction of the scientific potential of the country. A large percentage of the scientific manpower has emigrated. The level of research infrastructures in universities is very poor for lack of funding (funds for research from BiH State are inexistent for the time being) so that only a limited number of research projects can be launched in experimental sciences (research has been maintained at a fair level in social sciences, humanities and arts). Science has to be organized at the State level and this is the objective of the Science Law which is being drafted by the Ministry of Civil Affairs. Another Law for Higher Education, which aims at giving a framework for the management of universities, and an accreditation system in line with Bologna rules, has not yet been adopted by Parliament. These two laws are necessary. Pressure is being put on to accelerate the process.

The Commission stresses the asset that the multi-cultural dimension of the BiH heritage represents. This heritage is of great value for the future of the country and UNESCO has a role to keep it alive; it is also an important task for Europe.

Unit for Economic Planning and Implementation of the Medium-term Development Strategy of BiH

Mustajbega Fadilpasica 1, 71000 Sarajevo tel. 387 33 218 552, www.eppu.ba,
Mrs Azemina Vukovic Head of office, avukovic@eppu.ba, Fahrudin Memić, consultant for
statistics and indicators, fmemic@prps.info

The Office, which is under the responsibility of the Council of Ministers of BiH, has the mission of preparing a plan for the development strategy of the country. The plan has been adopted for the period 2004-2007. 21 working groups (including experts such as academics, representative of administration and of economic sectors) have prepared the strategy. There was no specific group or panel for R&D activities (the importance of research for economic sectors as energy and metallurgy is, however, underlined in the plan). The fact that research is almost totally absent from the plan is the result of dispersion of competence in this domain between the Federation, the cantons and the RS (statistics in this domain are rather rare and are badly needed). A Science Law is being drafted and its adoption is necessary to launch the reconstruction of the S&T potential of the country. There does not yet exist a clear awareness of the importance of R&D for the future of the country.

South East Europe Eranet

National Information Point for Sixth Framework Programme in BiH

Zmaja od 71 000 Sarajevo, tel. 38 Bosne 8, tel. 387 33 559 520 www.nip-fp6.ba
Ammar Mirasija, Director, ammar.mirascija@nip-fp6.ba

This focal point conveys information to laboratories in the country about the present (i.e. Sixth) EU Framework Programme. BiH belongs to the SEE Eranet (network for South-European countries supported by EU and which is coordinated by Austria).

South East Europe Eranet

Lamija Tanovic, Professor at the University of Sarajevo, coordinator for BiH,
ltanovic@pmf.unsa.ba

The network has been created by EU with funding from FP 6; it aims at gathering information on basic science indicators on research activities in the region (output and input) and on scientific cooperation between partners. It has also the objective of catalysing possibilities of cooperation. BiH is not yet involved in COST and Eurêka and it is desirable that it could be involved in these programmes. Several institutes of BiH appear to be involved in FP 6 projects but it is presently difficult to have a clear picture of those that have succeeded in gaining approval of their projects. The situation of academic research is dim, since funding is scarce and not yet a priority of universities, and international cooperation is necessary to reconstruct the potential, in particular through the EU. A Science Law appears necessary at the country level.

Circle 99, association of BiH intellectuals

Vrazova 1, Pen club offices, Sarajevo 71 000, tel.387 33 20 01 55 www.penbih.ba
Professor Dolocek, President University of Sarajevo, krugpen@bih.net.ba

This association was created in 1993 to facilitate dialogue between intellectuals from various communities within the country by launching debates on various aspects of the reconstruction

of the country. It has a large audience in many parts of BiH and its positions are well covered by the media. It is considered as a space for debating democratic issues. It organizes conferences and it publishes a regular review. One of its main objectives is to contribute to “Think Bosnia” of the future by highlighting, in particular, the asset that the diversity of its cultural heritage represents. It is necessary to go beyond the Dayton Peace Agreement so as to be able to construct policies in various sectors at the level of the whole country.

Oslobodjenje

Ms Angelina Simic, journalist

Oslobodjenje is one of main journals of BiH, with a large audience throughout the country. It played an important role during the Sarajevo siege as a symbol of the resistance of the city. Besides daily information, it publishes articles on various political, economic and cultural issues but rarely on scientific issues. In general, there are few debates in the country on science issues or events; public opinion is not aware of the situation of scientific research of the country and why science is relevant for its future. Debates on these questions would be necessary and welcome.

Office of the High Representative (OHR)

Emerika Bluma 1, 71000 Sarajevo, tel 387 33 283 506

Ambassador Werner Wnendt, Senior Deputy High Representative, Ms Daria Duilovic assistant, daria.duilovic@ohr.int

The Office is the agency in charge of Dayton Peace Agreement implementation (civilian aspects) on behalf of the international community. The High Representative and his deputies have the mandate of overseeing all those civilian aspects. Ambassador Wnendt stresses the necessity of preparing the future of the country beyond the application of the Dayton Agreement. Scientific research should be considered as both a means to stabilize peace in the country and a factor for its development. This requires the definition of a policy at the level of the country, as science necessitates national priorities and investments. The laws which are being prepared (higher education and science) are important steps in this direction. For the time being the OHR has not been involved in the preparation of these laws. It is also necessary to define a clear European perspective for the whole country so that its research activities could be integrated in the European Research Area as soon as possible.

The World Bank country office of BiH

Fra Andela Zvizdovica 1, 71000 Sarajevo,

Ms Zorica Lesic, tel. 387 33 251 500, zlecic@worldbank.org

The World Bank has been deeply involved in the reconstruction of the country by support through loans (soft credits without interest) and sometimes grants to the rebuilding of public infrastructures (bridges, roads, etc.). Education is one of the priorities; support to the economy is another (a privatization process has been engaged since Dayton). The Bank has not been involved in the funding of research operations; however, it is engaged in support to university reform (more specifically management structures in relation to the Bologna process) at the level of US\$ 10 million. Its usual partner is the BiH State (with the Conference of Rectors in the case of higher education).

OSCE Mission to BiH

Fra Andela Zvizdovica 1, 71 000 Sarajevo tel. 387 33 752-333, www.oscebih.org

Mr Claude Kieffer, Deputy Director of Education Department (legislative reform),
claudek@oscebih.org

The OSCE is not directly involved in the legislative process concerning the Higher Education and Science Laws, although it considers that legislation is necessary at the State level in these two domains. The Higher Education Law should give guidelines for the application of the Bologna process, accreditation and evaluation. It considers that the legislative process in this domain has been too much delayed. Taking into account the urgency of building-up BiH research capacities, it suggests a gradual strategy which would consist of attracting foreign donors to constitute a R&D fund to finance research projects. Neither OSCE nor the OHR have been involved in debates about the reconstruction of the BiH potential.

Delegation of the European Commission to Bosnia and Herzegovina

Union Bank building, Dubrovacka 6, 71 000 Sarajevo, tel. 387 33 254 700,
www.delbih.cec.eu.int,

Michael Humphreys, Ambassador, Head of the Delegation, André Lys, First Counsellor,
Head of Operations, andrelys@cec.eu.int, Gianmatteo Arena, Attaché,
gianmatteo.arena@cec.eu.int

The EU Delegation represents the Union and it supervises civil aid granted by the Union to BiH. It has a close relationship with the OHR. European support to the reconstruction of the country has been important and is still important. For the time being EU does not support research activities and higher education in BiH directly, although BiH laboratories can participate in the Sixth Framework Programme (in particular through the Western Balkans programme in the international programme of FP6). The scientific and technological potential of BiH must be reconstructed (an effort is being made in the domain of information technology); this requires a policy at the country level which is presently non-existent, hence, the importance of the Higher Education and Science Laws that are presently being discussed. The future integration of BiH into the EU presupposes a more unified country with policies at the national level (in research, for example). A partnership between BiH scientific institutions and the EU also presupposes unification of views between the various entities and speaking with a common voice. In this respect participation in the Seventh Framework Programme will be very important.

Embassy of France to Bosnia and Herzegovina

18 Ulica Mehmed Bega Kapetanovica Ljubusaka 71 000 Sarajevo, tel 387 33 65 81 49,
www.ambafrance.ba

Mr Henry Zipper de Fabiani, Ambassador, Jean-Jacques Beucler, Counsellor for cultural cooperation, Erik Ponsard, Attaché for scientific cooperation, Obala Isa-bega Isakovica 6, 71 000 Sarajevo, tel. 387 33 239 845, Julia Nietsch, Attaché for scientific cooperation, tel. 387 33 239 956, kult@bih.net.com

Ten years after the Dayton Peace Agreement, the BiH situation is still difficult in many domains, although basic infrastructures have been largely reconstructed (unemployment remains very significant, as does the trade deficit, and economic investments are insufficient). Reconstructing the scientific and technological potential was not considered until now as a priority, although it is important for the future (BiH lacks technical and scientific expertise in many areas, which is a serious handicap); European cooperation is certainly a means to catalyse this reconstruction (and France has several on-going projects of cooperation with BiH partners, in particular in the social sciences and humanities, priorities for cooperation being: environment, energy, industrial technologies, agriculture, and public health). It is now

necessary to go beyond the Dayton Peace Agreement in many areas to build a more unified country with policies at the level of BiH (on research, for example), which is a condition for the future integration of BiH into the EU. The tax reforms that have been adopted should help the funding of such policies at the State level.

Banja Luka

Ministry of Science and Technology, Republika Srpska (RS)

St Vuka Karadzica 4, 78 000 Banja Luka, tel 387 51 331 542, www.vladars.net

Mr Fuad Turalic, Minister, f.turalic@mnk.vladars.net,

The ministry deals with issues of science and technology within RS. It has a limited staff. Its budget amounts to 3 million KM in 2005, dedicated 80% to R&D activities through the support of projects. The RS has voted a law for research activities which defines the main guidelines for these activities. The Ministry has also adopted a basic document for the research strategy of RS that defines the main areas to be supported and developed within the universities, institutes and industry. In 2005 a call for tenders has been launched by the Ministry for the support of projects in all disciplines (130 proposals have been submitted, projects leaders should have at least 3 publications). A committee will rank the proposals according to criteria decided upon by the Ministry.

Any BiH State Law on Science should be harmonized with existing laws in other political entities as RS, the Federation of BiH and its cantons, and should take into account the present situation of the research potential of BiH on which information is incomplete; a broad debate on these issues is necessary before voting the Law. The definition of priorities will be certainly necessary.

University of Banja Luka

Trg srpskih vladara 2/II 78 000 Banja Luka, www.unibl.org, tel. 387 51 312 112,

Rector, Professor Dragoljub Mirjanic, uni-bl@urc.ac.yu, uni-bl@urc.bl.ac.yu, Prof. Djordje Marajanovic, Responsible of International cooperation, tel. 387 51 21 8997, uni-bl@blic.net

The university is financed by the Government of RS (Ministries of Culture and Education, and of Science and Technology). Founded in 1975, the university has presently 15 000 students and a budget amounting to 10 million KM; it consists of thirteen faculties located on several campuses in the city (a new campus is being built). It is strongly involved in the application of the Bologna scheme for the reorganisation of higher education. The university receives little funding for its research activities (none from the Ministry of Culture and Education), but projects can be funded by the Ministry of Science and Technology of the RS; it has kept research activity in the social sciences and humanities, as well as in food technology (cooperation is ongoing with the Institute of Agriculture of the Srpska Republic).

Industry is no longer strongly developed in RS; however, priorities such as food industry, water, forestry and public health are certainly important and have to be integrated in a research policy at various levels (State of BiH , RS, etc.).

Faculty of Electrical Engineering

Patre 3, 78000 Baja Luka, tel. 387 51 221 221 824,

Professor Slavko Maric, Vice-dean, Email: ms@etfbl.net

The main activities of the faculty are in the areas of electricity power, electronics, computers, communication and information technology (700 students in total). The faculty has few financial means and has lost its critical mass for research (it is lacking equipment). Meanwhile, it has developed good contacts with the telecommunication industry with which it is undertaking technical projects (it has thus established an expertise in multimedia activities and it is equipped for video conferences).

Agriculture Institute of the Republika Srpska, Banja Luka

Knjaza Milosa 17, 78000 Banja Luka,

Dr. Vojislav Trkula, Dep. Director, tel. 387 51 303-112, 33-287, dzbrs@teol.net, vtrkulja@blic.net

Founded in 1947, the Institute has presently a staff of 73 persons (including 9 PhDs) and consists of 6 departments (mostly in plant research and certification); its budget amounts to 3 million KM (from three sources: Ministry of Science and Technology, Ministry of Agriculture of RS, contracts). It has also field stations which produce plants and seeds; this production is a source of revenue. It has maintained a high level of research activities in several areas (including GMOs) with equipment which is of an international standard. It maintains a gene bank and it has developed activities on plant nutrition and environment protection, and on the appearance of pest diseases and their control; it has a recognized expertise at the level of BiH, in particular within a network for the health of plants. The Institute has developed an important effort for the training of national experts and is involved in several international cooperative projects.

Banja Luka College of Modern Management, private faculty of Economics

78250 Karadovreda 44, 78000 Banja Luka, tel. 051 322 850

Professor Zejko Baros, Dean

The college was created in 2003 and has been accredited as a private faculty of management and economics by the Ministry of Culture and Education of the RS. For the time being it has no research activity, although the creation of a postgraduate programme is planned.

National and University Library of the Republika Srpska

51 000 Banja Luka Jevreska 30, R.S, BiH, tel. 387 51 215-894, <http://www.nubdrs.rs.ba>

Director Mr Ranko Risojevic, risco@blic.net

The library is altogether the library of RS, of the municipality of Banja Luka and of the University of Banja Luka. It has not really its own budget (staff 50 persons), but receives an operating budget from the Ministry of Culture and Education (40 000 KM) and from the municipality (20 000 KM) so that it has almost no possibility to invest. It cannot support subscriptions to international journals for the university (with a few exceptions in medicine), and to access to the Web of science. It receives some support from German and French embassies for dedicated books collections. Connection with the COBISS platform (virtual library of BiH) is possible and useful (but at low internet bandwidth). The library has kept some rare manuscripts of Turkish origin. It has maintained a link with the National Library of BiH in Sarajevo. The library organizes scientific conferences for the public from time to time, in close cooperation with the University. Among urgent matters: the necessity of having a clear statute with a budget for investing and covering operation costs; possibility of a connection to internet through an academic network for BiH with rapid speed.

Mostar

Ministry of Education, Science, Culture and Sport, Herzegovina-Neretva Canton

Stepana Radica 3, 88000 Mostar, tel. 387 36 186, prosvjetahnz@net.hr

Prof. Jago Musa, Minister

There does not exist yet a Law for Science and Higher Education at the cantonal level. The two Mostar universities are funded by the canton but there is no contribution of the canton for their research activities. The infrastructures of the universities have been seriously damaged during the war and many professors have left the city. Defence and metallurgy (aluminium) were two important industrial activities in the region before the war, those activities have greatly suffered from the war although it is recovering with regard to the aluminium industry. Students (presently 25 000) are coming from other cantons (teaching being in Croatian) and 3 other cantons contribute to the budget of the universities. Employment is a major preoccupation of students. The aluminium industry and the food industry (linked to Mediterranean agriculture) with tourism are certainly two major economic priorities of the canton, to which training and research activities should be linked.

Mostar University

Trg hrvatskih velikana 1, 88000 Mostar

Prof. Zeljko Suman Vice-Rector, tel. 387 (0) 36 317-972, 310-778, zeljko.suman@sve-mo.ba,

Prof. Vojo Visekruma Vice-Rector, tel. 387 (0) 36 310-778, 327-815, zeljko.suman@sve-mo.ba

The university (900 professors and associated professors, 11 000 students, with 10 % of them from other cantons and Croatia) is under the tutorship of the canton from which it receives its budget. It comprises 9 faculties or departments and it is strongly involved in the Bologna process (this issue had been highlighted in a European University Association evaluation report in 2004) although it is still waiting for a Law on Higher Education at the level of BiH State. The university has created 6 research institutes (agronomy, economics, law, Croatian language and literature, civil engineering, mechanical engineering).; a PhD programme is existing in law and economics. The university is conscious of the necessity of developing its research activities and is in favour of a science law which would entrust the BiH State with prerogatives in research policy.

Dzemal Bijedic University of Mostar

Marsal Tita bb, 88104 Mostar , tel. 387 (0) 36 571 197, 570 727 www.unmo.ba

Prof. Fuad Catovic, Rector, fuad.catovic@unmo.ba

The university (approximately 5 000 students, staff of 300 persons) was created in 1997, after the war in which most of its premises and equipment were lost or destroyed. Its premises are being presently rebuilt, including a new library. It comprises 8 faculties and 4 institutes (mechanical engineering, civil engineering, economic development, international centre for philosophy and creation) devoted to research activities. Its total budget amounted to 7 million KM in 2004 (salaries, equipment, operation costs; 35% was granted by the canton, 60% came from tuition, remaining from contracts). The Agro-Mediterranean faculty, created in 2003, is also developing its own research. Poor material conditions (obsolescence of infrastructures) and economic difficulties in the region are presently an obstacle to the development of research activities (this was stressed in an internal evaluation report) although some potential is still existing (for example in engineering, agriculture, social sciences). Thus, the Agro-

Mediterranean faculty is creating a basis for serious research activities in agriculture, horticulture and food industry in cooperation with partners in the region and abroad, research contracts being used to finance a new building and to renew the equipment.

Aluminij Company

88 000 Mostar tel 387 36 385 555 aluminij@aluminij.com

Mijo Brajkovic, General director

The company was created in 1945 to exploit bauxite ores. After a merger with Energoinvest, and through cooperation with Pechiney it became an aluminium producer in 1981. The plant was seriously damaged during the war, the electric substation was destroyed cutting electrical power supply, but electrolysis cells were saved. After the war the plant was completely rebuilt and new processes were introduced (new technology with a very high yield, close to 94%) with the technical support of foreign companies such as Glencore. Presently Aluminij in Mostar is the major exporter in BiH (a staff of 950 persons, a production of 130 000 tonnes exported, it produces pure aluminium or mixed products, the plant has its own automated anode production). Electrical power represents 35% of the company's production costs and the high electricity cost in BiH is a disadvantage for the company, which exports all its production; it is a critical parameter for the future of this company, as several others. The majority of the shares are in the hands of the Federation of BiH (Croatia being a shareholder at 12%). The privatisation process is presently open and the company is seeking a strategic partner to take the majority of its capital. The company has been engaged in an active social policy (developing agriculture activities on its own premises to employ disabled workers of the plant), and it has invested heavily and successfully in environment protection. The company performs in-house R&D on various projects directly related to its processes and products. It cooperates with academic laboratories on a project basis but this cooperation is not systematic; furthermore it has difficulties to find adequate training in universities for its future employees or to retrain its own staff (it has engaged in-house training programme).

Zenica

Institute of Metallurgy Kemal Kapetanovic

72 000 Zenica, Travnicka 7, tel. 387 32 417 336/117,

Director, Dr Mirsada Oruc, miz@miz.ba, Ms Neira Delic, in charge of finance and external relations, Ms Azemina Klobodanovic, general organisation.

The Institute had a well established scientific reputation in metallurgy before the war (it brought very fruitful support to the steel and aluminium industry in BiH) but has suffered great loss during the war and most of its equipment, which has not been renewed for lack of budget, is presently obsolete (staff 400 persons before the war, 120 presently). It has links with the University of Zenica, but its present statute is not clearly defined. The Institute has maintained, despite severe difficulties, scientific activity and recognized technical expertise in several areas of metallurgy (4 or 5 papers published per year), as well as cooperation with industry but on short-term basis. Two priorities have been defined: structural studies and metallurgy processes and environment. Renewal of equipment is urgent (in particular for electron microscopy). Its role as a national institute has to be defined in relationship with industrial activities and the university.

University of Zenica

Fakulteska 3, 72 000 Zenica, tel. 387 32 444 430, [http:// www.unze.ba](http://www.unze.ba)

Prof. Sabaduhin Ekinovic, Rector, rektorat@unze.ba, Ass. Prof. Darko Petkovic, vice-rector for science, development and int. cooperation, dpektovic@mf.unze.ba, Prof. Damir Kuuic, Dean of the Faculty of pedagogy, Prof. Memunna Kasacina, Vice-rector.

The university was created five years ago (it was formerly a branch of Sarajevo University) with seven faculties (including two new faculties for health management and pedagogy). The university has applied Bologna rules for university management (it is an integrated institution, faculties became departments) according to a new Zenica Canton legislation. Metal science and mechanical engineering are among priorities of the university which is very much willing to establish a strong cooperation with industry; it has created a technological park to facilitate this cooperation and the creation of start-ups. The university is under the tutorship of the Zenica Canton from which it receives the majority of its budget (60% from the canton, 40% through contracts, 1 million KM from the canton specifically for R&D, no funding from the BiH Federation). Most of the research infrastructures of the laboratories are obsolete for lack of funding. The university expects to develop its links with the steel industry and particularly with the Mittal company with which it has close contacts.

The faculty of pedagogy which provides mainly training for professors has a budget of 0.5 million KM from the canton (with an extra budget from admission fees). It envisages a post-graduate programme. Building-up its research infrastructures is a priority for the university.

Metalno

72000 Zenica Ul Srajevska, tel. 387 32 421 797, metal.ts@bih.net.ba
Mr Mujezinovic Nesib, Technical director

This company was created in 1947, producing mainly metallic structures (for bridges, industrial plants, etc.). Although few investments have been realized since the war it has maintained its production with 70% of exports (present staff 400 persons of whom 5-8% are engineers). The company does not perform in-house R&D; whenever technological development is necessary, it proposes a project to external partners such as academic laboratories. It has maintained cooperation with the Kapetanovic Institute in Zenica and with the university. Welding techniques is one of the company's technical priorities. Privatisation of the company is being planned according to local law but a strategic partner has to be found.

Mittal

Mr Seid Kapetanovic, Chief executive officer

After the war the iron and steel works in Zenica had to be restructured and new techniques introduced (electrical furnaces, for example). Mittal, which is a multinational company and the largest world steel producer, has become a strategic partner for BiH Steel in which it has invested to modernize steel production; in May 2005 this company became Mittal Steel Zenica (presently 3000 workers). It intends to bring steel production up to 2.2 million tonnes per year (representing a total investment of about 200 million dollars). Mittal has also acquired an iron ore mine in Ljubija (RS) with a production capacity of 1 million tonnes of ore per year. Mittal performs in-house R&D activities in several laboratories abroad (Chicago and Grandrange in France). Technical needs in Zenica steel factories are important and research cooperation with academic laboratories and the Kapetanovic Institute is certainly highly desirable.

ANNEX II

BIBLIOGRAPHY

- Kovac, N., *Bosnie le prix de la paix*, Paris, Michalon, 1995.
- Malcolm, M., *Bosnia a short history*, New York, NYU Press, 1996.
- Garde, P., *Vie et mort de la Yougoslavie*, Paris, Fayard, 2000.
- Observatoire des Sciences et des Techniques, *Indicateurs de la science et de la technologie*, Paris, Economica, 2005.
- Pen Centar, *Litterature and culture for peace*, Sarajevo, 2000.
- Kujundzic, E., *Memoria Bosniaca*, Medunarodni centar za mir, Sarajevo, 2001.
- Bosnia and Herzegovina Council of Ministers, Office of the BiH coordinator for PRSP, *BiH Medium Term Development Strategy-PRSP (2004-2007)*, Sarajevo, 2004.
- South East Europe Eranet Network, *Data on RTD situation*, Sarajevo, 2005.
- UNDP, *International assistance to BiH, 1996-2002, A tentative analysis of who is doing what, where*, Sarajevo, 2005.
- The University of Sarajevo, the Senate, *Institutional development plan of the University of Sarajevo*, Sarajevo, January 2003.
- Austrian Development Agency, *Austrian cooperation with Eastern Europe, Country Programme for Bosnia and Herzegovina 2005 to 2007*, Vienna, 2004.
- Centre for social innovation, *Position paper of the S.E.E Eranet as regards the participation of West Balkans countries in the 7th European Framework Programme for RTD*, Vienna 2005.
- International Network for the Availability of Scientific Publications (INASP), *Accessing and disseminating scientific information in South Eastern Europe*, Report to UNESCO-ROSTE, April 2005.
- International Commission on the Balkans, *The Balkans in Europe's future*, Sofia, 2005.
- The World Bank, *Bosnia and Herzegovina, Post-Conflict Reconstruction and the Transition to a market economy*, Washington, 2004.

- Milica Uvalic, *Science & Technology and Economic Development in South Eastern Europe*, a report to UNESCO-ROSTE, December 2004 (draft version).
- Federal Office of Statistics of Bosnia and Herzegovina, *Statistical Data on economic and other trends*, Sarajevo, 2005.
- UNESCO-ROSTE (Lasserre, P. and Anguelov, S., editors), *Reconstruction of Scientific Cooperation in South East Europe, International conference of experts, 24-27 March 2001, Proceedings*, Venice, October 2001.
- OST, Yann Cadiou and Laurence Esterle, *Scientific profiles in CEEC, a report for UNESCO-ROSTE*, Venice, March 2002.
- *Research infrastructures in South-East European countries*, a report to UNESCO-ROSTE, Simeon Anguelov and Pierre Papon, rapporteurs, Venice, 2002.
- Council of Europe, European Commission, European University Association, *Institutional Evaluation of "Dzemail Bijedic" University of Mostar*, Mostar, 2005.
- University of Mostar, *EUA Evaluation Report*, Mostar, 2004.

ANNEX III

SCIENCE AND TECHNOLOGY STATISTICS AND INDICATORS IN BOSNIA AND HERZEGOVINA

S&T INDICATORS PRODUCED BY THE ACADEMY OF SCIENCES AND ARTS OF BOSNIA AND HERZEGOVINA

The ANUBiH (Academy of sciences and arts of BiH) published in 'Politika Nauke u Federaciji Bosne I Hercegovine' ('Science Policy in the Federation of Bosnia and Herzegovina') significant data allowing comparison between the number of scientific publications in various parts of former Yugoslavia before and after the war in the country; these data clearly show the fall down of the scientific activity in BiH between 1990 and 2000.

Number of scientific publications per 100.000 persons:

Former republic	1990. god.	2000. god.
Monte Negro	1,79	3,41
BiH	1,95	0,61
Macedonia	2,36	5,24
Serbia	11,92	11,34
Croatia	18,40	26,00
Slovenia	29,63	76,84

Similar existing data regarding all other R&D activities are summarized in the following table:

Data		Federation BiH	Position of BiH in the world
1.	% of GDP for R&D	0,05	Between 55. Indonesia, 0.07, and 56. Ecuador 0.02
2.	Number of internet hosts per million people	950	Between 36. Russia, 1.037, and 37. Costa Rica, 855
3.	Number of PC's per 1.000 people	30	Between 39. Bulgaria, 30,08, and 40. Colombia, 28,70

SCIENCE AND TECHNOLOGY INDICATORS PRODUCED BY THE OBSERVATOIRE DES SCIENCES ET TECHNIQUES (OST), PARIS, FRANCE

Number of publications in Bosnia– all fields

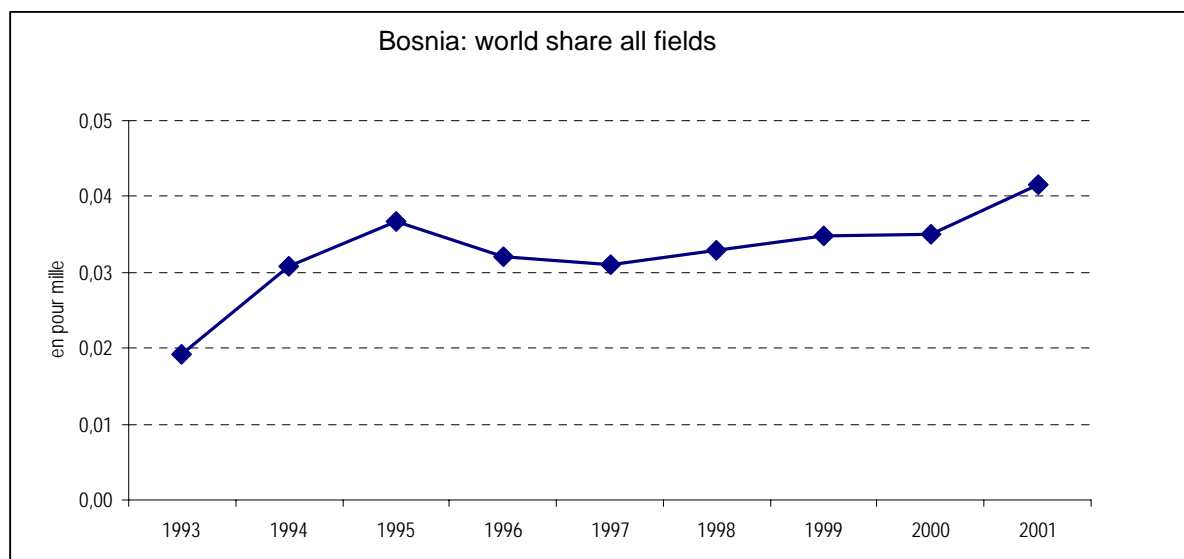
1993 : 12

2001 : 30

Bosnia: World share (%) evolution of the scientific literature between 1993 and 2001

	Bosnie : part/Monde (%)			Evolution	
	1993	1997	2001	2001/1993 (%)	2001/1997 (%)
Toutes disciplines	0,02	0,03	0,04	117	34

données ISI, traitements OST



Bosnia: scientific literature 2001

Scientific fields	Number of publications	Repartition by fields (%)	World share (%)
Fundamental biology	4	14,6	0,03
Medical research	12	39,3	0,05
Applied biology and Ecology	2	5,6	0,03
Chemistry	3	10,1	0,02
Physics	5	18,0	0,05
Earth and Space Science	1	2,2	0,01
Engineering and Technology	6	20,2	0,06
Mathematics	2	7,9	0,09
Total	30	100,0	0,04

Among the 8 scientific fields analysed by OST, Bosnia is active in particular in medical research with around 40% of its scientific literature in this field in 2001.

At international level, in 2001, Bosnia is mainly productive in mathematics, but these indicators are based on very weak sources.