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Djuro Kutlaca

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Contact information

Address: Edificio Expo. c/ Inca Garcilaso, 3. E-41092 Seville (Spain)  
E-mail: [jrc-ipts-secretariat@ec.europa.eu](mailto:jrc-ipts-secretariat@ec.europa.eu)  
Tel.: +34 954488318  
Fax: +34 954488300

<http://ipts.jrc.ec.europa.eu>  
<http://www.jrc.ec.europa.eu>

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## Executive Summary

In 2009, Serbia's GERD as a percentage of GDP was 0.919% which was significantly lower in comparison to the EU27 average (2.01%)<sup>1</sup>. In 2010 GERD was 0.76%, or almost one fifth less than in 2009, as direct consequence of economic crisis on GDP and overall economic performance in country. In 2010 the share of higher education sector expenditures for R&D (HERD) was 51.7% of GERD, much higher than the BERD share (11.63%) of GERD; GOVERD was 36.62% whereas the private non-profit (PNP) sector amounted to a negligible share of GERD (0.05%).

In 2010 Serbia had 12,637 researchers in total 8,800 of which were engaged in the Ministry of Education and Science (MES) projects. Following the *ScienceWatch.com* from April 2011 to June 2011, Serbia achieved Rising Star status in: Agricultural Sciences, Biology & Biochemistry, Chemistry, Clinical Medicine, Computer Science, Engineering, Materials Science, Neuroscience & Behaviour, Pharmacology & Toxicology, and Physics. Investments in R&D and innovation in Serbia from public sources are prioritised and budgeted in the framework of multi-annual plans to ensure predictability and long term impact. Project financing based on open competition for R&D and Innovation projects is decade's long practice in Serbia. There is no institutional, or block funding for R&D activities in Serbia. Programmes for the support of R&D and innovation activities (co)financed by the MES, the Ministry of Economy and Regional Development (MoERD) and the National Agency for the Regional Development (NARD) are not sector-specific.

The key structural challenges faced by the national innovation system in Serbia are:

1. The absence of coordinated governance and funding of national innovation system in Serbia between main ministries and public funding sources as a consequence of the fact that the concept, purpose and functioning of innovation is not sufficiently developed and accepted in the economy and the society in Serbia.
2. Still present linear model of governance of the R&D and innovation system in the country; this is the main obstacle for networking of R&D sector with the rest of economy and society. A crucial challenge for research governance in Serbia is the question how to increase R&D and Innovation activities in the BES.
3. One of the significant problems in preserving and strengthening the scientific community is the ongoing drain of highly educated individuals from the country.
4. The attractiveness of R&D system in Serbia for private investments in R&D is insufficient because of the present structure and capacities of public R&D system. Restructuring of public R&D system and integration of BES into national innovation system is primary task for the government. In addition, legal framework is not in favour of private sector engagement in R&D and innovation activities.
5. Undeveloped infrastructure for innovative entrepreneurship and lack of culture for technological entrepreneurship in Higher Education Sector (HES) and public R&D laboratories and institutes (PRO – Public Research Organisations).

Several more should be mentioned too: (a) Absence of evaluation culture and practice in R&D and innovation system in Serbia; (b) Insufficient knowledge about R&D and innovation capacities in BES; (c) Recognition of the needs for financing of innovation activities with a much larger budget and significantly increased financing per innovation grant; (d) Lack of demand-side R&D and innovation policy tools and measures in Serbia.

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<sup>1</sup> GERD for Serbia is calculated by the author of this report. Calculation is based on data provided by the Statistical Office of the Republic of Serbia within regular yearly statistical reports on S&T activities in Serbia, and using methodology proposed in Frascati Manual defined by the OECD.

The main policy document addressing cooperation between universities, research and business is the new “Strategy of S&T Development of the Republic of Serbia 2010-2015” (SSTDRS, 2010). “*The Strategy is guided by two basic principles: focus and partner. Focus* through defining a list of national research priorities in which we (i.e. R&D system in Serbia) can and must make significant progress. **Partner** through strengthening ties with institutions and companies to allow Serbia to validate its ideas in the global market”.

The **goals** of current research policy which should support solutions with all structural challenges, are: (1) the current 55-45% ratio of financing basic as opposed to applied research must progress to 40-60% in favour of applied science in the next five years; (2) Focus by setting seven national R&D priorities in the field of science and technology, for the period 2010-2015; (3) Strengthening of the human resource base by preventing brain-drain, establishing effective projects with leading individuals in the Serbian scientific Diaspora and identification, development and support for talented young researchers; (4) Partnership within the R&D system through rationalisation of the R&D network and close cooperation between institutes and faculties; (5) Partnership with society through science promotion; (6) Partnership with industry through an innovation fund, a new legal framework for intellectual property, and incentives and support for innovation activities; (7) Partnership with other ministries through the participation of the scientific community in major infrastructural and other projects in Serbia; (8) Increasing and diversifying R&D expenditure: The goal is to reach 1% of GDP for science by 2015, not counting infrastructure investments. The Project of Infrastructural Investments, worth EUR 400 million started in January 2010 and will last until the end of 2015 (SSTDRS, 2010).

National **priorities** in the domain of S&T, defined in S&T Strategy are: (1) Biomedicine and human health; (2) New materials and nanosciences; (3) Environment protection and countering climate change; (4) Agriculture and food; (5) Energy and energy efficiency; (6) ICT; and (7) Improvement of decision making processes and affirmation of national identity.

The R&D and Innovation activities in Serbia in the period 2011-2014 are structured through the following major policy measures:

1. Policy measures for R&D activities launched by the MES: “Programme supporting Basic Research for the Research Cycle 2011-2014” [“BR Programme”]; “Programme supporting Research in the Field of Technological Development for the Research Cycle 2011-2014” [“TD Programme”]; “Programme of Co-Funding of Integrated and Interdisciplinary Research for the Research Cycle 2011-2014” [“IIR Programme”]; “Programme of Providing and Maintaining Scientific Research Equipment and Scientific Research Facilities for the Research Cycle 2011-2014” [“SREF Programme”];
2. Policy measures for Innovation activities: (a) Programme for Supporting SMEs and Entrepreneurs to Strengthen Innovation Activities in 2011 (responsible institution is the National Agency for the Regional Development); (b) The MINI GRANTS and MATCHING GRANTS Programmes – Public call for the MINI GRANTS programme is launched in December 2011, Public call for the MATCHING GRANTS programme is about to be launched in spring 2012 (responsible institution is the Innovation Fund); (c) The Programme for co-financing of the Innovation projects – Public call for this programme is launched in December 2011 (responsible institution is the MES).

Major changes in the R&D and innovation policy mix are:

- The “IIR Programme” is a new programme for supporting the integration of basic, applied and development research as well as for fully utilising R&D resources of the country, emphasising commercialisation of R&D activities and results;
- The “SREF Programme” is a new programme for improving the material base of basic, applied and development research as well as for fully utilising R&D equipment and infrastructure in the country;
- The MINI GRANTS Programme launched by the Innovation Fund will award selected innovation projects with substantially larger amounts of money per grant in comparison with all past and on-going innovation projects, i.e. up to €80,000. Also, the MINI GRANTS Programme overcomes the legal obstacle that resulted from the rules defined in the innovation law. This implies, in particular, the obligation for companies to be registered in the MES innovation register in order to be eligible for the competition under public calls launched by the MES;
- The Programme for Supporting SMEs and Entrepreneurs to Strengthen Innovation Activities, launched in 2011 by the National Agency for the Regional Development, is more oriented to support non-technological innovation activities. The focus is on service and organisational innovations as well as efficient adoption of quality standards.

The creation of the National Strategy for science, education, research and innovation is a crucial step for developing a National Innovation System in Serbia. This strategy should address the structural challenges of the present R&D and innovation system in Serbia and propose solutions for major problems such as the absence of coordinated governance and funding of national innovation system in Serbia between the main ministries (MES, MoERD) and public funding sources (NARD, Innovation Fund), networking of R&D sector with the rest of economy and society, and particularly mobilisation of R&D and innovation capacities in BES.

The development of integral innovation strategy and policy with an appropriate action plan which will stress demand-side as well as supply side R&D and innovation policy tools and measures is a direction for medium term evolution of the policy mix (for the 2012-2015 period). Another medium term activity should be the infrastructure development for innovative entrepreneurship and creation of the culture for technological entrepreneurship in HES and PROs.

The current policy mix should include the development of the evaluation standards as well as institutions responsible for evaluation in the area of science, technology and innovation in Serbia, in short term, i.e. in a very near future (target for 2012-2013).

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# 1 Introduction

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Serbia is an associated country for EU membership, and according to Eurostat has 7.31 million inhabitants, which comparing to the estimated EU27 population of around 501.1 million inhabitants on January 1, 2010, presents 1.44%<sup>2</sup> share of the total. In the year 2010, Serbia's GDP per capita (€3981) reached 16.3% of the EU27 average. At the same time Serbia's unemployment rate was 20%; more than twice higher than the EU27 average of 9.7%<sup>3</sup>. Real growth rate of GDP in 2010 was 1%, in 2009 was -3.5% and in 2008 3.8%. In 2009, Serbia's GERD as a percentage of GDP was 0.919% which was significantly lower in comparison to the EU27 average (2.01%)<sup>4</sup>. In 2010 GERD was 0.76%, or almost one fifth less than in 2009, as direct consequence of economic crisis on GDP and overall economic performance in country. The main characteristics of these investments are change and instability i.e. in 2004 Serbia's GERD as a percentage of GDP was 0.32%, in 2006 it increased to 0.71%, in 2007 decreased to 0.64% and in 2008 increased to 0.732%<sup>5</sup>. Comparing to other Eastern European Countries, Serbia significantly lags behind Slovenia (1.86%), Czech Republic (1.53%), Estonia (1.42%), and Hungary (1.15).

According to the data provided by the national statistical office, in 2010 the share of higher education sector expenditures for Research and Development (HERD) was 51.7% of GERD, much higher than the BERD share (11.63%) of GERD. Governmental expenditure for R&D was 36.62% whereas the private non-profit (PNP) sector amounted to a negligible share of GERD in the same year (0.05%).

Serbian budget allocations for science grew significantly, from the modest sum of €28m in 2001, to about €100m in 2008 and 2009 (data for the Ministry of Education and Science (MES) only). During that eight-year period, there was a substantial growth in salaries of researchers, and almost €30m were invested in capital equipment for scientific research work (SSTDRS, 2010).

According to the data of the Republic Statistics Office, in 2009 Serbia had 12,006 researchers in total 8,800 of which were engaged in MES projects. The average age of the researchers was 44.3 years, which was above the average age of the population in country, pointing to the need for taking action to provide and nurture young scientific researchers.

The Science Law, adopted by the Parliament in 2005, promoted excellence in R&D work; imposing publishing of scientific articles in ISI referred scientific journals as a precondition for career advancement in the R&D sector. A direct empirical consequence of such regulation was a large increase in the number of publications. Thus, the figure of

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<sup>2</sup> This estimation is based on the calculation that Serbia becomes the 28th member of the EU. So in this scenario the total sum of the EU population will be the sum of Serbia's population (2010 estimate) and the EU population (2010 estimate).

<sup>3</sup> Latest data provided by the Statistical Office of the Republic of Serbia for April 2011 showed that unemployment rate (the share of the unemployed in total active population), in the Republic of Serbia amounted to 22.9.

<sup>4</sup> GERD for Serbia is calculated by the author of this report. Calculation is based on data provided by the Statistical Office of the Republic of Serbia within regular yearly statistical reports on S&T activities in Serbia, and using methodology proposed in Frascati Manual defined by the OECD.

<sup>5</sup> R&D Indicators for Serbia are calculated by the author of this report. Calculations are based on data provided by the Statistical Office of the Republic of Serbia within regular yearly statistical reports on S&T activities in Serbia, and using methodology proposed in Frascati Manual defined by the OECD.

1022 scientific papers published in 2000, grew to 3.614 in 2010. Following the Essential Science Indicators from Thomson Reuters, *ScienceWatch.com* produced a listing of the scientists, institutions, countries, and journals that achieved the highest percentage increase in total citations from the second bimonthly period of 2011 to the third bimonthly period of 2011- i.e., from April 2011 to June 2011. Serbia's citation rise continued, as it achieved the highest percent citation increase in nine fields. Serbia has achieved Rising Star status in multiple fields: Agricultural Sciences, Biology & Biochemistry, Chemistry, Clinical Medicine, Computer Science, Engineering, Materials Science, Neuroscience & Behaviour, Pharmacology & Toxicology, and Physics. The number of patents registered by R&D organizations in the period from 2003-2009 was just 54; while in the period 2003-2009 over 3,400 technical solutions were implemented in the field of technological development in Serbia. The relevant figures in the corporate sector were not remarkably better, with about 20 patents registered per year, while individuals registered more than 300 patents in the same period. In the year 2010 in total 579 patent applications were filled in the Intellectual Property Office out of which 290 were resident and 289 non-resident patent applications<sup>6</sup>. In view of such results, Serbia was at the bottom of the list in Europe. In the domain of knowledge demand in the Republic of Serbia, the main activities are generated by the “Strategy of S&T Development of the Republic of Serbia 2010-2015” (SSTDRS, 2010).

**Table 1: Main policy instruments in the knowledge demand domain**

Challenges	Main Policy Instruments
Identifying the drivers of knowledge demand	“Strategy of S&T Development of the Republic of Serbia 2010-2015”
Co-ordinating and channelling knowledge demands	“Programme for the research cycle 2011-2014”
Monitoring demand fulfilment	“Act on the selection, evaluation and financing of research for the project cycle 2011 – 2014”

The main and still the only knowledge demand driver in the Republic of Serbia is the Ministry of Education and Science (MES). This is the continuation of the practice in Serbia in which science has been functioning as an activity funded exclusively through scientific-research projects financed by the MES with neglected participation of private sector for funding and/or performing R&D activities. Certain incentives toward greater involvement of companies in R&D and innovation activities are initiated by the MES with proposal for partnership between R&D organisations and business sector. New Innovation law is the legal framework for public – private partnership in R&D and innovation, and SSTDRS presents an action plan for realisation of such partnership. Since 2001, international scientific and technological cooperation has become an additional knowledge driver with increasing importance, both in research and financial aspects. The basic programmes are the Seventh EU Framework Programme (FP7), as well as COST, EUREKA, NATO SPS, including cooperation with the IAEA, and bilateral cooperation programmes.

Agriculture and energy are sectors of economy with the strongest support from government sources for R&D; a significant share of government budget is allocated for R&D activities addressed to industrial production and technology and protection and improvement of human health.

<sup>6</sup> Intellectual Property Office of the Republic of Serbia and MES, combined data.

**Table 2: Allocation of GBAORD to socio-economic objectives**

Socio – economic objective	Share of GBAORD in 2009 (%)
Agriculture production and technology	11.94%
Industrial production and technology	17.22%
Production, distribution and rational utilisation of energy	8.88%
Transport and telecommunications	2.22%
Infrastructure and general planning of land use	0.51%
Control and care of the environment	2.50%
Protection and improvement of human health	5.93%
Social structures and relationships	15.69%
Exploration and exploitation of space	2.91%
General university funds	32.11%
Defence	0.10%

Source: Statistical Office of the Republic of Serbia: Bulletin on S&T activities in Serbia in 2009

### Main actors and institutions in research and innovation governance

The Serbian research system consists of three operational levels: 1) The Parliament and the National government level, represented by the Committee for S&T development; 2) The ministry level responsible for the design and implementation of science and research programmes on the national level; and 3) performers of R&D activities and intermediary organisations.

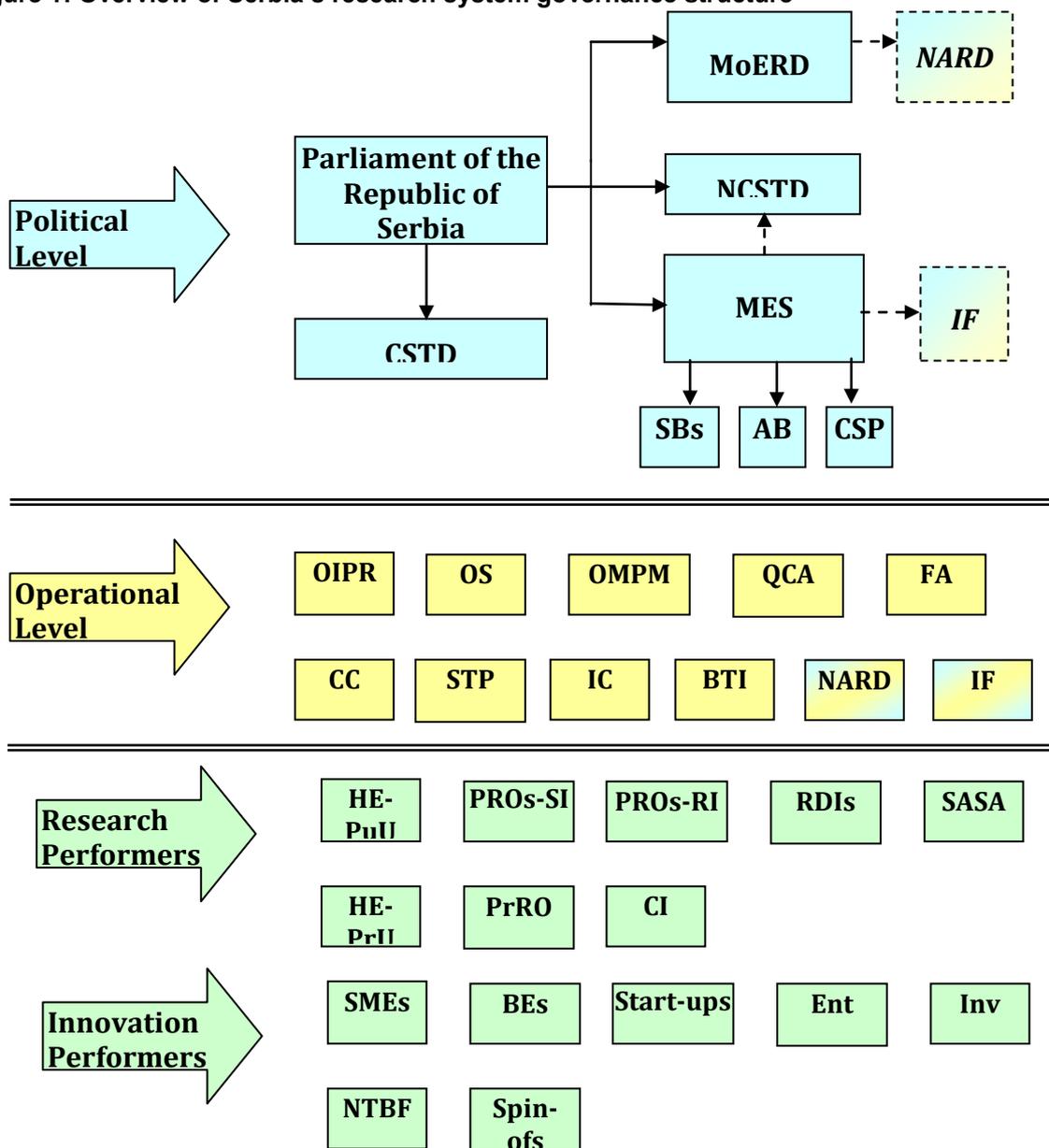
The first level of research governance is the *Serbian National Parliament*, the highest legislative authority in the country, and the *Committee for S&T Development* reviews and proposes to the Parliament the laws regulating the area of science, technology and innovation. *The Ministry of Education and Science* (MES) governs the functioning and development of S&T in Serbia and is responsible for fulfilment of the country's obligations in this area. On the other hand, the main task of the *National Council for S&T Development* is to design and propose to the government a strategy for S&T development and to monitor its implementation. *The Ministry of Economy and Regional Development* (MoERD) is important institution for support of innovation activities and creation of national innovation system in Serbia as well. The National Agency for the Regional Development (NARD) and Innovation Fund (IF) of the Republic of Serbia are in limited extent also relevant innovation policy institutions in country concerning their independence in policy formulation, although their main activities are in funding of innovation activities (i.e. on the operational level); therefore both institutions are figured in political and operational levels

The operational level consists of intermediary and funding organisations.

Research performers are private and public research organisations in government, higher education and the business enterprise sector. R&D organisations in the public sector form a block which comprises seven public universities with 78 faculties, the Serbian Academy of Sciences and Arts with its 10 scientific institutes, 28 other scientific institutes, a centre of scientific excellence, 30 research institutes, 65 innovative organisations, five business associations for support of innovation and 107 registered innovators. It also includes scientific and technical infrastructure that encompasses: the academic intranet, a gene bank, an accelerator, libraries of the institutes and faculties, the University Library and the National Library of Serbia, which boasts the KoBSON network that provides access to scientific and technological information worldwide. R&D organisations in the private sector include seven private universities with 45 faculties, research resources of foreign companies in Serbia and research and innovation resources of domestic firms. The efforts and results of small and medium-sized enterprises in the field of software engineering, new materials and biotechnology are particularly noteworthy.

Innovation performers are private and public companies, entrepreneurs and inventors.

Figure 1: Overview of Serbia's research system governance structure



Source: ERAWATCH Research Inventory

## The institutional role of regions in research governance

The Science Law as well as the Innovation Law in the Republic of Serbia defined MES

### Legend:

#### **Political Level:**

CSTD – Committee for S&T development

**MES – Ministry of Education and**

#### **Science**

NCSTD-National Council for S&T Development

AB – Accreditation Board

SB – S&T Boards

CSP – Committee for Scientific Promotion

**MoERD – Ministry of Economy and**

#### **Regional Development**

*IF – Innovation Fund*

*NARD – National Agency for the Regional Development*

#### **Operational Level:**

OIPR – Office for Intellectual Property Rights

OS – Office for Standardization

OMPM – Office for Measurements and Precious Metals

QCA – Quality Certification Agencies

CC – Chambers of Commerce

IC – Innovation Centres

BTI-Business and Technological Incubators

STP – S&T Parks

FA – Foreign Agencies for support of Technological Development

ITA – IT and Internet Agency

*NARD – National Agency for the Regional Development*

*IF – Innovation Fund*

#### **Research Performers:**

HE-PuU – Higher Education, Public Universities

PROs-SI – Public Research Organisations – Scientific Institutes

PROs-RI – Public Research Organisations – Research Institutes

RDI – R&D Infrastructures

SASA-Serbian Academy of Sciences and Arts

HE-PuU – Higher Education, Private Universities

PrRO – Private Research Organisations

CI – Corporate Institutes

#### **Innovation Performers:**

SMEs – Small and Medium Sized Companies

BEs – Big Enterprises

Ent – Entrepreneurs

Inv – Inventors

NTBF – New Technology Based Firms

as the main and the only governing institution in the country, responsible for R&D and Innovation activities. Research governance was transferred to the level of Autonomous Province of Vojvodina (APV) to a limited extent, as it was defined by the “Law on regulation of jurisdictions of the APV”, adopted by the Parliament of the Republic of Serbia on November 30, 2009: 1) creation of the Strategy for technological development of the APV, which must be harmonized with national S&T strategy; 2) (co)funding of establishment of high-tech installation, building of homes for young scientists, and international S&T cooperation; 3) (co)funding of R&D activities; 4) definition and funding of programmes important for APV in the area of S&T; 5) project financing for R&D projects important for APV; 6) financing of capital expenses and R&D infrastructure established by the APV; 7) establishment of the innovation fund in APV, based on local revenues; 8) establishment of local R&D centres and popularization of S&T activities in APV; 9) financing of Academy of Sciences and Arts of the APV. Some of these activities could be co-financed by the MES under the specific decision made by the Minister.

## 2 Structural challenges faced by the national system

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The Serbian research system is centralised and governed by the Ministry of Education and Science (MES). Following the obligations defined by the Science Law ("Law on Scientific and Research Activities", "Official Gazette of the Republic of Serbia", no. 110/2005, 50/2006 - corr. and 18/2010), a new national "Strategy of Scientific and Technological Development of the Republic of Serbia 2010-2015" (SSTDRS) was adopted by the Government of the Republic of Serbia on February 25, 2010, defining seven national priorities in the domain of science and technology. The main contribution of the new SSTDRS for support of innovation activities in the country is, in fact, the definition of key priorities of the MES in the area of S&T for the next five years and this is "the development of a national innovation system as an absolute prerequisite for establishment of a knowledge-based economy and society. The MES will work together with other competent state institutions and rely on the existing resources, in the direction of development, integration, and elaboration of a national innovation system as the only way of generating and marketing new technologies on the long run." (SSTDRS, 2010)

The Ministry of Economy and Regional Development (MoERD) is an important institution for the support of innovation activities as well as the creation of a national innovation system in Serbia. The "Strategy for the Development of Competitive and Innovative Enterprises" was adopted in 2008 and implemented by the MoERD; it is a strategic policy document for development of small and medium-sized enterprises and entrepreneurship, which defines key priorities and the way they will be implemented. The Strategy is based on five pillars, further developed in modules and measures, corresponding to the priorities in SME development and aimed to contribute to improving the performance of the entrepreneurs through all stages of start-up, growth and development of SMEs. The MoERD activities are dedicated to the realisation of the strategic vision defined by the SDCIE: "The development of an Entrepreneurial Economy, based on knowledge and innovativeness, which creates strong, competitive and export oriented SME sector and sustainability contributes to an increase in living standards in the Republic of Serbia." (SDCIE, 2008)

The innovation landscape in Serbia could be succinctly described with the fact that no innovation policy in the country has been officially and formally approved by the central government or any ministry or parliament. Nevertheless, the official attempts to create a national innovation policy were registered two times since 2000 year: the very first effort was in 2003, with a working document prepared by the (then) Minister for Science, Technology and Development (due to the change of the government, and new political party in power, this document remained as a draft, without official recognition); the second attempt was initiated by an EU funded project managed by the European Agency for Reconstruction in Serbia ("Support to Enterprise Development and Entrepreneurship – Serbia", 2005-2006) in 2006, with the aim to build a "National Innovation Strategy for Serbia", which failed too (the mentioned document remained a draft text, another change of the government stopped activities). The second attempt was also influenced by the legal obligation defined by the first Innovation Law adopted in Serbia in 2005 (Law on Innovation Activity, "Official Gazette of the RS", No. 110/2005; this law has been recently moderately changed: "Official Gazette of the RS", No.18/2010: "The ministry in charge of the scientific and research activity and technological

development shall be responsible for establishing and implementation of the innovation policy" - Article 6).

According to IUS2010 (Innovation Union Scoreboard), Serbia is one of the modest innovators with a below average performance. Relative strengths are in human resources, open, excellent and attractive research systems and outputs. Relative weaknesses are in intellectual assets and innovators. High growth is observed for public-private co-publications, community trademarks and license and patent revenues from abroad. A strong decline is observed for business R&D expenditure, community designs and sales of new products. Growth performance in linkages and entrepreneurship, intellectual assets and outputs is above average. In the other dimensions it is below average.

Summarising, the key structural challenges faced by the national innovation system in Serbia can be grouped into the following issues:

1. Besides the fact that no innovation policy in the country has been officially and formally approved by the central government or any ministry or parliament so far, as a logical consequence of the missing innovation policy the first and main structural challenge is the absence of coordinated governance and funding of a national innovation system in Serbia between the main ministries and public funding sources: The Ministry of Education and Science (MES), The Ministry of Economy and Regional Development (MoERD), National Agency for the Regional Development (NARD), and recently (in March 2011) (re)established the Innovation fund.

The concept, purpose and functioning of innovation is not sufficiently developed and accepted in the economy and the society in Serbia. Therefore, the development of the national innovation system in Serbia is currently in a phase of conceptualisation and far from being operational and functional. The absence of a formal innovation policy leads to a situation, in which the governance of innovation activities in Serbia is not structured, organised and budgeted between responsible ministries and agencies. Because of fact that NARD is organisationally subordinated by the MoERD, funding and governance activities between these two institutions are fully synchronised. The main challenge in near future is establishment of the coordination between the MES, MoERD and NARD. Possible solution could be mutual participation of representatives from both ministries and NARD in policy related bodies (councils, committees, etc.) in order to harmonise both measures and finance addressed to same clients / users of public budget.

Creation of the first innovation policy in Serbia for more efficient and effective use of public budget and national innovation resources and capacities should be one major priority for governing institutions in country. Possible solution for this challenge is clearly defined responsibility and assigned task within national government, eventually after elections in 2012.

2. Another important structural challenge is still present linear model of governance of the R&D and innovation system in the country; this is the main obstacle for networking of R&D sector with the rest of economy and society, i.e. R&D sector and economy in Serbia are separate and mutually independent, without needs and aspiration for cooperation.

Existing instruments and mechanism are more oriented to preserve the situation rather than convert this into a networked, mutually dependent cooperation. This situation is particularly evident in the R&D sector with strong orientation of R&D community, enhanced by the Science law and criteria for advancement in research

career based on articles published in scientific publications, rather than technology development and innovation.

The direct consequences of the obstacles shown above are the preservation of a role and structure of a R&D system that had been created in a time of a quasi-market economy. A crucial challenge for research governance in Serbia is the question of how to increase R&D and Innovation activities in the Business Enterprise Sector (BES). Official figures (Statistical Office of the Republic of Serbia: Bulletin on S&T activities in Serbia in 2010) showed that BERD share in GERD was only 14.319% in 2009, compared to 62.046% in EU. Although recent R&D and Innovation surveys support findings with a different situation in BES, i.e. investments in R&D and innovation in this sector are much higher than official statistics shows, and further investigations to reveal of the real situation in R&D and Innovation investments in BES in Serbia are needed, still scope and level of investment in R&D and innovation activities in BES in Serbia is far from needed.

The MES has implemented the “Law on innovative activities” and “Law on intellectual property rights (IPR)” in order to create a mechanism for more intensive linkage of science, research and innovation with the wider economy. The laws stipulate among other things: Strategic changes of the method of funding, partly oriented to the entities in the economic sector as the proponents of innovation projects; Regulation of IPR protection, under the joint projects between the corporate sector and R&D organisations; Formation of joint investment funds for financing the innovation projects. Through the future action plan under this strategy and in cooperation with the Ministry of Finance, taxation and budgetary incentives for investment into science and research shall be pursued. The proposals of the MES are as follows: The investment by corporations into projects involving science research organisations, which are co-financed by MES shall be free of corporate profit tax (recognised as a cost); Employment of young researchers registered in the projects of MES in the private sector enables the private sector to give salaries for two years free of contributions and taxes (payable by the employer); Should an enterprise choose to fund an employee’s doctoral studies MES would bear up to one half of the costs; Young researchers registered by the MES, who would incorporate their own enterprise, would be exempt from paying income and profit tax up to the age of 30. After that, they will be transitioned to standard progressive taxation within 5 years; MES would cover the costs of patent applications and other forms of protection of intellectual property for projects co-financed by MES (SSTDRS, 2010).

3. According to MES, one of the significant problems in preserving and strengthening the scientific community is the ongoing drain of highly educated individuals from the country. In the period 1990-2000, about 73,000 inhabitants left Serbia, and among them 17,000 had university degrees. This emigration trend continued after 2000, with some 50,000 people leaving, of which about 2,000 were university graduated (SSTDRS, 2010). The majority of the highly educated emigrants are from the area of engineering and technological studies and from the area of natural sciences. It is exactly for these reasons that a change has to be introduced in the High Education (HE) policies, including the introduction of initiatives aimed at keeping the best graduates and researchers in the country, along with the adoption of a long-term plan for the return of scientists from the Diaspora. MES just launched the project which will engage Serbian Diaspora in joint projects, to transfer their knowledge and skills for the benefit of Serbian society, as well as to motivate the scientists to return to Serbia.

4. The attractiveness of R&D system in Serbia for private investments in R&D is insufficient because of the present structure and capacities of public R&D system. Restructuring of public R&D system and integration of business enterprise R&D sector into national innovation system is the strategic orientation of government as articulated in a Strategy for S&T development of the Republic of Serbia until 2015. In addition, the legal framework is not favourable to private sector engagement in R&D and innovation activities because of the following:
- Legal barriers to companies to apply for public funds for R&D and innovation activities: according to Innovation law, there is formal obligation for companies to be registered in the MES innovation register in order to be eligible for competition under public calls for co-financing of the innovation grants. Direct consequence of this regulation is that less than 100 companies out of more than 100.000 companies in Serbia are registered in the MES innovation register, and only these companies could apply for innovation grants funded by the MES. Partly, this problem is resolved with funding from the Innovation fund which operates under the combination of national and international laws in order to comply between foreign donors request to be opened for all innovative companies in Serbia, and avoid national Innovation law which is highly restricted in that sense;
  - Legal framework for risk and venture capital investments in R&D and innovation activities is not transparent enough and fully adapted to the “rules of game” in market economy: practically, there is no law which regulates venture capital and other risk investments. Existing legal regulation of financial activities are not in favour of R&D and innovation activities.
5. Undeveloped infrastructure for innovative entrepreneurship and lack of culture for technological entrepreneurship in Higher Education Sector (HES) and public R&D laboratories and institutes (PRO – Public Research Organisations) is another structural challenge in Serbian R&D and innovation landscape.

Crucial steps forward in order to create an environment to support technological entrepreneurship in Higher Education Sector (HES) and public R&D laboratories and institutes (PRO – Public Research Organisations) are the changes in HE Law and Innovation Law which stimulates and legally approves creation of university and PROs spin-offs. There are just few examples of spin-offs initiatives, such as within University of Novi Sad – Faculty of Technical Sciences and “Mihajlo Pupin” Institute in Belgrade. Only two TTOs (Technology Transfer Office) are established within University of Novi Sad and University of Belgrade (in 2010) so far.

Overall assessment is that most of the private HE institutions are so-called “teaching” faculties, with transmission of knowledge (teaching) as primary and only activity. Other two main missions: generation of new knowledge (research) and the 'third mission' (contribution to local or regional wealth and economic development) are mostly present in some of public HE institutions;

Several more obstacles for creation and functioning of the national innovation system in Serbia should be mentioned:

- Absence of an evaluation culture and practice in R&D and innovation system in Serbia: besides accreditation procedure (obligatory under the HE Law), for teaching competence, and under the Science Law, for R&D competence, there is no specific evaluation of teaching and R&D performance of HE institutions in Serbia. Other R&D and innovation organisations are obliged to pass regular,

rather formal accreditation procedure which is legal obligation under the science and innovation laws. The Introduction of permanent and transparent monitoring and evaluation practice in governance of innovation policy measures is urgently needed: there are no evaluation standards or institutions responsible for evaluation in the area of science, technology and innovation in Serbia. Only ex-ante evaluations of innovation activities proposed under public calls for funding from the MES, MoERD and NARD are regularly organised. Further monitoring of on-going activities, ex post and impact evaluation of innovation activities are organised as sporadic initiatives within EU sponsored projects. It is necessary to organise national programme for evaluation of innovation activities which are (co)financed from the public sources, with development of evaluation standards, identification and training of evaluators, establishment of legal framework for such activities, etc.;

- Insufficient knowledge about R&D and innovation capacities in business sector: recognition of resources and capacities of business enterprise R&D sector and integration with public R&D organisations could strengthen overall R&D and innovation system in Serbia;
- Recognition of the needs for financing of innovation activities with a much larger budget and significantly increased financing per innovation grant. Present situation finances innovation activities in companies up to several thousand Euros, which is not enough for significant innovations. A Possible solution for this challenge is the operation of a recently established innovation fund, which policy is promising exactly in this direction: financing of innovation activities will be approved with grants between €50.000 minimum and €300.000 as maximum per grant;
- Lack of demand-side R&D and innovation policy tools and measures in Serbia: administration and good governance in harmonisation between supply and demand-side innovation policy tools and measures are needed. Possible solution is development of integral innovation strategy and policy with an appropriate action plan which will stress demand-side as well as supply side innovation policy tools and measures.

## 3 Assessment of the national innovation strategy

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### 3.1 National research and innovation priorities

The main policy document addressing cooperation between universities, research and business is the new "Strategy of S&T Development of the Republic of Serbia 2010-2015" (SSTDRS, 2010). "The Strategy is guided by two basic principles: focus and partner. **Focus** through defining a list of national research priorities in which we (i.e. R&D system in Serbia) can and must make significant progress. **Partner** through strengthening ties with institutions and companies to allow Serbia to validate its ideas in the global market". The Strategy presents an action plan for realisation of such partnership (SSTDRS, 2010).

The rationalisation of the R&D institutes' network, and closer cooperation with the universities to enhance the quality of study programmes, should result in a favourable environment for R&D. Its results will contribute to the economic and social development of the Republic of Serbia (SSTDRS, 2010).

Links between education and science is one of the cornerstones for implementation of the Strategy. R&D institutes and faculties have to be integrated into one science-educational system. For the sake of integration of science institutes into the educational and scientific process at the university, the institutes should be allowed to become equitable members of the university, provided they meet the accreditation criteria for doctoral studies. In that way the Institutes would acquire the independent status or in cooperation with other university units, organise doctoral studies and become places where the doctoral dissertations could be prepared. Universities and their units (faculties, departments) could become founders of science institutes, science and research centres (with or without the status of legal person), defined in the Statutes of the University (SSTDRS, 2010).

The **goals** of current research policy are:

1. The current 55-45% ratio of financing basic as opposed to applied research must progress to 40-60% in favour of applied science in the next five years (SSTDRS, 2010, based on the MES internal unpublished data). This will be achieved through an appropriate and gradual allocation of additional public and private funds for applied disciplines in the coming years;
2. Focus on selected field of S&T by setting seven national R&D priorities in the field of science and technology, for the period 2010-2015;
3. Strengthening of the human resource base by preventing brain-drain, establishing effective projects with leading individuals in the Serbian scientific Diaspora and identification, development and support for talented young researchers;
4. Partnership within the R&D system through rationalisation of the R&D network and close cooperation between institutes and faculties;
5. Partnership with society through science promotion;
6. Partnership with industry through an innovation fund, a new legal framework for intellectual property, and incentives and support for innovation activities;
7. Partnership with other ministries through the participation of the scientific community in major infrastructural and other projects in Serbia;

8. Increasing and diversifying R&D expenditure: The goal is to reach 1% of GDP for science by 2015, not counting infrastructure investments. A realistic growth plan for budget appropriations for science is an annual growth rate of 0.15% GDP. At such a pace, the budget appropriations by 2015, the closing of this Strategy framework will reach 1.05%; The Project of Infrastructural Investments, worth EUR 400 million started in January 2010 and will last until the end of 2015 (SSTDRS, 2010).

Investments in research and innovation in Serbia from public sources are prioritised and budgeted in the framework of multi-annual plans to ensure predictability and long term impact. Project financing based on open competition for R&D and Innovation projects is a decade long practice in Serbia. Latest developments proved the Government's long-term orientation toward competitive rather than institutional funding of R&D activities. National priorities in the domain of S&T, defined in S&T Strategy are (SSTDRS, 2010):

1. Biomedicine and human health;
2. New materials and nanosciences;
3. Environment protection and countering climate change;
4. Agriculture and food;
5. Energy and energy efficiency;
6. ICT; and
7. Improvement of decision making processes and affirmation of national identity.

In addition to competitive financing of R&D and Innovation projects, MES announced a plan for **other investments in R&D** in Serbia in the period 2010-2015. The main sources of financing of the infrastructural projects which demonstrate and enable development of priority research fields in the next five years will be international financial institutions, and particularly the European Investment Bank, European Bank of Reconstruction and Development, the World Bank, Development Bank of the Council of Europe and various international donors, specifically EU pre-accession funds. The Project of infrastructural investments, worth €400m will start in January 2011 and last until the end of 2015. Projects selected for this investment were those conducive to the development of priority disciplines, likely to ensure successful development and identification of scientific talent, prevent brain drain, and finally, projects which will make up for almost twenty years of scarce investment into scientific infrastructure. Main projects within the "Serbian R&D infrastructure investment initiative" are (SSTDRS, 2010):

1. Serbian R&D infrastructure investment initiative comprises investments in upgrading existing capacities, for adaptation of existing buildings and laboratories and new capital equipment for research (app. €70m);
2. Development of Excellence centre and academic research centres (app. €60m);
3. Development of ICT infrastructure, for Campus for faculties of technical sciences of the University in Belgrade and Infrastructure for supercomputing initiative "Blue Danube" (app. €30m to €80m);
4. Creation of a knowledge-based economy through the construction of science parks in Belgrade, Novi Sad, Nis and Kragujevac (app. €30m);
5. Basic infrastructure projects, such as Apartment buildings for researchers in Belgrade, Novi Sad, Nis and Kragujevac, and Infrastructure for the MES (app. €80m).

In addition to these initiatives, special programme for development of human capital in Serbia is defined (app. €33m) with four main investment activities (SSTDRS, 2010):

1. Human resources programme (programme for the return of Serbian researchers from the Diaspora). One of the projects is to have the researchers back for a period of time is to provide them with working conditions, means, necessary equipment and adequate accommodation. The networking of researchers in Serbia with their colleagues Serbian nationals in other countries. has also been planned, along with visits of the eminent Serbian researchers and incentives for foreign based researchers to establish their own enterprises in Serbia;
2. The "Petnica" research centre is a unique institution with a history of 26 years and about 14,000 young trainees, many of whom are proponents of R&D in Serbia today. In the next three years the works on additional capacities of "Petnica" should be completed for both accommodation and modern laboratories (app. €7.6m);
3. Mathematical high school campus;
4. New Science and innovation centre in Belgrade (for popularizing science among the youth and public at large): one of the core projects within the initiative to build a new scientific infrastructure is the Centre for promotion and popularization of science in Belgrade (app. €20m).

The international S&T cooperation will be implemented in-line with the Strategy and identified priorities. In the FP7 the MES will pursue the policy of substantive promotion and imposition of topics of interest under the Strategy and its future implementation. For priority areas where the number of FP7 projects is small or the success low (health care, environment) special corrective action plans will be made.

A crucial step forward in order to create an environment which supports technological entrepreneurship in Higher Education Sector (HES) and PROs are changes in HE Law and Innovation Law which stimulates and legally approves creation of university and PROs spin-offs. Best practice case and recommended way of public-private knowledge transfer model is the (public) University of Novi Sad with almost 60 spin-off companies created within the last 5-6 years. The University of Novi Sad has established the first IPR Liaison Office within university, in cooperation with national IPR Office, as the first such office in R&D sector in Serbia. Agreement on the support of the IPR Office to the University of Belgrade and the foundation and work of the Technology Transfer Centre was signed in November 2010. The Centre is established by the decision of the University Council from October 26, 2010, in the purposes of identification, protection and commercialization of the results of research work of professors, researchers and students, and protection of IPR.

### **3.2 Trends in R&D funding**

Public funding of R&D and Innovation activities in the period 2011-2014 will be realized under the S&T strategy assumption that: "A realistic plan of growth of budget appropriations for science is an annual growth rate of 0.15% GDP. At such a pace, the budget appropriations by 2015, the closing of this Strategy framework shall reach 1.05%" (SSTDRS, 2010). The main R&D funding indicators (GERD, BERD, GBOARD and their evolution during the last three years in comparison with the corresponding EU 27 average are given in table below.

	Serbia 2008 [**]	Serbia 2009 [**]	Serbia 2010 [**]	EU average 2010 [*]
<b>GDP growth rate</b>	3.8	-3.5	1.0	-4.3 [1]
<b>GERD as % of GDP</b>	0.732	0.919	0.76	2.01
<b>GERD per capita</b>	32.46	36.27	29.61	473.9
<b>GBAORD (€ million)</b>	143.81	166.96	128.5	3,201.1
<b>GBAORD as % of GDP</b>	0.540	0.615	0.45	0.75
<b>BERD (€ million)</b>	21.72	38.02	25.17	5,597.2
<b>BERD as % of GDP</b>	0.066	0.132	0.089	1.25
<b>GERD financed by abroad as % of total GERD</b>	9.03	7.18	3.58	N/A
<b>R&amp;D performed by HEIs (% of GERD)</b>	50.51	54.78	51.70	23.7
<b>R&amp;D performed by PROs (% of GERD)</b>	40.41	30.87	36.62	13.2
<b>R&amp;D performed by Business Enterprise sector (as % of GERD)</b>	9.08	14.32	11.63	62

[1] GDP at market prices; Percentage change on previous period

Source: [\*] EUROSTAT and [\*\*] Statistical Office of the Republic of Serbia: yearly statistical bulletins on S&T activities in Serbia

The national R&D investment target is 1.05% for GBOARD/GDP, but the impact of the economic crisis on the R&D expenditure could be strongest in the public sector, because of fact that budget appropriations for R&D practically remain unchanged in 2009, 2010 and 2011, despite rather high inflation rate in the same period.

Investments in R&D and innovation in Serbia from public sources are prioritised and budgeted in the framework of multi-annual plans to ensure predictability and long term impact.

Funding from abroad, particularly from the EU (via Framework, Structural Funds etc.), or from other international sources became an important source of R&D funding in Serbia since 2006. The share of funding from abroad increased from only 2.64% in 2006 to 7.18% in 2009 because of the increase of success in competition for FP7 and other EU funds. Figures for 2010 are consequence of global financial crisis which affect Serbian economy and R&D system as well.

There was no significant funding for innovation activities in Serbia from any source other than MES, MoERD and NARD. A significant change in that sense happened in 2011: financial scheme for financing of the Innovation fund activities is under negotiation with the World Bank, the European Investment Bank, and the European Commission; preliminary negotiable is total sum of €75.5m for the period 2011-2014. Initial funding for the Innovation fund is provided by the "Innovation Serbia Project": The €8.4m project (Component 2: "Support Human Capital Development and Research) is funded by the EU pre-accession funds (IPA) allocated for Serbia in 2011, and implemented through the World Bank. The IPA project will provide funding for capacity building of the Innovation Fund and implementation of financial instruments supporting enterprise innovation (MINI GRANTS and MATCHING GRANTS Programs) by the Innovation Fund. Public call for MINI GRANTS programme has been launched in December 5th, 2011. Programmes for the support of R&D and innovation activities (co)financed by the Ministry of Education and Science (MES), the Ministry of Economy and Regional Development (MoERD) and the National Agency for the Regional Development (NARD) are not sector-specific.

The very first and still the only example of the public-private partnerships in funding of R&D and innovation activities in Serbia is the Innovation fund. The Innovation Fund has been established on a public-private basis between direct and indirect beneficiaries of the budget, public enterprises, international financial institutions, banks, private commercial companies and others. The Fund is established under the law governing incorporation and operation of investment funds, with majority state founding equity.

### 3.3 Evolution and analysis of the policy mixes

Following the taxonomy developed within the “Policy Mix” Project (Guy, K. et al 2009)<sup>7</sup>, evolution and analysis of the policy mixes in Serbia will be based on existing policies in country which could be grouped into four groups:

- A. Inputs: the impact of policy mixes on financial and human resource inputs; policies related to the knowledge inputs needed for the national innovation system to function properly;
- B. Internal Flows - Input/Output Transformations: policies related to the knowledge production and internal flows of finance, human resources and knowledge;
- C. Outputs: policies related to knowledge circulation, i.e. the transfer, diffusion and utilisation of knowledge outputs;
- D. Matching Supply and Demand: policies related to the mechanisms in place to articulate the demand for knowledge, but it could also cover the articulation of supply side capabilities and the processes in place to ensure that both resource mobilisation and knowledge production are in line with expected demand. It could also cover the policies needed to stimulate the demand for R&D.

Key **resources** for the effective functioning of R&D and innovation system are: finance, human resources, knowledge. Key **processes** for the effective functioning of R&D and innovation system are: resource mobilisation, knowledge demand, knowledge production, and knowledge circulation.

*Inputs: Policies related to knowledge inputs needed for the national innovation system in Serbia*

The R&D and Innovation activities in Serbia in the period 2011-2014 are structured through the following major policy measures:

3. Policy measures for R&D activities launched by the Ministry of Education and Science (MES):
  - a. “Programme supporting Basic Research for the Research Cycle 2011-2014” [“BR Programme”];
  - b. “Programme supporting Research in the Field of Technological Development for the Research Cycle 2011-2014” [“TD Programme”];
  - c. “Programme of Co-Funding of Integrated and Interdisciplinary Research for the Research Cycle 2011-2014” [“III Programme”];
  - d. “Programme of Providing and Maintaining Scientific Research Equipment and Scientific Research Facilities for the Research Cycle 2011-2014” [“SREF Programme”];
4. Policy measures for Innovation activities:
  - a. Programme for Supporting SMEs and Entrepreneurs to Strengthen Innovation Activities in 2011 (responsible institution is the National Agency for the Regional Development);

<sup>7</sup> Ken Guy, Patries Boekholt, Paul Cunningham, Reinhold Hofer, Claire Nauwelaers, and Christian Rammer. 2009. Designing Policy Mixes: Enhancing Innovation System Performance and R&D Investment Levels. Methodology Deliverable, Task 3. The “Policy Mix” Project. European Commission, DG Research, March.

- b. The MINI GRANTS and MATCHING GRANTS Programs – Public call for the MINI GRANTS programme is launched in December 2011, Public call for the MATCHING GRANTS programme is about to be launched in spring 2012 (responsible institution is the Innovation Fund);
- c. The Programme for co-financing of the Innovation projects – Public call for this programme is launched in December 2011 (responsible institution is the MES).

Major changes in the R&D and innovation policy mix are:

- The “IIR Programme” is a new programme for supporting the integration of basic, applied and development research as well as for fully utilising R&D resources of the country, emphasising commercialisation of R&D activities and results;
- The “SREF Programme” is a new programme for improving the material base of basic, applied and development research as well as for fully utilising R&D equipment and infrastructure in the country;
- The MINI GRANTS Programme launched by the Innovation Fund will award selected innovation projects with substantially larger amounts of money per grant in comparison with all past and on-going innovation projects, i.e. up to €80,000. [Innovation projects granted by the Ministry of Economy and Regional Development (MoERD) and the National Agency for the Regional Development (NARD) could be up to €10,000; the MES grant for the innovation project could be up to app. €30,000];
- The MINI GRANTS Programme overcomes the legal obstacle that resulted from the rules defined in the innovation law. This implies, in particular, the obligation for companies to be registered in the MES innovation register in order to be eligible for the competition under public calls launched by the MES. As this programme is administered by an agency independent from the MES, the applicant companies have no obligation for such a registration;
- The Programme for Supporting SMEs and Entrepreneurs to Strengthen Innovation Activities, launched in 2011 by the National Agency for the Regional Development, is more oriented to support non-technological innovation activities. The focus is on service and organisational innovations as well as efficient adoption of quality standards.

#### *Fiscal Policies*

The only tax incentive related to R&D and innovation activities in Serbia is addressed to organisations registered for R&D activities as non-profit organisations. These organisations are not obliged to pay taxes for R&D services they provide to clients under non-profit contracts.

#### *Human Resource Policies*

Two demographic factors sound major warnings for research governance in Serbia. According to the projection of the Republic Statistics Office (RSO), the population of Serbia will decrease by about 2% every five years; in other words, in 2022 Serbia will have 6.3% fewer inhabitants than in 2010. Additionally, the average age of the whole population is 41.4 (in 2002 was 40.25), classifying Serbia among the countries with an older populations. The average age of the researchers is 44.3 years, which is above the average age of the population as a whole, pointing to the need to take action to support and nurture young scientific researchers (SSTDRS, 2010).

MES has just launched a special programme for the development of human capital in Serbia (app. €33m have been set aside for this task) with four main lines of investment in the period 2010-2015:

(1) A human resources programme which will engage individuals in Serbian scientific Diaspora in joint projects and other initiatives, to transfer their knowledge and skills for the benefit of Serbian society, as well as to motivate these scientists to return to Serbia. The programme includes the following activities: (a) Motivating Serbian Diaspora for scientific research – financial package will include relocation expenses, costs of lab equipment, and studentships/fellowships for the any accompanying team members, and appropriate funding; (b) Setting up of a Network of Serbian Scientific Diaspora; (c) Short-term visits of eminent Serbian scientists from Diaspora to Serbia (including training, lectures. etc., in Serbian research institutions); (d) Attracting scientists from the Diaspora to launch start-up companies will be encouraged by offering a set of special incentives, which could include tax breaks, reduction of levies and duties on their products, availability of business space at reduced rates, etc. Strategic areas to be supported through the project would include life sciences, information technology, new materials and structures.

(2) The "Petnica" research centre is a unique institution with a history of 26 years and about 14,000 young trainees, many of whom are leaders of science research in Serbia today. In the next three years the work of providing additional capacities at "Petnica" should be completed with the opening of both new accommodation and modern laboratories (investment worth €7.6 million);

(3) The "Mathematical" high school campus in Belgrade is a specialised secondary school which enrolls, using special selection criteria, the most talented young mathematicians and others interested in natural sciences from across Serbia. The MES plan calls for the building of a campus for accommodation during the school year but also for organising preparations for international scientific competitions and many other activities;

(4) The new science and innovation centre in Belgrade for popularising science among young people and the public at large is one of the projects within the MES initiative to build a new national scientific infrastructure (investment worth €20m).

#### *Interaction between Knowledge Triangle Policies*

A crucial step forward in order to create an environment which supports technological entrepreneurship in Higher Education Sector (HES) and public R&D laboratories and institutes (PRO – Public Research Organisations) are changes in HE law and innovation law to help stimulate creation of university and PROs spin-offs. The best practice case and recommended example of public-private knowledge transfer model is the (public) University of Novi Sad with more than 60 spin-off companies created within last the 5-6 years. The University of Novi Sad has established the first Intellectual Property Liaison Office in a Serbian university, in cooperation with the national Intellectual Property Office (IPO). An agreement on the support for the Intellectual Property Office to the University of Belgrade and on the foundation and objectives of the Technology Transfer Centre was signed in November 2010. The centre was established in October 26, 2010. The innovation law supports cooperation between PROs and SMEs. The recently adopted S&T strategy and the latest public call for new R&D projects for 2011-2014 also support (and provide funding for) cooperation between PROs and SMEs.

Creation of a knowledge-based economy through the construction of S&T parks in Belgrade, Novi Sad, Niš and Kragujevac (an app. 30 million EUR investment) is one of the key elements of R&D policy for the immediate future which promotes the diversification of sources of finance for scientific projects through better cooperation with business partners.

#### *Other Policies*

There are no other policies which have explicit actions, measures and incentives on R&D activities in Serbia. This fact supports the conclusion that the innovation system

governance in Serbia is still based on a linear model. Nevertheless, there are a number of initiatives launched by the MES in 2010 in order to motivate other ministries to support R&D activities in their future investments responsibilities. Therefore, the MES will support in the near future, in cooperation with other ministries, specific projects where most of the project cost will be funded out of the money for large infrastructural projects, except for specific R&D related activities and part of researchers' salaries which would be funded by MES, such as: the R&D connected to the Corridor 10 infrastructure project of the Ministry for Infrastructure; Development of the academic network and Internet corridor with the Ministry of telecommunication and information society, and advancement of clusters and SMEs based on innovations with the Ministry of economy and regional development; Active participation in the national program "Serbia against cancer" and the future program "Serbia against cardio vascular diseases" with the Ministry of health, infrastructural and development programs with the Ministry of defence and the interior, and continuation of the National program for energy efficiency with the Ministry of energy; There are also plans to support new capital, infrastructural and development programs in the forthcoming massive investments in energy generation, continuation of the National program of water management with the Ministry of agriculture - Waters directorate, and other infrastructural projects with the Ministry of agriculture, preparations of Serbia for post-Kyoto world. The legal framework for the protection of intellectual property rights in Serbia is complete and fully in accordance with international recommendations and practice. The Republic of Serbia has become the member of the European Patent Organization (EPO) on October 1, 2010.

### 3.4 Assessment of the policy mix

Challenges	Policy measures/actions <sup>8</sup>	Assessment in terms of appropriateness, efficiency and effectiveness
The absence of coordinated governance and funding of national innovation system in Serbia between main ministries (MES, MoERD) and public funding sources	Possible solution could be <b>mutual participation</b> of representatives from both ministries and NARD in policy related bodies (councils, committees, etc.) in order to harmonise both measures and finance addressed to same clients / users of public budget	The absence of a formal innovation policy leads to a situation, in which the governance of innovation activities in Serbia is not structured, organised and budgeted within responsible ministries
The linear model of governance of the R&D and innovation system in the country	The creation of the <b>National Strategy for science, education, research and innovation</b> is a crucial step for developing a National Innovation System	Still present linear model of governance of the R&D and innovation system in the country is main obstacle for networking of R&D sector with the rest of economy and society
The brain-drain - ongoing drain of highly educated individuals from the country	MES has just launched a <b>special programme</b> for the development of human capital in Serbia with four main lines of investment in the period 2010-2015	According to MES (SSTDRS, 2010), one of the significant problems in preserving and strengthening the scientific community is the ongoing drain of highly educated individuals from the country. MES just launched the project which will engage Serbian Diaspora in joint projects, to transfer their knowledge and skills for the benefit of Serbian society, as well as to motivate the scientists to return to Serbia
The present structure and capacities of public R&D system	Restructuring of public R&D system and integration of business enterprise R&D sector into national innovation system is the strategic orientation of government as articulated in a " <b>Strategy of Scientific and Technological Development of the Republic of Serbia 2010-2015</b> " (SSTRS, 2010)	New Innovation law is the legal framework for public – private partnership in R&D and innovation, and "Strategy of Scientific and Technological Development of the Republic of Serbia 2010-2015" presents an action plan for realisation of such partnership
Undeveloped infrastructure for innovative entrepreneurship and lack of culture for technological entrepreneurship in HES and PROs	Crucial step forward in order to create environment which support technological entrepreneurship in Higher Education Sector (HES) and public R&D laboratories and institutes (PRO – Public Research Organisations) are changes in <b>HE Law</b> and <b>Innovation Law</b> which stimulates and legally approves creation of university and PROs spin-offs.	The concept, purpose and functioning of innovation is not sufficiently developed and accepted in the economy and the society. Therefore, the development of the national innovation system in Serbia is currently in a phase of conceptualisation and far from being operational and functional. Certain number of mechanisms, grant schemes, incentives and programmes has launched since 2005, supporting public-private sectors knowledge transfer, transfer of technologies from R&D to business sector, and realisation of innovation projects in business enterprise sector in Serbia.
Absence of evaluation culture and practice in R&D and innovation system in Serbia	There are no <b>evaluation standards</b> as well as institutions responsible for evaluation in the area of science, technology and innovation in Serbia. Only ex-ante evaluations of innovation projects proposed under public calls for funding from the MES, MoERD and NARD are regularly organised. Further monitoring of on-going activities, ex post and impact evaluation of innovation activities are organised as sporadic initiatives within EU sponsored projects. It is necessary to	The very first assessment of innovation and competitiveness support programmes in Serbia is ongoing activity within "The Improved SME Competitiveness and Innovation Project" (ICIP) (CRIS No: 2010/234-669), financed by the European Union with aims at improving the competitiveness of Serbian SMEs and increasing levels of innovation in SMEs. To support these aims ICIP has undertaken an in-depth analysis of innovation and competitiveness support programmes in Serbia to raise awareness for strong policy coordination among main stakeholders to further adapt the support tools in accordance with needs of enterprises and innovation service providers. In total, nine SME innovation and

<sup>8</sup> Changes in the legislation and other initiatives not necessarily related with funding are also included.

	organise national programme for evaluation of innovation activities which are (co)financed from the public sources, with development of evaluation standards, identification and training of evaluators, establishment of legal framework for such activities, etc.	competitiveness support programmes have been evaluated that are implemented by the Government of Serbia and managed by the MoERD, the MES, and the NARD. The results of this assessment have been released by the end of September 2011.
Insufficient knowledge about R&D and innovation capacities in business sector	The <b>Action plan</b> for realisation of the "Strategy of Scientific and Technological Development of the Republic of Serbia 2010-2015" should consider investigations in revealing of real situation in R&D and Innovation investments in BES in Serbia.	A crucial challenge for research governance in Serbia is the question how to increase R&D and Innovation activities in Business Enterprise Sector (BES). Official figures showed that BERD share in the GERD was only 14.32% in 2009, compared to 62% in the EU. Recent R&D and innovation surveys support findings with a different situation in BES, i.e. investments in R&D and Innovation in this sector are comparable to those by the MES. Further investigations in revealing of real situation in R&D and Innovation investments in BES in Serbia are needed. Policy instruments for knowledge circulation promotion could have limited effects for knowledge circulation because of insufficient integration of business sector and public R&D sector
Lack of demand-side R&D and innovation policy tools and measures	Possible solution is development of <b>integral innovation strategy</b> and policy with appropriate action plan which will stress demand-side as well as supply side innovation policy tools and measures	Key barriers in implementing demand-side policies in Serbia, besides the absence of an innovation policy are: (1) (traditional) separation between R&D sector and business sector; (2) legal obstacles (the rules defined in the Innovation law in sense of obligation for companies to be registered in the MES innovation register); (3) lack of public awareness of the need for such policies. Still, there are no national guidelines issued in any fields of demand-side innovation policy, neither indicators defined to capture the impact of demand-side innovation policies, nor specific national studies conducted in the topic of demand-side innovation policy issues.

## 4 National policy and the European perspective

The creation of the National Strategy for science, education, research and innovation is a crucial step for developing a National Innovation System. This strategy should address to the structural challenges of the present R&D and innovation system in Serbia and propose solutions for major problems such as the absence of coordinated governance and funding of national innovation system in Serbia between the main ministries (MES, MoERD) and public funding sources (NARD, Innovation Fund), networking of R&D sector with the rest of economy and society, and particularly mobilisation of R&D and innovation capacities in BES.

The development of integral innovation strategy and policy with appropriate action plan which will stress demand-side as well as supply side of R&D and innovation policy tools and measures is a direction for medium term evolvement of the policy mix (for the 2012-2015 period).

Another medium term activity should be the infrastructure development for innovative entrepreneurship and creation of the culture for technological entrepreneurship in HES and PROs.

The current policy mix should include the development of the evaluation standards as well as institutions responsible for evaluation in the area of science, technology and innovation in Serbia, in short term, i.e. in a very near future (target for 2012-2013).

**Table 3: Assessment of the national policies/measures supporting the strategic ERA objectives (derived from ERA 2020 Vision)**

	ERA dimension	Main challenges at national level	Recent policy changes
1	Labour Market for Researchers	Ensure an adequate supply of human resources for research and an open, attractive and competitive labour market for male and female researchers; Brain-drain and ageing of research population are critical issues for R&D system	There is no special regulation for career breaks (i.e. parental leave) in the R&D sector, and this is the same for all employees in the public sector. Restoration of the same position is guaranteed by the law, and a fixed-term contract must be extended due to maternity leave; MES recently (i.e. at the beginning of 2011) has launched a programme which will engage Serbian scientific Diaspora in joint projects and other initiatives, as well as to motivate the scientists to return to Serbia. Recently launched public call (May 23rd, 2010) for funding of three programmes – Basic Research, Technological Development and Integrated and Interdisciplinary Research by the MES has explicitly promoted initiative for integration of foreign researchers into domestic R&D teams;

	ERA dimension	Main challenges at national level	Recent policy changes
2	Cross-border cooperation	<p>Cross-border flows of knowledge are important particularly at the regional level;</p> <p>Serbia should make significant effort to attract international technology companies which would be ready to realize a part of their development programmes in the country.</p>	<p>Serbian science institutions took part as coordinators in 7 out of 11 projects funded under the FP7 regional call for tenders focusing on research infrastructural enhancement, 'Research Potential 3rd call' (RegPot-3), as well as participating in the realization of 3 out of 4 remaining projects;</p> <p>Currently, bilateral cooperation programmes are being implemented in collaboration between Serbia and a number of countries which resulted in the co-financing of R&amp;D projects carried out by teams consisting of researchers from Serbia and from: Germany, Hungary, France, Slovakia, Slovenia, Croatia, Switzerland.</p> <p>In the 2011 a call for S&amp;T cooperation was launched with Spain, Portugal, Greece (new cycle), China and India, while a framework agreement was drawn up with several other countries (Austria, the Czech Republic, Portugal, Spain, Russia, USA).</p>
3	World class research infrastructures	<p>Obsolete R&amp;D infrastructure as a consequence of twenty years without investments in R&amp;D equipment and infrastructures;</p> <p>Lack of resources for everyday functioning leads to the situation where that equipment is not used with its full capacity, or at all in some cases</p>	<p>Serbian R&amp;D infrastructure investment initiative is part of new S&amp;T Strategy in Serbia. The Project of infrastructural investments, worth €400m started in January 2011 and it will last until the end of 2015</p>
4	Research institutions	<p>Creation and support of excellent research institutions engaged in effective public-private cooperation and partnerships, which will form the core of research and innovation 'clusters';</p> <p>The Universities/ research institutions should be embedded in the social and economic life where they are based, while competing and cooperating across Europe and beyond;</p> <p>Integration of Serbian HE system into EU HE area;</p>	<p>In order to improve the quality and excellence of knowledge production, <b>accreditation process</b> for all organizations, institutions and companies intended to apply for government support for R&amp;D activities is obligatory under the Science and Innovation Law (2010).</p> <p>One of the major activities in the period 2010-2015, defined by the latest S&amp;T strategy, is the <b>restructuring</b> of the R&amp;D system.</p> <p>The Law on Higher Education (LHE), which fully implements the Bologna Declaration in Serbia, came into effect on 10 September 2005, opening the process of integration of Serbian HE system into EU HE area;</p> <p>Centres of excellence should act as disseminators of excellence in their surroundings and so contribute to the development of society and economy in Serbia. There are 2 centres of excellence to date: the Centre for Mathematical Research of Nonlinear Phenomena is a research unit at the Department of Mathematics and Informatics, Faculty of Science, University of Novi Sad, and the Centre for Solid State Physics and New Materials of the Institute of Physics Belgrade;</p>

	ERA dimension	Main challenges at national level	Recent policy changes
5	Public-private partnerships	Commercialisation of R&D results; Policy instruments for knowledge circulation promotion could have limited effects for knowledge circulation because of insufficient integration of business sector and public R&D sector;	Crucial step forward in order to create environment which support technological entrepreneurship in Higher Education Sector (HES) and public R&D laboratories and institutes (PRO – Public Research Organisations) are changes in HE Law and Innovation Law which stimulates and legally approves creation of university and PROs spin-offs; Innovation Law supports cooperation between PROs and small and medium sized (SME) companies. Recently adopted S&T Strategy and latest public call for new R&D projects for 2011-2014 period also support (in financial terms) cooperation between PROs and SMEs; It is a legally granted right and possibility that representatives from business sector could be elected in managing boards in public faculties and universities and PROs
6	Knowledge circulation across Europe	Facilitating knowledge circulation between university, PRO and business sectors Profiting from access to international knowledge Absorptive capacity of knowledge users	“Strategy of S&T Development of the Republic of Serbia 2010-2015” The Science Law (2010); The Innovation Law (2010) with by-laws (2011); The Higher Education Law (2010)
7	International Cooperation	International scientific cooperation should be implemented in-line with the new S&T Strategy and its priorities; Increase of Serbian FP participation provide an opportunity for knowledge circulation; There is very modest participation of R&D and innovative and corporate organizations in FP7	On the basis of the Memorandum of Understanding signed by the Republic of Serbia regarding its Association with the EU FP7, Serbia obtained the status of Associated Country on June 13, 2007. That status provides an opportunity for Serbian researchers to participate in practically all priority areas, and to engage in project coordination, but also the possibility of influencing research policy through the involvement of Serbian experts in different programme committees of the FP7; New S&T strategy (SSTDRS, 2010) promotes international multilateral and bilateral S&T cooperation

## Annex: Alignment of national policies with ERA pillars / objectives

### 1. ENSURE AN ADEQUATE SUPPLY OF HUMAN RESOURCES FOR RESEARCH AND AN OPEN, ATTRACTIVE AND COMPETITIVE SINGLE EUROPEAN LABOUR MARKET FOR MALE AND FEMALE RESEARCHERS

#### a. Supply of human resources for research

Two demographic factors are major warning for research governance in Serbia. According to the data of the Republic Statistics Office, population of Serbia will decrease by about 2% every five years; in other words, in 2022 Serbia will have 6.3% fewer inhabitants than in 2010; additionally, the average age of the population is 40.25, which places Serbia among countries with old population. R&D personnel made 0.68% of the employment in 2008, which was almost half of EU average 1.01%; the situation was slightly improved two years later, with 0.81% share of R&D personnel in total employment in 2010 in Serbia (no data for EU average available).

**Table 4: Human resources in R&D in Serbia, 2010**

	Total personnel	Researchers	Supporting staff and Technicians	Administration and Others
<b>FTE</b>	17,273.90	10,984.95	3,941	2,348.00
<b>Head Count</b>	19,341	12,637	4,193	2510.85

Source: EUROSTAT and Statistical Office of the Republic of Serbia: yearly statistical bulletins on S&T activities in Serbia

The number of researchers in Serbia changes from year to year, due to the permanent brain drain and incentives for higher employment in order to fight emigration of researchers from Serbia. Recent world economic and financial crisis is just one among number of factors that cause brain drain from the research sector.

Ageing of the research population could become an issue with more than a half of researchers in 2010 aged between 35 and 54 years (50.39%).

**Table 5: Researchers in Serbia, by sectors of performance**

Researchers, by sectors of performance, Head count	Res. total	Change (%)	Res. GOVS	Res. BES	Res. HES	Res. PNP
Serbia, 2008	11,534	109.02%	2,738	372	8,412	12
Serbia, 2009	12,006	104.09%	2,782	666	8,546	12
Serbia, 2010	12,637	105.26%	2,666	303	9,668	0
Researchers, by sectors of performance, FTE	Res. total	Change (%)	Res. GOVS	Res. BES	Res. HES	Res. PNP
Serbia, 2008	9,978.2	113.31%	2,675.5	306.9	6,990.2	5.6
Serbia, 2009	10,443.94	104.67%	2,718.48	600.4	7,119.46	5.6
Serbia, 2010	10,984.95	105.18%	2,634.67	251.86	8,098.42	0

Source: Statistical Office of the Republic of Serbia: yearly statistical bulletins on S&T activities in Serbia

**Table 6: Researchers, by sectors of performance, EU and Serbia**

Researchers, by sectors of performance, Head count	Res. total	Res. GOVS	Res. BES	Res. HES	Res. PNP	Population	Res/Pop
EU (27 countries), 2008	2,256,282	230,846	813,853	1,187,743	23,840	497,686,132	0.45%
EU (27 countries), 2009	2,318,518	237,357	813,675	1,243,451	24,035	499,705,399	0.46%
Index 2009/2008 (EU)	102.76%	102.82%	99.98%	104.69%	100.82%	100.41%	102.34%
EU (27 countries), 2008	100.00%	10.23%	36.07%	52.64%	1.06%		
EU (27 countries), 2009	100.00%	10.24%	35.09%	53.63%	1.04%		
Serbia, 2009	12,006	2,782	666	8,546	12	7,334,937	0.16%
Serbia, 2010	12,637	2,666	303	9,668	0	7,306,677	0.17%
Index 2010/2009 (Serbia)	105.26%	95.83%	45.50%	113.13%	0.00%	99.61%	105.66%
Serbia, 2009	100.00%	23.17%	5.55%	71.18%	0.10%		
Serbia, 2010	100.00%	21.10%	2.40%	76.51%	0.00%		
Researchers, by sectors of performance, Head count	Res. total	Res.	Res.	Res.	Res.	Population	Res/Pop

performance, FTE		GOVS	BES	HES	PNP		
EU (27 countries), 2009	1,548,631	195,773	693,595	641,338	17,925	499,705,399	0.31%
EU (27 countries), 2010	1,564,770	198,555	708,345	640,276	17,595	501,125,880	0.31%
Index 2010/2009 (EU)	101.04%	101.42%	102.13%	99.83%	98.16%	100.28%	100.76%
EU (27 countries), 2008	100.00%	12.64%	44.79%	41.41%	1.16%		
EU (27 countries), 2009	100.00%	12.69%	45.27%	40.92%	1.12%		
Serbia, 2009	10,443.94	2,718.48	600.4	7,119.46	5.6	7,334,937	0.14%
Serbia, 2010	10,984.95	2,634.67	251.86	8,098.42	0	7,306,677	0.15%
Index 2010/2009 (Serbia)	105.18%	96.92%	41.95%	113.75%	0.00%	99.61%	105.59%
Serbia, 2009	100.00%	26.03%	5.75%	68.17%	0.05%		
Serbia, 2010	100.00%	23.98%	2.29%	73.72%	0.00%		

Source: EUROSTAT and Statistical Office of the Republic of Serbia: yearly statistical bulletins on S&T activities in Serbia

MES recently (beginning of the 2011) launched a programme which would engage Serbian scientific Diaspora in joint projects, to transfer their knowledge and skills for the benefit of Serbian society, as well as to motivate the scientists to return to Serbia. The programme includes activities: (a) Motivating Serbian Diaspora for R&D. Such a financial package may include relocation of expenses, cost of specific lab equipment, if any, studentships / fellowships for the accompanying scholars, and appropriate award money. The scientific institutions within Serbia will host the potential recipients of the awards and extend necessary infrastructural facilities in areas that are of high priority for economic development of Serbia. The award recipients may be given temporary appointments and an opportunity to develop an institute in the area of their excellence; (b) Setting up of a Network of Serbian Scientific Diaspora. The MES will jointly launch this network to link the Serbian scientists around the world; (c) Short-term Visits of Eminent Serbian scientists from Diaspora to Serbia (including trainings, lectures. etc., in Serbian research institutions); (d) Attracting scientists from Diaspora to launch start-up companies. Return of these scientists to set up start-up units can be encouraged by offering a set of special incentives, which could include tax breaks, reduction of levies and duties on their products, availability of business space at reduced rates, etc. Strategic areas to be supported through the project will be announced by MES based on national priorities (SSTDRS, 2010).

The main source for recruitment of new researchers and scientists are students who completed their postgraduate studies, such as specialisation, master and doctoral studies. There are 518 new doctors of arts/sciences in Serbia in 2008 which is not sufficient for the actual needs of R&D sector in Serbia; and 557 new doctors of arts/sciences in Serbia in 2009 (no data by fields of S&T available).

**Table 7: Specialists, Masters and Doctors of Sciences (Arts), 2008**

	Education	Arts and Humanities	Social sciences, Business and Law	Natural sciences, Mathematics and IT	Technique, Production and Construction
Specialists	14	1	7	2	
Masters of (arts) sciences	49	275	562	210	157
Doctors of (arts) sciences	13	23	140	106	88
	Agriculture and Veterinary	Health and Social care	Services	Total	Share of population (%)
Specialists		46		70	0.00095%
Masters of (arts) sciences	101	253	73	1,680	0.02281%
Doctors of (arts) sciences	31	99	18	518	0.00703%

Source: Statistical Office of the Republic of Serbia: Statistical yearbook 2010

- b. Ensure that researchers across the EU benefit from open recruitment, adequate training, attractive career prospects and working conditions and that barriers to cross-border mobility are removed**

Researchers and scientists in government laboratories and institutes in Serbia are treated as civil servants, whose positions and a significant share (or the total amount) of income is regulated by the Science Law. Nationality of researchers and scientists is *not* mentioned at all within the Science Law. The same holds for recruitment and competition procedures for all applicants for permanent positions in public universities and public research institutes. Still, there are measures which have to be taken in order to facilitate and adapt process of recognition of professional qualifications which facilitate the equivalence/validation of foreign academic degrees and hence support international applications for posts within national R&D system. These measures include changes in High Education Law, concerning process of validation of diplomas granted abroad, as well as changes in Science Law which will introduce procedures for recognition of academic qualifications granted abroad.

Social security, pension, health and other taxes in the R&D sector are regulated within laws which regulate such rights and obligations for public services in Serbia.

There are no specific regulations to facilitate the integration of foreign researchers in the national research labour market, such as social security access, health insurance, compatibility of pension schemes in Serbia. Also, there are no tax incentives to facilitate the participation in supplementary pension schemes. Considering the researchers' status, their contracts/fellowships are subject to social and health taxes as all other business contracts in Serbia. There are no specific regulations for EU citizens/researchers to be distinguished from the rest of the world.

#### *Providing attractive employment and working conditions*

Career advancement in R&D sector is strictly regulated by the Science Law and by-laws (Science Law, 2010). There are four possible positions for researchers: (a) starting positions are research-apprentice and research associate; (b) scientific associate; (c) senior scientific associate; (d) scientific counsellor. Procedure for advancement is defined by the law, and certification of this procedure is under jurisdiction of MES, i.e. scientific position is granted only by MES decision. The first three positions are just temporary positions; only the fourth position is permanent, with the same consequence for working position of researchers and scientist in government laboratories and public institutes. There is full equivalence between research and scientific positions and positions in high education which are defined by the High Education Law: (a) assistant is equal to research associate; (b) docent is equal to scientific associate; (c) associate professor is equal to senior scientific associate; (d) full professor is equal to scientific counsellor position. There is *no* similar equivalence in the HE Law for scientific positions in HE institutions.

Official R&D statistics provide data on structure of GERD with 51.7% spent on gross salaries, 39.8% on material costs, and only 8.5% on investments in capital equipment in 2009. According to labour statistics, average salaries in R&D sector are:

- in 2009 gross RSD 73,921 (€772) and net RSD 52,731 (€551); compared to salaries in total economy this is 167.4% of average gross salaries and 166.2% of average net salaries in Serbia in 2009;
- in 2010 gross RSD 77,081 (€730) and net RSD 54,864 (€520); compared to salaries in total economy this is 162.4% of average gross salaries and 160.7% of average net salaries in Serbia in 2010. This is nominal increase of 4.1% but in real terms salaries in 2010 are 2.5% less than in 2009.

Nevertheless, unofficial information and surveys of public opinion about attractiveness of employment in R&D sector in Serbia could provide a basis for assessment of the

present situation which is not in favour of Serbian researchers who are paid 20-50% gross salaries less than researchers in Slovakia, Czech Republic and Hungary. In addition, there is a significant difference in salaries between researchers with equal scientific degrees and positions in Serbia. Therefore, proposal for a new law on salaries in public services which is in ongoing process with support of experts from World Bank will include regulations for remuneration in R&D sector. Besides emigration of researchers from Serbia because of small salaries, there is a professional shift to other national, more attractive sectors; particularly researchers in the area of ICT's are under permanent country wide offers to replace their academic career with a better paid job in ICT business in Serbia.

Salaries for researchers in government laboratories and public institutes are defined by their organisations. There is a *suggestion* by the MES that a minimum level of wages for researchers and scientists cannot be less than the amount of money which is paid for realisation of R&D projects, financed by the MES. There are fixed amounts for monthly payment of researchers and scientists in government laboratories and public institutes, as well as for research staff at the universities and faculties, defined by the MES, which are based on estimates according to different research and scientific positions, and modified according to quality and quantity of scientific results and achievements. Universities and research institutes are fully independent to determine salaries of academic staff, still having in mind above mentioned *suggestion* by the MES concerning a minimum level of wages for researchers and scientist. The present situation in the country is that for the same research and scientific positions the difference in salaries could exceed 100% due to eventual additional engagements and projects and different treatment of R&D staff in public R&D organisations, even in the same S&T field. In addition, payment for R&D activities for academic staff at public universities is in practice separated from the regular salaries, which are defined and financed by the MES. Money paid by the MES for R&D activities is distributed to university staff as an extra income, agreed with university staff as second wage from public budget. This could be, partly, explanation for intervention from World Bank experts for proposing a new law on salaries in public services and inclusion of salaries in R&D sector in this law as well.

The European Charter for Researchers and a Code of Conduct for the Recruitment of Researchers are practically unknown in R&D community in Serbia.

#### *Open recruitment and portability of grants*

Practically, researchers and scientists in government laboratories and institutes are treated as civil servants, whose positions and a significant share (or the total amount) of income is regulated by the Science Law. Nationality of researchers and scientists is *not* mentioned at all within the Science Law. The same holds for recruitment and competition procedures for all applicants for permanent positions in public universities and public research institutes. Still, changes in the High Education Law are necessary, concerning process of validation of diplomas granted abroad, as well as changes in the Science Law which will introduce procedures for recognition of academic qualifications granted abroad.

Serbia is in a position to create an environment attractive enough to preserve its own human resources in R&D sector, and attract Serbian scientific Diaspora to cooperate with domestic teams and institutions. Therefore, international advertising of research vacancies supported by public funds is not and will not be an issue, at least not in near future. A more serious issue for R&D sector in Serbia is internal mobility, i.e. transfer of researchers who are awarded a national research grant to another national institution, and emigration from Serbia to a foreign institution. The first case could be solved under agreement which should be achieved between both R&D organisation and MES as

financing and governing body. The second situation, i.e. emigration, will immediately cause cancellation of funding and, eventually, cancellation of R&D activity granted by the MES.

*Meeting the social security and supplementary pension needs of mobile researchers*

Social security, pension, health and other taxes in the R&D sector are regulated within laws which regulate such rights and obligations for public services in Serbia.

There are no specific regulations to facilitate the integration of foreign researchers in the national research labour market, such as social security access, health insurance, compatibility of pension schemes in Serbia. Also, there are no tax incentives to facilitate the participation in supplementary pension schemes. Considering the researchers' status, their contracts/fellowships are subject to social and health taxes as all other business contracts in Serbia. There are no specific regulations for EU citizens/researchers to be distinguished from the rest of the world.

*Enhancing the training, skills and experience of European researchers*

There are an increasing number of national doctoral programmes prepared in collaboration with other universities, jointly with the introduction of English as spoken language in PhD and Master degree courses, aiming at a greater degree of standardization of national PhD and Master degree programmes with those in EU. Domestic researchers are motivated to apply and join TEMPUS and other EU sponsored programmes and schemes that support curriculum development.

**c. Improve young people's scientific education and increase interest in research careers**

In parallel with MES actions to prevent brain-drain from country and attract Serbian Diaspora to cooperate with R&D community in Serbia, authorities in HE area are faced with decrease of interest of young people for studies in the area of natural sciences and engineering. Percentage of population aged 30-34 who completed tertiary education in Serbia is 20.52%, which is much lower than in EU27 in 2010 (33.6%). Adoption of Bologna process as an obligatory mode for HE organisation in Serbia was followed with changes in the education curricula which gradually included aspects such as creativity, critical thinking, problem solving, teamwork, and communication skills. Lectures on the entrepreneurship and innovation, although still very rare, are becoming increasingly present in universities, included in curricula for undergraduate and for master studies.

The total number of students in Serbia reached 3.09% of population in school year 2009/2010, with 65.88% of all students enrolled at public universities and 17.15% at public higher schools. Almost one fifth of all students are enrolled at private universities (14.85%) and private higher education schools (2.12%).

**Table 8: Number of Faculties, accredited for school year 2011/2012**

	Number of Faculties
Republic of Serbia	205
Public universities	83
Private universities	50
Public higher schools	50
Private higher schools	22

Source: Ministry of Education and Science, Register of HE institutions, January 2012

Social sciences, business activities and law studies are the most attractive fields of education, both in public and private high education institutions. Private high education institutions, although offering a number of educational fields, are mostly oriented to social sciences, business activities and law studies, with 78.19% of all enrolled students, and only studies in IT (5.88%) and services (5.52%) attract some more students in private high education institutions (data for school year 2009/2010).

**Table 9: Students by universities, school year 2009/2010**

	Total	Share of population (%)	Total	Budget financed	Budget financed	Self-financed	Self-financed
Population, Serbia, 2009 = 7,334,937	All	(%)	Females	All	Females	All	Females
Republic of Serbia	226,772	3.09%	125,444	98,609	57,794	128,163	67,650
Public Universities	149,393	2.04%	86,814	83,528	49,705	65,865	n.a.
Private Universities	33,672	0.46%	17,147	0	0	33,672	n.a.
Public Higher Schools	38,901	0.53%	19,290	15,081	8,089	23,820	n.a.
Private Higher Education Schools	4,806	0.07%	2,193	0	0	4,806	n.a.

Source: Statistical Office of the Republic of Serbia: Statistical yearbook 2011

**Table 10: Students by universities by fields of education, school year 2009/2010**

	Education	Arts and Humanities	Social sciences, Business and Law	Natural sciences, Mathematics and IT	Technique, Production and Construction
Republic of Serbia	15,250	23,249	88,633	20,885	32,272
Public Universities	10,806	19,105	48,683	14,154	22,746
Private Universities	384	2,351	26,328	1,601	320
Public Higher Schools	4,060	1,793	10,453	4,971	9,196
Private Higher Education Schools	0	0	3,169	159	10
	Agriculture and Veterinary	Health and Social care	Services	Total	Share of population (%)
Republic of Serbia	7,640	19,826	19,017	226,772	3.10%
Public universities	6,195	16,341	11,363	149,393	2.04%
Private Universities	376	390	1,922	33,672	0.46%
Public Higher Schools	1,069	2,368	4,991	38,901	0.53%
Private Higher Education Schools	0	727	741	4,806	0.07%

Source: Statistical Office of the Republic of Serbia: Statistical yearbook 2011

According to the 2002 census data, only 6.5% of total population in Serbia graduated faculties, and 4.5% completed higher schools, which made only 11% of total population with a kind of tertiary education. The main result of functioning of High Education System in Serbia was a number of graduate students, with 0.59% of all population in Serbia who achieved this level of education in 2009.

**Table 11: Graduated students in Serbia, by fields of education, 2009**

	Education	Arts and Humanities	Social sciences, Business and Law	Natural sciences, Mathematics and IT	Technique, Production and Construction
Republic of Serbia	4,103	4,263	16,141	3,448	6,852
Public Universities	2,550	3,512	7,437	2,243	4,486
Private Universities	4	250	6,003	277	70
Public Higher Schools	1,549	501	2,049	928	2,296
Private Higher Education Schools	0	0	652	0	0
	Agriculture and Veterinary	Health and Social care	Services	Total	Share of population (%)
Republic of Serbia	1,127	3,986	3,625	43,545	0.59%
Public universities	916	2,408	1810	25,362	0.35%
Private Universities	39	61	383	7,087	0.10%
Public Higher Schools	172	1,474	1026	9,995	0.14%
Private Higher Education Schools	0	43	406	1,101	0.02%

Source: Statistical Office of the Republic of Serbia: Statistical yearbook 2011

Women are in majority as newly enrolled students, as well as in the total number of active and graduate students in Serbia.

**Table 12: Graduated students in Serbia, 2009**

	Total	Share of population (%)	Total	Budget financed	Budget financed
	All	(%)	Females	All	Females
Republic of Serbia	43,545	0.59%	26,347	20,237	12,535
Public Universities	25,362	0.35%	15,775	17,382	10,784
Private Universities	7,087	0.10%	3,930	0	0

Public Higher Schools	9,995	0.14%	6,229	2,855	1,751
Private Higher Education Schools	1,101	0.02%	413	0	0

Source: Statistical Office of the Republic of Serbia: Statistical yearbook 2011

**Table 13: Newly enrolled students in academic studies in the first year of study in 2011/2012**

	Total	Total	Budget-funded	Budget-funded	Self-financing	Self-financing
	All	Females	All	Females	All	Females
Republic of Serbia	53,082	28,466	25,800	14,219	27,282	14,247
Public Universities	31,532	17,895	19,792	11,116	11,740	6,779
Private universities	6,202	3,126	0	0	6,202	3,126
Public higher schools	13,521	6,674	6,008	3,103	7,513	3,571
Private higher schools	1,827	771	0	0	1,827	771

Source: Statistical Office of the Republic of Serbia

#### **d. Promote equal treatment for women and men in research**

Overall gender structure of employment in R&D sector is balanced, with 48.82% of women researchers in 2010, although women in business (36.30%) and high education sector (47.52%) are less present in comparison with gender structure of researchers in government laboratories and institutes (54.95%).

There is no special regulation for career breaks (i.e. parental leave) in the R&D sector, and this is equal for all employees in the public sector. Restoration of the same position is guaranteed by the law, and fixed-term contract must be extended due to the maternity leave. There are no targets or quotas for women in science in Serbia. There are many women association in Serbia, but rare in the field of S&T. The Association of Business Women from Belgrade is an NGO with many scientists' members as well as entrepreneurs. In 2007, a new prize for the best women's team within the contest for "The best technology innovation in Serbia" was awarded. "Mileva Marić Einstein" is an association for researchers in women studies (EC-"Benchmarking policy measures for gender equality in science", 2008).

There are no examples of policy actions or regulation acts strictly addressed to promotion of equal gender representation in academic and research committees, boards and governing bodies in the area of R&D in Serbia.

### **2. FACILITATE CROSS-BORDER COOPERATION, ENHANCE MERIT-BASED COMPETITION AND INCREASE EUROPEAN COORDINATION AND INTEGRATION OF RESEARCH FUNDING**

In order to improve the quality and excellence of knowledge production, accreditation process for all organizations, institutions and companies intended to apply for government support for R&D activities is obligatory under the Science Law and Innovation Law. There is no international benchmarking of R&D organisations so far. Process of advancement in scientific career is regulated by the Science law and by-laws, with rigorous implementation of criteria which are in favour of international publications (SCI list of scientific journals). In addition, ex-ante evaluation of all proposed projects and other R&D activities became practice within MSTD public calls. Allocation of national funding for R&D projects goes through international evaluation procedures, as combination of domestic and foreign peer review. Monitoring of on-going R&D activities, as well as ex-post and impact evaluations of R&D activities (co)funded by the MSTD, are still in conceptual phase, not implemented as regular practice. Latest call for proposals of national R&D projects, launched in 2010, encourage engagement of young researchers and Serbian scientific Diaspora. Trans-national cooperation in R&D is encouraged through financial support of domestic institutions and individuals engaged in international calls for funding of R&D activities launched through multilateral

cooperation agreements, such as EU FP7, COST, EUREKA etc. as well as under bilateral cooperation agreements with a number of countries.

There are no specific regulations to facilitate the integration of foreign researchers in the national research labour market, such as social security access, health insurance, compatibility of pension schemes in Serbia. Also, there are no tax incentives to facilitate the participation in supplementary pension schemes. Considering the researchers' status, their contracts/fellowships are subject to social and health taxes as all other business contracts in Serbia. There are no specific regulations for EU citizens/researchers to be distinguished from the rest of the world.

MES launched in 2010 a public call for funding of R&D programmes in the period 2011-2014 which was explicitly open to foreign researchers (Act, 2010): *“A foreign researcher who within the last five years accomplished the results that met the minimal conditions for the management of projects can be engaged in the Ministry’s project. The foreign researcher engaged in the project of the Ministry is entitled to travel expenses and residence in Serbia in line with the respective act of the Ministry (Article 7)”*; and *“A project involving at least one foreign researcher is awarded one point additionally, and if involving 2 and more foreign researchers, it is awarded 2 points in the total sum of 50 points (Article 17)”*. Integration of foreign researchers into domestic R&D teams is very welcome and will be awarded in the selection procedure!

[Serbian EURAXESS services network](#) is the portal which provides free and personalised assistance on the challenges faced by researchers and their families when relocating, as stated in The EURAXESS Services Commitment: for Serbian researchers planning to develop career in the heart of ERA, or researchers from EU, eager of doing research in Serbia. Work permits are required for foreigners employed in Serbia and are issued with a validity of 3 to 12 months. An application for a work permit is submitted in person or by mail to the Labour market office in Belgrade. The average time for obtaining the work permit is two days. Work permit can be renewed without obstacles and the procedure is identical to the first application.

The Provincial Secretariat for Science and Technological Development (PSSTD) is the administrative body responsible for governance of research policy in the Autonomous Province of Vojvodina. PSSTD has responsibility for realisation of the INTERREG – Neighbourhood Programme Hungary – Romania- Serbia (the EU financed programme for cross-border cooperation). PSSTD is also responsible for building a digital networked library of PhD dissertations, MSc and graduate theses (through a contract between the Secretariat and University of Novi Sad, the Faculty of Natural Sciences and the Faculty of Technical Science); this project is a part of “Networked Digital Library of Theses and Dissertations” connecting over 180 libraries of universities, faculties and other educational institutions from all over the world.

### **3. DEVELOP WORLD-CLASS RESEARCH INFRASTRUCTURES (INCLUDING E-INFRASTRUCTURES) AND ENSURE ACCESS TO THEM**

The large national research and innovation infrastructure in Serbia in terms of quality was evaluated as obsolete; this is a consequence of twenty years of no investments in R&D equipment and infrastructures (SSTDRS, 2010). Lack of resources for everyday functioning leads to a situation where that equipment is not used to its full capacity, or at all in some cases. “Serbian R&D infrastructure investment initiative” is national R&D infrastructure roadmap, prepared in communication with ESFRI, following country membership status in this EU R&D infrastructure initiative, and this is reaction to the assessment of the quality and functioning of the R&D infrastructure in Serbia in 2009-2010.

One of the priorities defined in new S&T Strategy in Serbia is development of supercomputing capacities and IT infrastructure. In November 2008, Serbia became member of PRACE- Partnership for Advanced Computing in Europe. By applying the concept of grid computing capable of orchestrated performance it was possible to build a special computing network – so called "NIONET" programme that would include many computers from most of the R&D organizations in Serbia. A long term NIONET programme would be strategic and enable further advancement of the computing grid for the R&D community (academic network) (SSTDRS, 2010).

"Serbian R&D infrastructure investment initiative" is a part of the new S&T Strategy in Serbia. The main sources of financing of the infrastructural projects in the next five years will be international financial institutions, and particularly the EIB, EBRD, the World Bank, Development Bank of the Council of Europe and various international donors, specifically EU pre-accession funds. The Project of infrastructural investments, worth €400m already started in January 2011 and will last until the end of 2015. Projects selected for this investment were those conducive to the development of priority disciplines, likely to ensure successful development and identification of scientific talent, prevent brain drain, and finally, projects which will make up for almost twenty years of scarce investment into scientific infrastructure. Main projects within the "Serbian R&D infrastructure investment initiative" are: (1) Upgrading existing capacities (app. €70m); (2) Adaptation of existing buildings and laboratories; (3) New capital equipment for research: within the procurement of new capital equipment for research; (4) Development of Excellence centre and academic research centres (app. €60m); (5) Development of ICT infrastructure (between €30m to €80m); (6) Campus for faculties of technical sciences of the University in Belgrade; (7) Infrastructure for supercomputing initiative "Blue Danube"; (8) Creation of a knowledge-based economy through the construction of S&T parks in Belgrade, Novi Sad, Niš and Kragujevac (app. €30m); (9) Basic infrastructure projects (app. €80m).

#### **4. STRENGTHEN RESEARCH INSTITUTIONS INCLUDING NOTABLY UNIVERSITIES**

One of the major activities in the period 2010-2015, defined by the latest S&T strategy, is the restructuring of the R&D system. The rationalisation of the R&D institutes' network, coupled with a closer cooperation with the universities with the view to enhance the quality of study programmes must result in a favourable environment for R&D. Its results will contribute to the economic and social development of the Republic of Serbia (SSTDRS, 2010).

Thanks to the realization of certain number of projects, centres of excellence were formed in some R&D organizations. These centres are expected to become hotspots of future development, both in terms of recognition of such excellence by the European institutions and further mutual cooperation within the FP7 and subsequent FP, and in terms of attracting foreign technological companies and realization of parts of their development programmes in Serbian R&D organisations. According to the definitions in the science and innovation laws, the status of "centre of excellence" may be awarded to a science research organisation or its organisational unit if it achieved outstanding results on the national and international level, assessed by international criteria. Centres of excellence should act as disseminators of excellence in their surrounding and so contribute to the development of society and economy in Serbia. There are 2 centres of excellence to date: the Centre for Mathematical Research of Nonlinear Phenomena which is a research unit at the Department of Mathematics and Informatics, Faculty of Science,

University of Novi Sad, and the Centre for Solid State Physics and New Materials of the Institute of Physics Belgrade.

### *Academic autonomy*

Autonomy of Higher Education System in Serbia is granted by the HE Law. This autonomy, by law, refers to: (a) academic autonomy, comprising right of teachers to decide on what to teach, how to enrol students and how to organise process of studying, how to internally organise HE institution; and (b) political autonomy, which refers to the right to create statute and other legal documents, and power to appoint the heads of different units (rector, dean, head of department, etc.) and to deal with internal political conflicts, and c) "financial and managerial autonomy", which refers to having the freedom to decide on salaries, tuition fees, allocation of governmental funds, looking for additional funds, as well as to recruit teaching staff, researchers and other staff. All three autonomies could be assessed as fully recognised, implemented and in function in the HES in Serbia. In addition, the territory of HE institution is under the control of university – faculty management and no forces of the ministry of internal affairs are allowed to enter this territory without a permission of HE institution's responsible staff! Managerial functions in HE institutions are completely under internal jurisdiction. Government could be present only in managerial board with one sixth of the members, only if the Republic of Serbia is one of the co-founders of such HE institution. Another one sixth of members of managerial board must be appointed by the students' parliament, and the rest of the members (two thirds) must be selected within HE institution staff.

Rectors/Deans in public (usually, statutes in private HE institutions are similar to those in public ones) universities must be elected among peers. There is no approval for Rectors/Deans election needed by the higher/external entities (such as Ministry of Education) in Serbia; and the same holds for all other elections and posts in public HE institution management and governing bodies defined by their internal statutes.

Private HE institutions are fully responsible to their founders.

Both public and private HE institutions in Serbia are fully independent and in the capacity to autonomously design research agendas and topics of research specialisation, as well as in the management of research budgets and on hiring personnel.

Linkage between the education and science is one of the cornerstones for implementation of the Strategy: R&D institutes and faculties have to be integrated into one science-educational system; Universities and their units (faculties, departments) could become founders of science institutes, science and research centres (with or without the status of legal person), defined in the Statutes of the University (SSTDRS, 2010).

### *Academic funding*

Serbia has a dual university funding system with a split between block and competitive funding: block funding (institutional or general funding) is attributed directly to universities for their institutional tasks, for teaching purposes. In Serbia, there is no institutional funding allocated to universities for research, this being exclusively devoted to teaching and accordingly calculated predominantly on the basis of the number of students; this is fully under control of the Ministry of Education. Block funding, in general, is not linked to scientific results (i.e. bibliometric indicators, patents, etc.). Public competitive funding is made available through specific instruments (grants

competition) directly to individual researchers or research units, and this is fully under control of MSTD.

Most of the public universities in Serbia are still not integrated kind of universities; i.e. faculties are financial entities with the authority to allocate all funds, including a share which they have to distribute to university authorities.

Universities and faculties in Serbia are fully independent to make decisions for allocation of resources, autonomously in line with their teaching and research priorities. Staff salaries are just partly controlled by the government in the public HE institutions, due to financing rules defined by the Ministry of Education, and taking into consideration the number of students granted for financing from the national budget, number and academic position of staff, and rules for remuneration applicable for HE sector. Money collected from students who are enrolled but have to pay their scholarship, is fully under the control of the HE institution management. Allocation of money collected from self-financed students is, by the rule, unknown to the public and without any influence from the responsible Ministry. Staff which is partly or fully involved in R&D activities has autonomy to distribute funds collected from MSTD and other financial sources for R&D activities; usually, distribution is agreed with HE institution's management, in order to meet the needs and expenses for infrastructure, supporting and administrative staff and other internal rules and practice.

A consequence of such funding rules and practice in the HE sector in Serbia is an enormous difference in financial position and level of income between university staff within one university and between universities in the country. Faculties which are more attractive to students, could enrol a large number of self-financed students, and spend most of this money for their salaries, applying at the same time for government / budget money for infrastructure, equipment, maintenance, etc. The recent (starting in 2008-2009) financial crisis and lack of money in government budget implied interventions from responsible ministry, Ministry of Education and Science, in order to change the situation, and use all possible financial sources, including money collected from self-financed students, for the benefit of all involved stakeholders: faculty, university, staff and students. All these interventions must be in line with HE Law and the generally proclaimed and adopted academic autonomy.

#### *Quality of National Higher Education System*

The Law on Higher Education (LHE), which fully implements the Bologna Declaration in Serbia, came into effect on 10 September 2005. The National Council for Higher Education and the Accreditation and Quality Assurance Commission were approved the norms and standards for accreditation of higher education institutions and curricula according to Bologna process on 20 October 2006, while in early December 2006 the Council and the Commission determined detailed procedure for accreditation and code of conduct of all the participants in the process. In compliance with the LHE and the adopted Standards, the accreditation of colleges, bound by the Law to enter first the accreditation process, started on 15 December 2006.

Besides accreditation procedure, which is obligatory under the HE Law, for teaching competence, and under the Science Law, for R&D competence, there is no specific evaluation of teaching and R&D performance of HE institutions in Serbia. Therefore, funding of HE institutions for their teaching and/or R&D activities is not linked to scientific results (i.e. bibliometric indicators, patents, etc.). There is no single HE institution from Serbia within "Shanghai top 100 Universities" so far.

### **5. FACILITATE PARTNERSHIPS AND PRODUCTIVE INTERACTIONS BETWEEN RESEARCH INSTITUTIONS AND THE PRIVATE SECTOR**

The main policy document addressing cooperation between universities, research and business is the new “Strategy of S&T Development of the Republic of Serbia 2010-2015” (SSTDRS, 2010). Certain incentives toward greater involvement of companies in R&D and innovation activities are initiated by the MES with proposal for partnership between R&D organisations and business sector. New Innovation law is the legal framework for public – private partnership in R&D and innovation, and “Strategy of Scientific and Technological Development of the Republic of Serbia 2010-2015” presents an action plan for realisation of such partnership.

The MES implemented “Law on innovative activities” and the “Law on intellectual property rights” in order to create a mechanism for more intensive linkage of science, research and innovation with economy. The laws are stipulating among others things: Strategic changes to the method of funding, partly oriented to the entities in the economic sector as the proponents of innovation projects; Regulation of intellectual property rights (IPR) protection, a pressing issue, under the joint projects between corporate sector and scientific and research organisations, and partly financed by MES, that is the investment fund in the majority state ownership. The provisions on the IPR shall be fully harmonized with the international practice according to which the owner of so created intellectual property is both the employer and the client who contracted the work. On such occasion MES has already (beginning of the 2011) issued the document prescribing publicity and confidentiality of information relative to the realization of the innovation project, and how mutual relations are regulated among the project participants, in terms of IPR and respective financial compensation in the case of commercialization of an IPR. Considerable part of income would go to the innovators (not less than 30%) and institution (no less than 20%); Formation of joint investment funds for financing the projects. Through the future Action plan under this Strategy and in cooperation with the Ministry of finance, taxation and budgetary incentives for investment into science and research shall be stipulated. The proposals of MES are as follows: The investment by corporations into the projects involving science research organizations, which are co-financed by MES shall be free of corporate profit tax (recognized as a cost); Employment of the young researchers registered in the projects of MES in the private sector enables the private sector to pay salaries for two years free of contributions and taxes (payable by the employer); If the enterprise chose to fund an employee’s doctoral studies MES would bear up to one half of the costs; Young researcher registered in MES, who would incorporate their own enterprise would be exempt from paying income and profit tax up to the age of 30. After that, they would be transitioned to standard progressive taxation within 5 years; MES would cover the costs of patent applications and other forms of protection of IPR for projects co-financed by MES (SSTDRS, 2010).

For the projects directly related to the developing or bringing to market products, processes and services, in areas that were marked as priorities by the Strategy a special Innovation Fund is established in spring 2011 on a public-private basis between direct and indirect beneficiaries of the budget, public enterprises, international financial institutions, banks, private commercial companies and others. The Fund is established under the law governing incorporation and operation of investment funds, with majority state founding equity. A special rulebook defined the operations of the Fund, its financing, allocation of assets, procedures for selection of projects, form of contracts with the beneficiaries, etc. The Fund defined criteria, under the specific rulebook for evaluation and financing of the project. In such a way the fund for development of innovation would enable direct financing of private companies who are capable of implementing a project for development of products, processes or services, by selecting

the competent science research organization. Based on the criteria and evaluation procedures approved, the Fund should select the best projects carried by R&D organisation or a company with which it would sign a contract defining in detail their mutual obligations. Additionally, the contract would regulate the IPR, ownership and of the participants (SSTDRS, 2010). Initial funding for the Innovation fund was provided by the "Innovation Serbia Project": The €8.4m project (Component 2: "Support Human Capital Development and Research") was funded by the EU pre-accession funds (IPA) allocated for Serbia in 2011, and implemented through the World Bank. The IPA project will provide funding for capacity building of the Innovation Fund and implementation of financial instruments supporting enterprise innovation (MINI GRANTS and MATCHING GRANTS Programs) by the Innovation Fund. Public call for MINI GRANTS programme was launched in December 5th, 2011.

#### *Spin-offs*

A crucial step forward in order to create an environment which supports technological entrepreneurship in Higher Education Sector (HES) and PROs are changes in HE Law and Innovation Law which stimulates and legally approves creation of university and PROs spin-offs.

#### *Inter-sectoral mobility*

Mobility of researchers is, at present, a one-way move from PROs to private universities or private companies, because of higher salaries. There are no official obstacles for such a move, but there is official statement of Belgrade University which declares any part-time engagement of their staff in private universities as a non-acceptable act which could cause a break of working status with Belgrade University.

#### *Governance of Universities and PROs*

Managerial functions in HE institutions are completely under internal jurisdiction. Government could be present only in managerial board with one sixth of the members, only if the Republic of Serbia is one of the co-founders of such HE institution. Another one sixth of members of managerial board must be appointed by the students' parliament, and the rest of the members (two thirds) must be selected within HE institution staff

The rights and possibility that representatives from the business sector could be elected in managing boards in public faculties and universities and PROs are already legally granted by Science and Innovation laws. In a number of R&D organisations this is a reality and potential for possible cooperation between private sector and public R&D organisations

## **6. ENHANCE KNOWLEDGE CIRCULATION ACROSS EUROPE AND BEYOND**

In the period from 2001 to 2011, Serbian researchers accomplished encouraging initial results in the domain of international scientific and technological cooperation. The basic programmes through which this was implemented were the Sixth and the Seventh EU Programmes, as well as COST, EUREKA, NATO SPS, including cooperation with the IAEA, and bilateral cooperation programmes.

On the basis of the Memorandum of Understanding signed by the Republic of Serbia regarding its Association with the EU FP7, Serbia obtained the status of Associated Country on June 13, 2007. That status provides an opportunity for Serbian researchers to participate in practically all priority areas, and to engage in project coordination, but also the possibility of influencing research policy through the involvement of Serbian experts in different programme committees of the FP7.

The first results of the participation in 2007 were encouraging, especially those achieved at the regional level. Thus, Serbian science institutions took part as coordinators in 7 of the 11 projects funded under the regional call for tenders focusing on research infrastructural enhancement, "Research Potential 3rd call" (RegPot-3), as well as participating in the realization of 3 of the 4 remaining projects.

Statistical data for the first two years of the programme (by the end of December 2010) showed that 1,132 researcher groups from Serbia participated in the preparation of 912 projects applications. Of that number, 118 projects involving 147 research groups/organizations from Serbia were granted funding.

Encouraging initial results were also achieved in other international programmes, such as: COST – Serbia (FR of Yugoslavia) became a full member in June 2001. Currently, Serbian research teams participate in 101 COST actions, and are the coordinator of one action (in the area of materials, physics and nanosciences); EUREKA – Serbia has been a full member of EUREKA since 2002. Serbian researchers and businessmen currently participate in the implementation of 36 EUREKA projects the total budget of which is €15.3m; NATO Science for Peace and Security – on July 27, 2007 the Republic of Serbia signed a Presentation Document concerning the participation of the Republic of Serbia in the Partnership for Peace Programme committing itself to cooperation frameworks with NATO in the field of S&T. Serbian researchers joined the programme late in 2007 and the results achieved so far have been reflected in the implementation of eight projects; Cooperation programme with the International Atomic Energy Agency (IAEA) over the past several years developed primarily through technical assistance programmes involving equipment, expert knowledge and training courses, as well as through regional and interregional activities. Technical cooperation was mainly focused on programmes for decommissioning a research nuclear reactor and radioactive waste management, however it also involved nuclear and radiation security, radiation medicine and health, and nuclear and radio-chemical application of isotopes in hydrology, agriculture and industry; Cooperation with UNESCO is based on UNESCO's support for organizing major international conferences on topics of global interest for the international community, support for maintaining regional cooperation networks between research teams that work in a specific area of basic research and expertise in science policy issues and the creation of strategic documents.

At its 161st meeting at CERN, December 16th, 2011, the CERN Council unanimously voted to admit the Republic of Serbia to Associate Membership as the pre-stage to Membership of CERN. In November 2008, Serbia joined the membership of the Partnership for Advanced Computing in Europe. Serbia's membership in leading international organisations of this kind is one of the key factors in the development of its international cooperation.

Since the MES is the focal point for the above programmes it is also responsible for the adoption and implementation of measures meant to facilitate a broader inclusion and higher competitiveness of Serbian research groups, including groups in innovative companies and corporations. These measures are being implemented through the cooperation of the associates in the Sector for International Cooperation and European Integrations MES, national contact person's network for the FP7 (formed towards the end of 2006) and the Consultative Bureau for International Projects (formed in March 2008).

Participation of Serbian R&D, innovative and corporate organizations in the FP7 could be evaluated as still a very modest: estimates are that less than 20% of Serbian researchers were involved in European projects.

Serbia has not yet managed to attract significant international technology companies who would be ready to realize a part of their development programmes in Serbia by investing in the existing research capacities or by creating new ones. The FP7 can be a catalyst for this cooperation, facilitating it by joint participation in project consortia. Government measures in the form of tax and budget subsidies focused on attracting technological companies are of extreme importance to attract FDI in R&D.

Positive examples of FDI in R&D do exist, but are positively scarce. Microsoft opened one of its five development centres outside the USA in Serbia (Microsoft Development Centre Serbia started in 2005). According to Microsoft Serbia CEO, Microsoft Serbia will open its first Innovation Centre in Serbia in 2012, which will, together with the existing Development Centre, improve the country's competitiveness in the regional and global IT markets. Also, Siemens acquired a team of local engineers and over time extended its development capacities in Serbia. Several local institutions and companies have successful cooperation programmes with international leaders (the Faculty of Electrical Engineering in Belgrade, "Mihajlo Pupin" Institute, Institute for Crop and Vegetable Growing and others). However, this is still a very small portion of their total operations.

## **7. STRENGTHEN INTERNATIONAL COOPERATION IN SCIENCE AND TECHNOLOGY AND THE ROLE AND ATTRACTIVENESS OF EUROPEAN RESEARCH IN THE WORLD**

There is no specific national strategy for international S&T cooperation; the international S&T cooperation will be implemented in-line with the new S&T Strategy and identified priorities.

Currently, bilateral cooperation programmes are being implemented in collaboration between Serbia and a number of countries resulted in co-financing of R&D projects realised by the teams consisting of researchers from Serbia and from: (1) Germany (DAAD Programme) – there are 24 on-going R&D projects; (2) Hungary. – there are 20 on-going R&D projects; (3) France – two programmes: Pavle Savic / Hubert Curien partnership and cooperation with CNRS, all together 85 joint R&D projects; (4) Slovakia, 42 R&D projects; (5) Slovenia, 149 R&D projects since 2002; (6) Croatia, 35 bilateral R&D projects; (7) Switzerland (SCOPES Programme), 31 R&D projects; (8) China (12 approved projects); and (9) Belarus (10 approved projects). In the near future, the cooperation will be launched with Spain, Portugal, Greece (new cycle), and India, while a framework agreement was achieved with several other countries and the relevant procedures are underway (Austria, the Czech Republic, Portugal, Spain, Russia, USA). These agreements could be assessed as important for R&D sector and S&T development in Serbia.

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## List of Abbreviations

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BERD	Business Expenditures for Research and Development
BR Programme	Programme supporting Basic Research for the Research Cycle 2011-2014
CERN	European Organisation for Nuclear Research
ERA	European Research Area
COST	European Cooperation in Science and Technology
ERA-NET	European Research Area Network
ERP Fund	European Recovery Programme Fund
ESA	European Space Agency
ESFRI	European Strategy Forum on Research Infrastructures
FP	European Framework Programme for Research and Technology Development
EU	European Union
EU-27	European Union including 27 Member States
FDI	Foreign Direct Investments
FP	Framework Programme
FP7	7th Framework Programme
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GOVERD	Government Intramural Expenditure on R&D
GUF	General University Funds
HEI	Higher education institutions
HERD	Higher Education Expenditure on R&D
HES	Higher education sector
IIR	Programme of Co-Funding of Integrated and Interdisciplinary Research

Programme	for the Research Cycle 2011-2014
IP	Intellectual Property
IPR	Intellectual Property Rights
MES	The Ministry of Education and Science of the Government of the Republic of Serbia
MoERD	The Ministry of Economy and Regional Development
NARD	National Agency for the Regional Development
PRO	Public Research Organisations
OECD	Organisation for Economic Co-operation and Development
R&D	Research and development
RI	Research Infrastructures
RS	Republic of Serbia
RSD	Republic of Serbia Dinars
RTDI	Research Technological Development and Innovation
SF	Structural Funds
SME	Small and Medium Sized Enterprise
S&T	Science and technology
SORS	Statistical Office of the Republic of Serbia
SREF	Programme of Providing and Maintaining Scientific Research Equipment and Scientific Research Facilities for the Research Cycle 2011-2014
Programme	
TD	Programme supporting Research in the Field of Technological
Programme	Development for the Research Cycle 2011-2014
VC	Venture Capital

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#### Abstract

The main objective of the ERAWATCH Annual Country Reports is to characterise and assess the performance of national research systems and related policies in a structured manner that is comparable across countries. EW Country Reports 2011 identify the structural challenges faced by national innovation systems. They further analyse and assess the ability of the policy mix in place to consistently and efficiently tackle these challenges. The annex of the reports gives an overview of the latest national policy efforts towards the enhancement of European Research Area and further assess their efficiency to achieve the targets.

These reports were originally produced in November - December 2011, focusing on policy developments over the previous twelve months. The reports were produced by the ERAWATCH Network under contract to JRC-IPTS. The analytical framework and the structure of the reports have been developed by the Institute for Prospective Technological Studies of the Joint Research Centre (JRC-IPTS) and Directorate General for Research and Innovation with contributions from ERAWATCH Network Asbl.

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new standards, methods and tools, and sharing and transferring its know-how to the Member States and international community.

Key policy areas include: environment and climate change; energy and transport; agriculture and food security; health and consumer protection; information society and digital agenda; safety and security including nuclear; all supported through a cross-cutting and multi-disciplinary approach.