<table>
<thead>
<tr>
<th>ACRONYMS</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AESS</td>
<td>Academy of Engineering Sciences of Serbia</td>
</tr>
<tr>
<td>APV</td>
<td>Autonomous Province of Vojvodina</td>
</tr>
<tr>
<td>BERD</td>
<td>Expenditure on R&amp;D in the Business Enterprise Sector</td>
</tr>
<tr>
<td>CAB</td>
<td>Current Account Balance</td>
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<tr>
<td>CAQA</td>
<td>Commission for Accreditation and Quality Assessment</td>
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<tr>
<td>CARDS</td>
<td>Community Assistance for Reconstruction Development and Stabilization</td>
</tr>
<tr>
<td>CEN</td>
<td>European Committee for Standardization</td>
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<tr>
<td>CENELEC</td>
<td>European Committee for Electro-technical Standardization</td>
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<tr>
<td>CERN</td>
<td>European Organization for Nuclear Research</td>
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<tr>
<td>CIP</td>
<td>Competitiveness and Innovation Program</td>
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<tr>
<td>COST</td>
<td>Cooperation for Science and Technology</td>
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<tr>
<td>ECOST</td>
<td>European Cooperation in Science and Technology</td>
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<tr>
<td>EBRD</td>
<td>European Bank for Reconstruction and Development</td>
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<tr>
<td>ECE</td>
<td>European Commission</td>
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<td>EC</td>
<td>European Commission</td>
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<tr>
<td>ECTS</td>
<td>European Credit Transfer System</td>
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<td>EHEA</td>
<td>European Higher Education Area</td>
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<tr>
<td>EIB</td>
<td>European Investment Bank</td>
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<tr>
<td>EIP</td>
<td>Entrepreneurship and Innovation Program</td>
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<td>EPO</td>
<td>European Patent Office</td>
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<td>ERA</td>
<td>European Research Area</td>
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<tr>
<td>ESG</td>
<td>Standards and Guidelines for QA in the EHEA</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>EUREKA</td>
<td>Intergovernmental organization for pan-European research and development funding and coordination</td>
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<tr>
<td>FAO</td>
<td>Food and Agriculture Organization of UN</td>
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<tr>
<td>FP6</td>
<td>Framework Program 6</td>
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<tr>
<td>FP7</td>
<td>Framework Program 7</td>
</tr>
<tr>
<td>FTE</td>
<td>Full Time Equivalent</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<tr>
<td>GERD</td>
<td>Gross Expenditures for Research and Development</td>
</tr>
<tr>
<td>HE</td>
<td>Higher Education</td>
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<tr>
<td>HERD</td>
<td>Higher Education Expenditure on R&amp;D</td>
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<tr>
<td>ICIT</td>
<td>Innovative Center for Information Technologies</td>
</tr>
<tr>
<td>ICMF</td>
<td>Innovation Center, Faculty of Mechanical Engineering, Belgrade University</td>
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<tr>
<td>ICT</td>
<td>Information and Communication Technologies</td>
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<tr>
<td>IEC</td>
<td>International Electro-technical Commission</td>
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<tr>
<td>IECEE</td>
<td>Worldwide System for Conformity Testing and Certification of Electro-technical Equipment and Components</td>
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<tr>
<td>IPA</td>
<td>Instrument for Pre-Accession Assistance</td>
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<td>IPO</td>
<td>Intellectual Property Office</td>
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<td>IPRs</td>
<td>Intellectual Property Rights</td>
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<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
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</table>
ISS Institute for Standardization of Serbia
KoBSON Serbian Consortium for Coordinated Acquisition of Electronic Resources
LEDIB Local Economic Development in the Balkans
LHE Law on Higher Education
MES Ministry of Education
MFE Ministry of Finance and Economy
MOERD Ministry of Economy and Regional Development
MoU Memorandum of Understanding
MSTD Ministry of Science and Technological Development
NARD National Agency for Research and Development
NCHE National Council for Higher Education
OECD Organization for Economic Co-operation and Development
OSCE Organization for Security and Cooperation in Europe
PCT Patent Cooperation Treaty
QA Quality Assurance
R&D Research and Development
RDI Research and Development for Innovation
REER Real Effective Exchange Rate
S&T Science and Technology
SAA Stabilization and Association Agreement
SASA Serbian Academy of Sciences and Arts
SECEP Support to Enterprise Competitiveness and Export Promotion
SEDP Serbia Enterprise Development Project
SME Small and Middle-sized Enterprises
SRI Science, Research and Innovation
STD Scientific and Technological Development
TTC Technology Transfer Center
UN United Nations
USAID United States Assistance for International Development
WBC Western Balkan Countries
WHO World Health Organization
FOREWORD

This Paper was prepared under the Western Balkans Regional R&D Strategy for Innovation -- World Bank Technical Assistance Project funded by the European Commission (DG ENLARG – TF011064), as part of the Country Paper Series.

The Country Paper Series aims to provide for each project beneficiary (Albania, Bosnia and Herzegovina, Croatia, Kosovo*, FYR Macedonia, Montenegro, and Serbia) a brief profile of the current conditions of the national research system (rather than an exhaustive assessment of the country’s national innovation system). Emphasis on selected issues reflected the priorities identified by participants during the implementation of the Technical Assistance.

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The note was prepared in January 2012 - June 2013 with data available until December, 2012.

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DISCLAIMER

The findings, interpretations, and conclusions expressed herein are those of the authors and do not necessarily reflect the view of the World Bank or the Government of the respective country.

* This designation is without prejudice to positions on status, and is in line with UNSC 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.
# CONTENTS

**EXECUTIVE SUMMARY** .................................................................................................................. 7

**INTRODUCTION** ............................................................................................................................... 8

**IMPORTANCE OF R&D AND INNOVATION** .................................................................................. 9

1. **WHERE THE COUNTRY STANDS** ............................................................................................... 10
   Economic Performance and Structure ................................................................................................. 10
   R&D and Innovation Trends .............................................................................................................. 12
   R&D Spending and Trends ................................................................................................................. 12

2. **National Research and Innovation System – Features and Challenges** .................................... 18
   Need for a Systemic View .................................................................................................................. 18
   Need for Good Governance ............................................................................................................ 19

3. **Policy Making** ........................................................................................................................... 20
   Policy Formulation ........................................................................................................................... 20
   Key Implementing Stakeholders ........................................................................................................ 21
   Public R&D institutes ....................................................................................................................... 22
   Higher Education Institutions ......................................................................................................... 22

4. **Policy Development** .................................................................................................................. 24
   National Strategy ............................................................................................................................. 24
   Research Funding Policies ............................................................................................................... 25
   Research Infrastructure .................................................................................................................... 25
   Human Capital, Mobility and the Diaspora ........................................................................................ 26
   Private Sector R&D and Innovation .................................................................................................. 26
   Technology Transfer and Science-Industry Collaboration ............................................................... 27
   Fiscal Policies Promoting R&D and Innovation .............................................................................. 28

5. **Research and Innovation Infrastructure** .................................................................................... 28
   Innovation centers ............................................................................................................................ 29
   Supporting Institutions: the IPR System and Certification Institutes ........................................... 29

6. **Integration with ERA and International Collaboration** ............................................................. 31

7. **Conclusions: Policy Challenges and Pending Reforms** ................................................................ 32
REFERENCES ........................................................................................................ 34
ANNEX .............................................................................................................. 37

Figures
Figure 1: Serbian Imports, Exports, and Current Account Balance ........................................ 11
Figure 2: Serbia Performance on Key Variables in Comparison to Europe and Central Asia ........ 17
Figure 3: Knowledge Economy Index Pillars – Serbia vs. Europe and Central Asia ................. 17

Boxes
Box 1: The State of Scientific Performance in the WBCs – The Case of Serbia ..................... 15
Box 2: Reforms in the Higher Education System .................................................................. 23

Tables
Table 1: Patent applications .............................................................................................. 16
Table 2: Number of quality certificates ISO 9001 and ISO 14001 ........................................ 16
Table A 1: Country Profile Indicators .................................................................................. 37
Table A 2: Available budget resources by main category of research and innovation activity .... 38
Table A 3: Innovation budgets of the main government departments and agencies .............. 39
Table A 4: FP7 proposals, success rates and contributions in EUR ..................................... 40
EXECUTIVE SUMMARY

1. Serbia has made progress in recent years in the area of Research and Development (R&D) and innovation. Legislation regulating higher education, innovation, scientific and research activities, and intellectual property rights was adopted in early 2010. A National Strategy for science and technological development for 2010-2015 was also formulated and initiated. Steps have been taken to address the critical issues of brain drain, and reforms of the Serbian Academy of Sciences and Arts have been initiated. In May 2010, 400 million euros were allocated at the national level to fund science and technology infrastructure for a period of 4 years.

2. Serbia’s participation in the Competitiveness and Innovation Program (CIP) helped strengthen inter-ministerial cooperation. In March 2011, the Ministry of Education and the Ministry of Science and Technological Development were merged into a new Ministry of Education and Science. Over time, this consolidation of science, research, and innovation (SRI) activities under one ministry could help better coordinate SRI programs, improve budget financing, and enhance monitoring and evaluation of SRI results.

3. Serbia has also advanced the process of international cooperation, with notable progress in integration into the European Research Area (ERA). Serbia signed new bilateral agreements in science and technology with the United States, Italy, Spain, Austria, the Russian Federation, and the Republic of Montenegro, and became an associated country in the European Organization for Nuclear Research (CERN) on January 10, 2012. The country is also active in the FP7 Program, the Cooperation for Science and Technology (COST), and EUREKA.

4. In the area of innovation, Serbia has been active at the national and regional levels in securing financing for innovative companies. In December, 2011, the National Innovation Fund (established in May, 2011) launched the Serbia Innovation Project worth 8.4 million euros, funded by the European Union (EU) and implemented by the World Bank. Concurrently, the Western Balkan Investment Framework accepted Serbia’s proposal to establish a 141 million euro regional Enterprise Development and Innovation Facility.

5. Even with these significant advances in the development and modernization of Serbia’s R&D and innovation system, the country must overcome important challenges before it can realize the full potential of the reforms.

6. First, public and private investment in research remains low, with Gross Expenditures for Research and Development (GERD), at less than 1 percent of Gross Domestic Product (GDP), significantly lagging the EU average. Moreover, investments are biased in favor of basic, as opposed to applied, science, and are weakly linked to the needs of the business sector, disconnected from areas of revealed competitive advantage, and, too often, seem distributed on the basis of backward looking criteria.

7. Second, the number of researchers has been steadily declining, due to brain drain and aging of the research population.

8. Finally, the present system for the allocation of funding underrates the importance of the nexus between research and business, as well as the need for early stage innovation financing. A systemic (public and private) approach to the R&D and innovation system, its functioning, and its financing levels could help lift Serbia out of a pattern of low growth by increasing the scope for a modern technologically advanced and dynamic private entrepreneurial sector.
**INTRODUCTION**

9. Mainstreaming and implementing effective innovation policy is a priority in the Western Balkans and in European Union countries in general. Innovation – the transformation of ideas into economic and development solutions – is critical to enhance the competitive advantage of firms and countries, to promote productivity growth, and to raise living standards.

10. For the Western Balkans to catch up and effectively integrate with knowledge networks such as the ERA and global markets, it is necessary to enhance national innovation capacity. This requires countries to substantially increase investment in R&D on a sustained basis, while also transforming national innovation systems into more effective, coherent, and competitive systems. In this process, enabling policy frameworks and adequate incentives for the actors in the system are crucial to stimulate new ideas, facilitate their transfer to industry, and promote private sector investment in risky and long-term innovative projects.

11. Following the signing of the Stabilization and Association Agreement (SAA) in 2007, Serbia has taken important steps to integrate into the larger European economy and research area. Reforms have led to the adoption of new laws and policies aimed at developing the science, technology, and innovation (STI) system, and improving higher education.

12. A national strategy for innovation was approved in early 2010, identifying priorities and actions for the period 2010-2015, along with a human resource development program. To foster implementation, the government has set up new supporting agencies, technology transfer offices, and funding programs to bolster the research and innovation infrastructure and to facilitate research activities.

13. Developed countries, including in the EU, have strengthened efforts to increase investment in R&D and have used innovation policy as a counter-cyclical instrument to secure new sources of growth in the context of the recent economic downturn. If the Western Balkan Countries (WBCs) do not emulate such efforts and increase investment in knowledge, the technological and economic gap between the Western Balkans and the EU may widen, thus increasing the cost of accession. In the context of rising unit labor costs and a small share of technology-intensive goods in total export (less than half the EU-27 average), Serbia will need to rely more on research and innovation to increase export competitiveness and economic performance. For that to happen, expenditures on research and innovation will have to increase substantially, and existing resources will have to be utilized more efficiently.

14. This note describes Serbia’s profile in terms of R&D capacity, and discusses the main features of the national research system, its strengths and weaknesses, recent policy trends, and challenges. The first section details the importance of R&D for Innovation (RDI) and economic development and growth. The second section briefly describes national trends in economic performance and R&D and innovation. The third section outlines the governance system for research, while section four reviews the process of policy making, and the role of main agencies and actors in RDI. Section five briefly discusses the most recent national strategy for research and innovation and other policy development issues. Section six takes stock of innovation infrastructure and supporting institutions (IPR and certification institutes). Section seven discusses the level of integration with ERA and international collaboration. The note concludes with a discussion of remaining

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3 Strategy on Science and Technological Development of the Republic of Serbia for the Period 2010-2015.
challenges in the area of research and development, and identifies potential policy areas suitable for policy collaboration among the WBCs.

**IMPORTANCE OF R&D AND INNOVATION**

15. There is growing worldwide awareness about the importance of innovation for economic development. The capacities to undertake scientific and applied industrial research; to transfer, adapt, and assimilate new technologies into economic structures; and to diffuse them into society are critical to national competitiveness and growth.

16. Ample and compelling evidence confirms the correlation between R&D and economic performance. Several international studies demonstrate that R&D spending increases result in a corresponding increase in productivity, leading to per capita income growth. These increases mutually reinforce each other and lead to growth rates that are sustained in the long term.\(^4\) At the country level, R&D explains up to 75 percent of the differences in total factor productivity growth rates, once externalities are taken into consideration.\(^5\) At the firm level, R&D expenditures of enterprises are often correlated to higher sales and productivity growth, as well as to a propensity to export. Further, product innovation, which results from R&D efforts, by expanding demand and new business opportunities, leads to employment growth and more qualified and better paid jobs.\(^6\)

17. The potential impact of investments in research and innovation on productivity growth is even higher for developing countries – given the opportunity for catching up associated with larger investments in innovation.\(^7\)

18. Results from a study using firm level data for the Western Balkans show that innovative firms grow 15 percent faster in sales and 8 percent faster in labor productivity than do non-innovative firms.\(^8\) R&D expenditures by enterprises significantly contribute to sales (by 14 percent) and labor productivity growth (by 7 percent). Furthermore, when firm-level R&D, training, and infrastructure services are compared, R&D is shown to have the highest correlation to sales growth. Similar evidence is reported neighboring countries.\(^9\) Accordingly, reaching the European 2020 Agenda and in particular the 3 percent of GDP target, could generate a permanent increase in exports ranging between 8 and 13 percent for Bulgaria and Romania, for example.

19. Investing in R&D is necessary not only to enhance firms’ innovation capacity but also to absorb external technology. R&D allows firms to screen and identify technology options, adopt and adapt foreign technology and knowledge, and benefit from spillover effects from foreign direct investments and other sources of knowledge transfer. As is well recognized, informal knowledge activities and day-to-day learning are also sources of ideas. Formal R&D is important, however, to the extent that it represents a systematic and more effective approach to technological innovation – radical and incremental – in both the manufacturing and non-manufacturing sector.

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\(^4\) Hall and Jones (1999).
\(^5\) Griliches (1979).
\(^6\) Harrison et al., (2008).
\(^7\) See Lederman and Maloney (2003) for estimates of social rates of return for R&D.
\(^8\) Seker (2012).
20. Public support for research and innovation is critical, particularly in the context of stagnant economies. Consistently, public investments in research and innovation have been a priority in economic stimulus packages of OECD economies. In this sense, a growing consensus on the importance of counter-cyclical innovation policies – increasing R&D investment and improving framework conditions – is emerging.\textsuperscript{10} Finland and South Korea, for example, are at the forefront of this approach, increasing public spending on innovation even in the context of tighter fiscal policies.\textsuperscript{11}

21. Building an environment conducive to enduring innovation requires a comprehensive policy mix and multiple resources. Smart policy design is needed, which requires devising cost-effective and sustainable strategies that will bring results in both the short and long run. Market and coordination failures may hinder progress. The lack of linkages among actors – between public research institutions and the private sector, within and across industries – can prevent innovation investment and businesses from reaching their growth potential. Failures in financial services and other specialized resources discourage private investment in innovation and new business creation, leading to an inefficient allocation of resources. Interventions are therefore needed at different levels and through different mechanisms, in collaboration with the private sector and other relevant decision-makers.

1. **WHERE THE COUNTRY STANDS**

   **Economic Performance and Structure**

22. After the change of government in October, 2000, Serbia began to undertake market-oriented economic reforms and recorded strong growth. During 2001-2008, real GDP increased 4.9 percent annually on average, accompanied by changes in economic structure and rapid reductions in poverty. Between 2002 and 2008, the share of the population below the national poverty line declined from 14 to 6.1 percent, while the number of those affected by the extreme poverty also fell to between zero and 0.31 percent of the population. Growth was primarily driven by strong domestic demand fueled by foreign grants, remittances, and ample capital inflows. Strong Real Effective Exchange Rate (REER) appreciation resulted in exceptionally fast growth of imports, which fueled widening trade and current account deficits (Figure 1). By 2008, the current account deficit had reached 21.6 percent of GDP.

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\textsuperscript{10} See, for instance, OECD (2010).
\textsuperscript{11} World Bank (2009).
Figure 1: Serbian Imports, Exports, and Current Account Balance

Source: NBS and RSO databases.
M = Imports of Goods in billion USD (light gray/blue -- lhs); E = Exports of Goods in billion USD (dark gray/red -- lhs)
CAB = Current Account Balance in billion USD (full line w square markers -- lhs)
REER = Real Effective Exchange Rate index (2000=100, double line w circle markers -- RHS)

23. This type of consumption-led growth produced very uneven sector response on the supply side. Non-tradable sectors responded strongly to consumer demand and contributed the bulk of increased value added (over 95 percent), while the tradable sectors contributed less than 5 percent. The sluggish supply response in the sectors producing tradable goods can be partly explained by real appreciation of the Dinar and rising unit labor costs, but other dimensions of eroded competitiveness played a larger role.

24. The recent crisis has revealed structural weaknesses in the Serbian economy and highlighted the need to promote long-term growth through structural policy reforms and innovation. The immediate impact of the global economic and financial crisis on the Serbian economy was relatively modest in 2009 (with a 3.5 percent GDP decline), but the subsequent recovery turned out to be weaker than expected: positive growth in 2010 and 2011 (of 1.0 and 1.6 percent, respectively) was followed by a recession in 2012 (marked by a 0.5 percent GDP decline).

25. Aside from lower remittances and slower global trade, Serbia has been adversely affected by the difficulties in the Euro area (both through lower trade and contraction of cross-border financing), domestic political tensions, and inadequate policy responses to the crisis. Given the cost of external debt and continued primary fiscal deficit driven by high social expenditure commitments, such slow GDP growth is not sustainable. The Serbian economy needs urgent policy interventions to close the gaps and promote sustainable productivity increases through revised structural policies and innovation.

26. With a GDP per capita of US$6,310 (€4,330) in 2011, Serbia is an upper middle-income country. The country had been on the verge of high-income status in 1990, but the civil wars, the ensuing United Nations (UN) sanctions, and economic mismanagement created hyperinflation, economic implosion, and a financial meltdown resulting in a huge 55 percent GDP contraction between 1991 and 1993. Serbia is one of the few countries in the Europe and Central Asia region that has not yet recovered the production and real income levels it enjoyed in the past. Massive emigration of educated and economically active citizens during the past two years has contributed to this persistent gap.

12 Serbia’s 2011 GDP per capita was 11,883 in current PPP dollar prices, and 9,830 in constant 2005 PPP prices.
decades has been a drain on the country’s labor potential, albeit a source of substantial remittances, which have ranged between 5 and 9 percent of GDP annually since 2007.

27. Since 2000, the Serbian government has undertaken a range of structural and institutional reforms, including financial market liberalization and privatization of socially and state-owned enterprises and banks. All Small and Medium-sized Enterprises (SME) have been privatized, as well as enterprises in manufacturing and services. Progress has been made in the privatization of strategic sectors, like telecom, banking, gas, and oil. A significant share of assets in key infrastructure services (telecom, power, utilities, waterways, railways, etc.) remains under state ownership, however, and further privatizations are likely in the coming years. The banking sector has increased the amount and quality of loans and financial services, but the overall availability of credit remains low relative to GDP and the level of economic activity. Yet the cost of borrowing and financial intermediation continues to be high by both regional and world standards.

28. The competitiveness of the Serbian economy is still low and based on factor (labor) costs rather than high value added products or services, despite the progress in economic restructuring and productivity growth. The sector composition of GDP follows the pattern of upper middle-income countries. According to World Bank statistics, between 2000 and 2011 the share of agriculture in GDP declined substantially from almost 20 to 9 percent, the share of industry decreased from 30.5 to 26.9 percent, and the share of services recorded a commensurate increase from 49.6 to 64 percent. By contrast, over the past decade the structure of employment remained virtually unchanged, with agriculture accounting for around 24 percent, industry about 25 percent, and services around 50 percent. Over the past decade, exports have increased in both absolute (from less than US$2 billion to US$11 billion) and relative terms (from 21 to 36 percent of GDP), but are still insufficient to meet sharp increases in imports, and contain large trade and current account deficits.

29. In March, 2012, Serbia achieved candidate status with the EU. The date to start the accession process is likely to be set during 2013. Serbia has benefited from national and regional financial assistance since 2001, including the new EU Instrument for Pre-Accession Assistance (IPA) in 2007. Serbia is also a beneficiary of the FP7. As in other WBC countries, part of the EU assistance was aimed to support cross-border cooperation between Serbia and EU member states, as well as with neighboring candidate and potential candidate countries.

R&D and Innovation Trends

30. While Serbia is among the leaders in the Western Balkans in R&D investment, it lags behind most EU member countries. Spending levels are relatively low, have not increased sustainably, and are highly concentrated in the public sector under the direction of the Ministry of Education and Science. While the country has been tapping into foreign (especially EU) resources, private sector investment in R&D has been limited. In addition to direct institutional support financing, a portion of research funding is allocated on a competitive basis.

R&D Spending and Trends

31. The level of GERD has gradually increased over the last decade, rising from 0.32 percent of GDP in 2004, to 0.64 percent in 2007 and 0.92 percent in 2009, before declining back to 0.76 percent of GDP in 2010. Yet Serbia lags significantly behind new EU member states, including Slovenia (2.09 percent), Czech Republic (1.55 percent), Estonia (1.63 percent), and Hungary (1.17 percent).
32. The government is the primary source of R&D funding in Serbia, where the budget covers 88.32 percent of total R&D expenditures. Budget sources directly fund some 61 percent of public funding received by government-owned institutes and R&D centers, and close to 70 percent of R&D activities in Higher Education (HE) institutions. Higher Education Expenditure on R&D (HERD) as a percentage of GDP has increased from 0.18 percent in 2006 to 0.50 percent in 2010, according to data from Erawatch.

33. Foreign sources, particularly EU sources (via Framework, Structural Funds, etc.), have been an important source of R&D funding in Serbia. Their share in GERD peaked at 9 percent in 2008, then gradually started to decline. The private non-profit sector is at an early stage of development and its contribution to human resources or funding for R&D is still negligible. Presently in Serbia, there is no institutional R&D funding, although this may change when the restructuring and possible privatizations in the R&D sector move beyond the conceptual phase.

Human Resources for R&D

34. Total researchers (full-time equivalent, or FTE) in Serbia increased from 6,40613 in 2000 to 10,98514 in 2010. Yet, the number of researchers per million inhabitants (1,503) was less than a half that in the EU-27 (3,171) in 2010, amounting to 0.17 percent of the total population.

35. Participation of researchers in the business sector is very low (5.5 percent in 2009 and 2.4 percent in 2010), while in the EU-27, 35.1 percent of researchers worked in the business sector in 200915. In contrast, more than 70 percent of the researchers in Serbia are in higher education institutions, compared to 53 percent in the EU-27.

36. The continued brain-drain poses a critical problem for the Western Balkan countries. According to the Ministry for Religion and Diaspora, it is estimated that 3 to 4 million Serbs were living abroad as of 2010. The emigration rate of the highly-educated (i.e., those holding at least a first stage degree of tertiary education) was 12 percent in 2000, though it decreased to 7.2 percent in 2005/2006.16 This rate is, however, still higher than the corresponding average for non-OECD European and Central Asian economies (5.9 percent as a weighted regional average). According to MSTD data estimates,17 between 1991 and 2000, 30,000 graduates left the country but, during the last decade (2000-2010), only 2,000 graduates have been recorded as leaving the country. Most of them are professionals from Information and Communication Technologies (ICT) and natural sciences.

37. In 2011, the Ministry of Education (MES) launched a program that might mitigate emigration of young researchers. The program aims to engage Serbian researchers abroad in joint projects to transfer their knowledge and skills to their home country, as well as to motivate scientists to return.

The Business Sector

38. The total expenditure on R&D in the business enterprise sector (BERD) as a percentage of GDP in Serbia is highly volatile. In 2008, the BERD amounted to only 0.07 percent of GDP, increasing to 0.13 percent

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13 wbci-innco.net.
15 Erawatch. Values for headcount of researchers.
16 OECD (2012).
17 Presentation by Kutlaca, (2010).
in 2009 and dropping again to 0.09 percent in 2010, far behind the EU average of 1.25 percent for 2010. The percentage of R&D performed by the business sector has increased from 9.08 percent in 2008 to 11.63 percent in 2010, yet it continues to be low by EU standards (62 percent). The share of the BERD in total R&D expenditures (GERD) was only 14.32 percent in 2009, compared to 62.05 percent in the EU.

According to data for the 7th Community Innovation Survey from Eurostat, 51.7 percent of Serbian companies introduced some form of innovation in 2010, close to the EU average (52.9 percent). Most companies (75.5 percent) bought machinery or equipment, for 72.5 percent of innovation expenditures, which points to the adoption of new technologies as the main conduit for innovation.

### Industry-Science Linkages

Collaboration between companies and research institutions is an important source of innovation. In 2010, 24.9 percent of Serbian enterprises developed their innovations in collaboration with other partners, close to the 25.5 percent in the EU.

In 2012, Serbia ranked 99 out of 144 countries in a measure of university-industry collaboration, far behind the average for the EU (40). One of the main obstacles for cooperation between business and scientific sectors is the variety of legal barriers that companies face when applying for public funds to co-finance R&D and innovation grants.

### S&T Outputs and Innovation Performance

The output of the Serbian Research & Innovation sector appears modest by EU standards, if high within the Western Balkans region. R&D output can be measured by tracking the number of journal articles in science and technology fields per million inhabitants. According to World Development Indicators data, Serbia is above the regional average (160 in Serbia and 125 in the region) in terms of publications per million inhabitants, though it lags far behind the average of the EU (500) in 2009. According to a study conducted by SCIMAGO for the purposes of this project, publications in Serbia increased dramatically from 2006 onwards, making Serbia the second most prolific country in the WBC region after Croatia. However, publications per thousand inhabitants have decreased in Serbia from 163 in 2003 to 2 from 2008 onwards. Further details are reported in Box 1.

The quality of publications has improved in recent years. Although the normalized citation index increased between 2003 and 2010, and actually surpassed regional and Eastern European averages, this indicator of quality of science remains far below EU-27 averages (between 1.20 to 1.40). Citations per document in Serbia are slightly above the WBC average, but far behind Eastern Europe and EU-27 averages.

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18 Erawatch.  
19 Eurostat.  
Box 1: The State of Scientific Performance in the WBCs – The Case of Serbia

- The activity index per area for the WBC shows that Serbia stands out in Agricultural and Biological Sciences, Biochemistry, Genetics and Molecular Biology, Chemical Engineering, Chemistry, Computer Sciences, Decision Sciences, Dentistry, Energy, Engineering, Health Professions, Material Sciences, Mathematics, Neuroscience and Pharmacology, and Veterinary. The areas with the lowest production are Arts and Humanities, and Nursing.

- Publication distribution by institution indicates that publications are concentrated in the higher education sector (near 57 percent), followed by health (15 percent) and public institutions (12 percent). There are six institutions with more than 1,000 documents in the period: the University of Belgrade (8,604 documents), the University of Novi Sad, the Vinca Institute of Nuclear Sciences, the Clinical Center of Serbia, and the University of Kragujevac. International collaboration rates in these institutions range from 18.29 percent in the case of the Clinical Center of Serbia to 41.54 percent for the Vinca Institute of Nuclear Sciences. The institution with the highest normalized impact is the Serbian Academy of Sciences and Arts, with 2.15 percent.

- Serbia presents rates of international collaborations (33.89 on averages) lower than the WBC and EU-27. Serbia collaborates with Bosnia and Herzegovina, Croatia, and Montenegro within WBC. Collaborations with other countries of Europe are also relevant in particular with Germany, Great Britain, Italy, France, and Greece. Outside Europe, Serbia collaborates with the United States, Canada, and Russia.

- Patterns of intra-sector collaborations (universities and private sector; PROs and private sector) have been changing. In the period 2003-2010, collaborations between higher education and private institutions amounted to 22.13 percent of total collaborations (compared 0.02 percent in the WBC and 1.38 percent in EU-27). Collaborations between government and private institutions represent 4.77 percent of total collaborative publications, much higher than for the WBC (0 percent) and EU-27 (0.56 percent).


44. In the business sector, Serbia has low innovation performance in comparison with the region and the EU. According with the Global Innovation Index Rank 2012, Serbia is 95th out of 125 countries, while the Western Balkan region average is 60 and the EU average is 24. Serbia was at the bottom of the Intellectual Property Protection ranking in 2012. A low proportion of firms use technology licensed from foreign companies, and there are only 3.4 utility patents per million inhabitants, far below 117 for the EU.

45. During 2010, the Intellectual Property Office received 313 patent applications directly, 16 applications as Patent Cooperation Treaty (PCT) contracts, and 3,559 applications on the basis of cooperation and extension of an extended European patent. Of the total number of applications, 290 (8 percent) were from domestic applicants. Foreigners submitted 3,598 patent applications, representing 92 percent of all applications. In comparison to 2009, the number of applications from domestic applicants was lower by 9, or approximately 3 percent.

46. The following table represents the number of patent applications, both domestic and international, in the period from 2007 to 2010, and the difference in the number of submissions between 2009 and 2010. There is also a reduction in EPO applications per million inhabitants in Serbia, from 1.47 in 2003 to 0.69 in 2011.\footnote{EPO and Eurostat.}
Table 1: Patent applications

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<tr>
<td>National applications</td>
<td></td>
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<tr>
<td>Applications from</td>
<td>388</td>
<td>386</td>
<td>299</td>
<td>290</td>
<td>-9</td>
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<tr>
<td>domestic applicants</td>
<td></td>
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<tr>
<td>Applications from</td>
<td>20</td>
<td>16</td>
<td>21</td>
<td>23</td>
<td>+2</td>
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<td>foreign applicants</td>
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<td>directly to IPO</td>
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<tr>
<td>International</td>
<td>55</td>
<td>73</td>
<td>40</td>
<td>16</td>
<td>-24</td>
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<tr>
<td>applications</td>
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<td>PCT applications in</td>
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<td>national phase</td>
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<tr>
<td>Extended applications</td>
<td>5,372</td>
<td>5,625</td>
<td>4,258</td>
<td>3,559</td>
<td>-699</td>
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<tr>
<td>of European patents</td>
<td></td>
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<tr>
<td>Total number of</td>
<td>5,835</td>
<td>6,100</td>
<td>4,618</td>
<td>3,888</td>
<td>-730</td>
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<td>applications</td>
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Table 2: Number of quality certificates ISO 9001 and ISO 14001

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<th>ISO 9001</th>
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<th>ISO 14001</th>
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<tr>
<td>Albania</td>
<td>23</td>
<td>43</td>
<td>155</td>
<td>52</td>
<td>164</td>
<td>…</td>
<td>1</td>
<td>…</td>
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<tr>
<td>BiH</td>
<td>652</td>
<td>811</td>
<td>909</td>
<td>944</td>
<td>1119</td>
<td>…</td>
<td>60</td>
<td>87</td>
</tr>
<tr>
<td>Croatia</td>
<td>2073</td>
<td>2302</td>
<td>2567</td>
<td>2102</td>
<td>2117</td>
<td>…</td>
<td>…</td>
<td>…</td>
</tr>
<tr>
<td>FYR Macedonia</td>
<td>255</td>
<td>271</td>
<td>…</td>
<td>…</td>
<td>…</td>
<td>…</td>
<td>343</td>
<td>469</td>
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<tr>
<td>Montenegro</td>
<td>136</td>
<td>160</td>
<td>157</td>
<td>85</td>
<td>146</td>
<td>…</td>
<td>17</td>
<td>18</td>
</tr>
<tr>
<td>25Serbia</td>
<td>1987</td>
<td>2091</td>
<td>2733</td>
<td>1790</td>
<td>2868</td>
<td>…</td>
<td>176</td>
<td>298</td>
</tr>
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</table>


Other difficulties for enterprise-level innovation in Serbia can be found by examining the World Bank’s Knowledge Economy indicators. Figure 1 illustrates Serbia’s performance in comparison to Europe and Central Asia for select indicators spanning the knowledge economy. Serbia lags behind regional averages on most fronts, including the availability of computers, scientific publications, and patents granted. However, Serbia is closer to regional averages on other aspects of ICT penetration, including telephone usage and Internet penetration. Serbia lags behind on all pillars of the knowledge economy, as Figure 2 illustrates, especially on education and innovation, which is measured by innovation inputs and outputs. ICT penetration driven by telephone and Internet penetration is the only pillar where Serbia is close to regional averages.
Figure 2: Serbia Performance on Key Variables in Comparison to Europe and Central Asia

Figure 3: Knowledge Economy Index Pillars – Serbia vs. Europe and Central Asia

Intellectual Property Rights System (IPRs)

48. Intellectual property systems – laws and institutions for managing and enforcing intellectual property rights (IPRs) – are one of the main instruments to encourage innovation and diffusion of ideas and technology. In the last 5 years, Serbia has undertaken meaningful steps in improving the legal framework of IPRs, as well as in the implementation and enforcement of the IPR laws with the re-definition of activities of the IPO in 2007, and later in 2011, with the adoption of the National Strategy for Intellectual Property Rights. The European Commission (EC) Analytical Report, which accompanied the Commission’s Opinion on Serbia’s application for membership in the EU, emphasizes the following issues: the need to improve IPR enforcement; the IPO’s role in education and awareness; and, the need to provide training for the judiciary and specialization of courts.

49. These challenges are currently being tackled with the Action Lines of the National Intellectual Property Strategy 2011-2015. The 2007 the Law on Ministries stipulates that the IPO should not only be responsible for granting procedures, but it should also be the central institution coordinating activities related to IPR enforcement and implementation, which were previously dispersed across different institutions. The IPO will also be responsible for IPR protection and educational and informational activities in the field of IPRs.

2. NATIONAL RESEARCH AND INNOVATION SYSTEM – FEATURES AND CHALLENGES

50. The following section explores the nature of Serbia’s R&D and innovation system – stakeholders, governance, stated strategy, funding, and dynamics – with the aim of identifying possible weaknesses and resultant reform possibilities. It posits, in line with its own national strategy plus the emerging Western Balkans R&D Strategy for Innovation, that Serbia can accelerate its path toward research excellence and innovation by undertaking selected R&D governance reforms, combined with prioritized initiatives to strengthen the research base, enhance effective research commercialization from public funded research institutions, and encourage large expenditures in research and innovation by the business sector.

Need for a Systemic View

51. In line with the cross-sectoral nature of knowledge and innovation, governance of research and innovation policy incorporates a broad set of mechanisms and actors, instruments, and institutions in the field of R&D, education, technology and specialized services, and entrepreneurship, which calls for policy coordination across different ministries and agencies.

52. The innovation system in Serbia, as in other countries, comprises many stakeholders within the public and private sphere (universities, research institutes, the Serbian Academy of Sciences and Arts, ministries, and

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23 By providing exclusive ownership and commercialization rights to inventors, the IPR system allow inventors to “appropriate” innovation returns – exclude others from exploitation – and thereby recoup costs of R&D and creativity. In addition, by encouraging disclosure of ideas and promoting their exploitation, the IPR system encourages technology diffusion avoiding thereby duplication of innovation efforts in the economy.

24 Serbia has a long tradition in IPRs protection, since the Kingdom of Serbia was one of 11 founders of the Paris Union in 1883. Since its inception, the Intellectual Property Office (IPO) of the Republic of Serbia has been in charge of the protection of the industrial property, including, since 1994, copyright and related rights.
private entrepreneurs). These actors invest in R&D and interact as parts of a value chain that should move ideas to market.

53. When properly functioning, R&D transforms into innovation and leads to products and services that strengthen the country’s business investment, technological sophistication, comparative advantage, and economic performance. Performance of national innovation systems depends on both the capabilities of its actors – science sector, private sector, policy institutions, financial institutions and market intermediaries, society – and well-articulated and strong linkages among them. Different stakeholders act at different stages in the innovation process.

54. In the context of developing countries, a well-functioning innovation system facilitates incremental private sector technological improvements. This can happen in various ways, including via the employment of highly qualified science and technology personnel, collaboration with researchers, training, extension services (R&D and engineering services; quality certification and standards), or ability to access and utilize global technological developments.

55. Improving knowledge capacity (R&D) and innovation is not a simple or quick task, and it requires the active participation of all stakeholders. Challenges are inherent in the multiplicity of players, in the difficulty in aligning incentives and establishing modern legal frameworks and government policies, and in encouraging private sector actions. Overcoming ingrained cultural differences, if not distrust, between entrepreneurs and researchers, reducing red tape, or stimulating the private sector to take a more proactive interest in R&D to gain global market share require concerted and well-conceived initiatives.

Need for Good Governance

56. On the path towards research excellence, it is essential to have research systems that are competitive and transparent, with quality-driven recruitment practices and efficient administrative procedures. Better governance of universities and public laboratories can be achieved through the use of new mechanisms, such as greater use of project funding (typically contracts and grants awarded through competition), and selective increases of funding for research fields that are linked to social and economic need. Through incentives that focus on excellence and relevance, reform of the management and funding of higher education and science institutions can help strengthen the contribution of public investment to scientific progress and innovation.25

- Merit-driven research funding translates into competitive granting, subject to a peer-review system and international criteria, in which projects are selected on the basis of the quality of proposals and expected results.

- Good governance in research funding implies meritocracy and transparency in grant funding, accountability, evaluation and monitoring practices, transparency, and performance evaluation that can gauge contributions to knowledge, local economic and social needs, and growth. Evaluation criteria must recognize that excellence in research and training has become, at least in some disciplines, more tied to industry applications and contributions to addressing social problems.26

57. In research institutions, appropriate governance mechanisms provide performance-driven career development, clear and transparent recruitment policies, and clear rules regarding ownership and

26 OECD (2011).
commercialization of intellectual outcomes – revenue participation by researchers – resulting from research. This also implies that results of publicly funded research are protected and published in a way that encourages their exploitation. The European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers provides examples of governance principles to make research careers more attractive, a key element in improving governance for research excellence, and consistent with the goal of a better integration to ERA. 27

58. Good governance of universities requires enhanced autonomy to organize activities in the areas of education and training; research and innovation; open transparent and merit-driven recruitment methods; institutional accountability; quality assurance systems; and, the ability to access alternative sources of funding and engage in interactions with industry (e.g., collaboration, curricula development, and doctoral training).

Some of these policy areas are covered by the Bologna Declaration, within the framework of the European Higher Education Area, signed in 2007 by 46 governments. Countries agreed on 10 action lines aimed at making higher education in Europe more compatible and comparable, and more competitive and attractive for students and researchers in Europe and worldwide. 28

3. POLICY MAKING

Policy Formulation

59. The Serbian research system is fairly centralized. It has three levels. The policy/strategy level includes the Parliament, as represented by the Committee for Science and Technology (S&T) Development, and the government, which is represented by the MES and Ministry of Finance and Economy (MFE). The National Council for S&T has a strategic advisory role, while S&T Boards, the Accreditation Board, and the Committee for the Promotion of Science assist the MES in the design and implementation of science and research programs on the national level. The operational level consists of intermediary and enabling offices, agencies, and funding and supporting organizations. The implementation level includes public and private research and innovation organizations, and intermediary organizations.

60. The highest body is the Parliament of the Republic of Serbia, the principal legislative authority in the country. Its Committee for Science and Technological Development reviews and proposes laws in the area of science, technology and innovation. At the executive (government) level, the Ministry of Education and Science (MES) governs the development and implementation of regulations, policies, and programs in science and technology in the country. The National Council for Science and Technology Development, which consists of 16 members, is responsible for development of a national S&T strategy and monitoring of its implementation. The Ministry of Finance and Economy (MFE), established in July 2012 to replace the Ministry of Economy and Regional Development, also supports innovation activities and a national innovation system. At the sub-national

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27 Merit-based recruitment implies not only scientific productivity but a wider range of evaluation criteria, such as teaching, supervision, teamwork, knowledge transfer, management, and public awareness activities (see Innovation Union and the Code of Conduct for Recruitment of Researchers, EC).

28 This entails comparability in degrees – countries are setting up national qualifications frameworks that are compatible with the overarching framework; adoption of quality assurance mechanisms in accordance with the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG); and fair recognition of foreign degrees and other higher education qualifications in accordance with the Council of Europe/UNESCO Recognition Convention.
level, the government of the Autonomous Province of Vojvodina has a regional secretariat for science and technological development, which also funds research activities in the province.

61. The MES was established in March, 2011, as a successor to the previous Ministry of Science and Technological Development; it is responsible for research and education at all levels.\(^{29}\) In the area of science, MES oversees strategies and programs in S&T; promotion of S&T; support for research expertise; technological entrepreneurship; transfer of knowledge and technology; development of the innovation systems; protection of IPRs; development of SRI infrastructure; nuclear energy research; and related issues of security, such as facilities storing radioactive material. MES has three S&T departments for: (i) Basic Research and Human Resources Development in Science; (ii) Technological Development, Technology Transfer and Innovation System; and, (iii) European Integration and Development and research programs in education and science.

62. In fact, based on existing legislation,\(^{30}\) MES plays the dominant role in defining the national R&D strategy, development of R&D programs, setting up of rules and procedures for all R&D activities financed and promoted by the Ministry, certification of R&D organizations and researchers, international bilateral and multilateral S&T collaboration agreements, and projects and programs with the industry. MES is the only governing institution in the country responsible for RDI activities. To a limited extent, research governance is delegated and/or transferred to the Autonomous Province of Vojvodina (APV) as approved by the Serbian Parliament in November, 2009.

**Key Implementing Stakeholders**

63. The main research organizations can be divided in three groups: (i) public scientific institutions, which include higher education and research institutions; (ii) R&D organizations in the private sector; and, (iii) R&D and innovation infrastructure institutions. Such innovation organizations include private and public companies, entrepreneurs and inventors.

64. Most of the research and scientific activity in Serbia is performed at universities and institutes. The bulk of R&D organizations comprises 7 public universities with 78 departments (faculties), the Serbian Academy of Sciences and Arts (SASA) with its 10 scientific institutes, 28 other scientific institutes, a center of scientific excellence, 30 research institutes, 65 innovative organizations, 5 business associations for support of innovation, and 107 registered innovators.\(^{31}\) R&D organizations in the private sector include 7 private universities with 45 departments (faculties), research resources of foreign companies in Serbia, and the research and innovation resources of domestic firms. The efforts and results of SMEs in the field of software engineering, new materials, and biotechnology are particularly noteworthy.

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\(^{29}\) The scope of authority of MES is regulated by Article 12 of the Law on Ministries (Official Gazette of RS, No. 16/11).


\(^{31}\) The institutions are: "Mihajlo Pupin" Institute, Archeological Institute of SASA, Electro technical Institute "Nicola Tesla", Institute for Biological Research "Sinisa Stankovic", the Institute for Chemical Sources of Electricity, Institute for Plant Protection and Environment, Institute for reproduction and domestic animals insemination – Temerin, Institute for Technology of Nuclear and other Mineral raw materials., Institute of Chemistry Technology and Metallurgy, Institute of Electrochemistry, Institute of Oncology and Radiology of Serbia, Institute of Physics – Zemun, Institute of Soil Science, Institute of Technical Sciences of the Serbian Academy of Sciences and Arts, Institute of Transportation – CIP, Mathematical Institute of SASA, Military Geographical Institute, Military Technical Institute, Scientific Institute for Agriculture and Truck Farming, Institute for Veterinary Science "Novi Sad", The Institute of Nuclear Sciences "Vinca", The Serbian Chemical Society, University of Novi Sad, Faculty of Science and Mathematics, Institute of Mathematics, Veterinary institute Niš, Institute for Water Recourses.
SASA is the highest scientific, research, and educational institution in the country, governed by a separate law adopted in March, 2010. The Academy is financed by the state budget, private funds, endowments, and foundations such as the Foundation for Studies of Science and Art. The Academy of Engineering Sciences of Serbian (AESS) is a scientific engineering institution that brings together prominent scientists from the fields of engineering sciences with the goal of developing and supporting engineering and technical sciences and their application in the economy and society. The primary objective of the Academy is to support and guide basic, development, and innovation research, the development of the system of engineering education, and transfer of knowledge between all fields of engineering science.

**Public R&D institutes**

All research institutes in Serbia are organized within the Association of Research Institutes, according to the Law on Research Activities. They include scientific and technical infrastructure that encompasses: the academic intranet, a gene bank, an accelerator, libraries of the institutes and schools, the University Library, and the National Library of Serbia, which hosts the KoBSON network. KoBSON provides research scientists with access to scientific and technological information worldwide.

**Higher Education Institutions**

Of the state universities, the oldest and most established is the University of Belgrade. It was founded in 1905 and consists of 31 departments (faculties) with a total of 4,300 professors and teaching associates, and approximately 90,000 students. Among the private universities, the oldest is the University “Braća Karić,” and the largest is Megatrend University of Applied Sciences in Belgrade, with 11 departments and approximately 26,000 students.

The governing bodies of the higher education system include: the National Council for Higher Education (NCHE), which is elected by the Parliament; the Commission for Accreditation and Quality Control whose members are selected by NCHE; and, the Conference of Universities, which consists of rectors and vice rectors of all universities.

The 2005 Law on Higher Education (LHE) fully implemented the Bologna Declaration in Serbia. It established the Conference of Universities of Serbia and the Conference of Headmasters of Colleges, and introduced the standards for accreditation of higher education institutions and curricula in late 2006. A new Law on Higher Education was adopted 4 years later to strengthen the integration of Serbia’s higher education system into the European HE area. Unfortunately, the new law does not differentiate teaching and research universities.

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33 AESS was founded in 1998 as the Engineering Academy of Yugoslavia and switched to its present name in 2006. In 2010, the Academy had 91 regular, 86 correspondent, and 14 honorary members-advisors, as well as 53 members abroad. All members have been selected by secret voting at the meetings of the Assembly of the Academy, with the purpose of setting scientific and technical criteria. AESS is organized in six departments covering principal areas of engineering sciences (i.e., biotechnical, civil engineering, electro-technical, mechanical, mining-geological, and technological-metallurgical). In addition, the Academy operates through multidisciplinary committees and working groups.

34 State universities funded through the national budget for higher education include: University of Belgrade, University of Novi Sad, University of Nis, University of Kragujevac, and University of Priština in Kosovska Mitrovica, University of Arts Belgrade, and the State University of Novi Pazar.
Box 2: Reforms in the Higher Education System

**Implementation of the Bologna Process:** The Law on Higher Education (2005) provided a legal basis for the Bologna Declaration and the Lisbon Convention. The implementation of the Bologna Process formally commenced in academic 2006/2007. The three-cycle structure was established in all HE institutions, and the third-cycle programs (PhD) started in 2006/2007 in many university institutions. The transfer to the new system was gradual. In 2008/2009, some 89 percent of all students below the doctoral level were still enrolled in the two-cycle degree system.

**The European Credit Transfer System (ECTS):** The Law on HE mandates ECTS for all HE institutions in all degree programs, for both credit transfer and accumulation. The ECTS system has been fully implemented in all HEIs; every study program covers a description of the courses and the number of ECTS credits. ECTS credits are based on the workload students need in order to achieve the expected learning outcomes.³⁵

**Standards and Guidelines for Quality Assurance:** Serbia operates an integrated national quality assurance (QA) system complying with the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG). The QA system includes internal and external quality assurance and accreditation. The Commission for Accreditation and Quality Assessment (CAQA), established in June 2006, is legally responsible for organizing and monitoring the quality assurance scheme for all HEIs in Serbia.

70. The Law gives universities and departments (faculties) complete autonomy in allocating resources in line with their teaching and research priorities:

- Academic autonomy gives professors the right to decide on what to teach, how to enroll students, how to organize the teaching process, and how to internally organize HE institutions;

- Political and legal autonomy gives HE organizations the right to have their own statutes and bylaws, elect or appoint the heads (rector, dean, head of department, etc.), and resolve internal political conflicts; and,

- Financial and managerial autonomy gives HE organizations the freedom to decide on salaries, tuition fees, allocation of governmental funds, and mobilize additional funds, as well as to recruit teaching staff, researchers, and other staff.

71. Most public universities in Serbia are not strongly integrated. Departments (faculties) are independent financial entities with the authority to allocate all funds, including a share which they have to distribute to university authorities.

72. All public and private HE institutions are legally required to have an internal quality assurance system as one of the criteria of the accreditation framework. Program accreditation depends on the existence of a coherent internal quality assurance system with clear goals and regular monitoring that leads to continuous improvement. The self-assessment report is a mandatory document in the accreditation file of any HEI. Students are involved in the preparation of self-assessment reports and in the follow-up procedures. The external quality assurance system operates at the national level. Only accredited HE institutions and study programs are entitled to award bachelor, master, and doctoral (PhD) degrees.

³⁵ While the ECTS system is fully developed and the mutual recognition of the ECTS credits is “functional” between Serbian and foreign universities and faculties, in practice there is a problem with mutual recognition of the ECTS credits among Serbian universities and faculties, as recently pointed out by a member of the Accreditation Commission.
4. **POLICY DEVELOPMENT**

**National Strategy**

73. The STD Strategy 2010-2015 aims to make Serbia a knowledge-based economy and an innovative country, where scientists would attain European standards in both research inputs and outputs, contribute to society’s overall level of knowledge, and advance the technological development of the economy. The strategy is based on two pillars: *focus*, demonstrated through a set of national research priorities; and *partnership*, realized through stronger and more productive ties between STD (universities and institutes) and companies that would allow Serbia to validate its ideas/innovation potential in the global market.

74. The STD Strategy focuses on six topics: (i) identification of national S&T priorities; (ii) determination of main investments in R&D infrastructure; (iii) restructuring of the existing R&D system; (iv) development of human capital and integration of the Serbian diaspora into national R&D activities; (v) integration of the national STD system into ERA; and, (vi) creation of a national innovation system.

75. The strategy defines seven national S&T sector priorities: (i) biomedicine and human health; (ii) new materials and nano-sciences; (iii) environmental protection and climate change; (iv) agriculture and food; (v) energy and energy efficiency; (vi) ICT; and, (vii) improved public governance and affirmation of national identity.

76. In addition to endorsing competitive financing of R&D and innovation projects, the Strategy identified the following programmatic priorities: (i) *R&D infrastructure investment initiative*, which proposes to upgrade existing capacities, adapt buildings and laboratories, and provide new capital equipment for research (with a budget around 70 million euros); (ii) *Human capital development* (with 33 million euro budget), which includes four sub-programs: (a) return of Serbian researchers from the diaspora; (b) “Petnica” research center; (c) mathematical high school campus; and, (d) the New Center for Promotion of Science in Belgrade; (iv) *Development of Centers of Excellence and Academic Research Centers* in priority research fields (such as energy and environment, material science, agriculture, and food) and science fields (such as biomedical sciences in Belgrade (budget around 60 million euros); (v) *Development of ICT infrastructure* for the campus of technical sciences at the University in Belgrade and the supercomputing initiative "Blue Danube" (with a budget from 50 – 80 million euros); (vi) *Development of a knowledge-based economy* through the construction of science and technology parks in Belgrade, Novi Sad, Nis, and Kragujevac (budget around 30 million euros); and (vii) *Provision of basic/enabling infrastructure* such as apartment buildings for young researchers in Belgrade, Novi Sad, Nis and Kragujevac, and infrastructure for the MES (approximately 80 million euros).

77. The real challenge will be the implementation of this program and its sustainability, given the limited expenditures allocated to R&D. The strategy calls for an annual increase in GERD of 0.15 percent of GDP for the 5 years to partially close the gap with recent EU accession countries by 2015. But this will not be easy to achieve under the policy of fiscal restraint and the economic growth slowdown. As the 2011 EU Progress Report on Serbia noted, serious efforts are needed to achieve the targets set in the 2010-2015 STD strategy, in particular regarding investments in infrastructure and integration with ERA.
Research Funding Policies

78. The MES is the primary source of public R&D funding in Serbia. It channels budget resources to R&D either directly, in the case of publicly owned institutes and other research organizations, or via higher education organizations where part of the funding is earmarked for teaching and part for research. All public sources of R&D funding, beyond that given to maintain institutions functioning, are allocated on a competitive basis. Serbia has a decade-long tradition of allocating research funding on a competitive basis, although the basis for evaluating research teams, organizations, and results has evolved over time.

79. Until 2011, STD activities were supported by three main public funding sources: budgetary allocations channeled through MES, additional resources from the Ministry of Economy and Regional Development, and funds made available through the National Agency for Regional Development. In 2010, the total budget for all categories of research and innovation amounted to €107.5 million. The situation improved slightly in 2011, with a planned budget of €109 million due to the Innovation Fund resources financed under the EU IPA program (€1.5 million MINI GRANT Program). Overall, 98.6 percent of the financing of R&D and innovation activities in 2011 came from the budget. Additional funding for STD is provided by the Foundation for Science and Arts, established in 1996 by the SASA, the National Bank of Serbia, and the Association of Banks of Serbia. The Foundation supports the education of young talented students in the spheres of science and art.

80. Serbia has a dual funding system for universities. Block funding (also called institutional or general funding) is allocated directly to universities exclusively for their institutionally mandated teaching mission. The funding is calculated predominantly on the basis of the number of students, but the MES has the final say in this process. Block funding, in general, is not linked to scientific results (i.e., bibliometric indicators, patents, etc.). No institutional funding is given to universities for research.

81. Public competitive funding is directly allocated to individual researchers, research teams, or research units. Competitive grants are the main instrument used by the MES to allocate resources to research programs in public and private HE institutions. It should be emphasized that both public and private HE institutions are independent in designing their research agendas, managing research budgets, and hiring staff.

Research Infrastructure

82. An R&D infrastructure investment initiative is an important part of the new STD Strategy in Serbia. A €400 million project aimed at improving research infrastructure and enabling the development of priority research fields in the next 5 years was launched in January, 2011. The project was financed by major international financial institutions (including European Investment Bank, EBRD, World Bank, and the Development Bank of the Council of Europe) and EU pre-accession funds.

83. Components selected for this project were those conducive to the development of priority disciplines, likely to identify and nurture scientific talent, prevent brain drain, and compensate for almost two decades of under-investment in scientific and research infrastructure. The main components of the “Serbian R&D infrastructure investment initiative” project are:

- Upgrading existing capacities (app. €70 million);
- Adaptation of existing buildings and laboratories;
- Acquisition of new capital equipment for research;
- Development of Centers of Excellence and academic research centers (app. €60 million);
Country Paper Series: Serbia

- Development of ICT infrastructure (€50 to €80 million);
- Campus for technical sciences of the University in Belgrade;
- Infrastructure for supercomputing initiative "Blue Danube";
- Creation of science parks in Belgrade, Novi Sad, Niš, and Kragujevac (app. €30 million); and,
- Basic infrastructure projects (app. €80 million).

**Human Capital, Mobility and the Diaspora**

84. A special human capital development program has been designed with a €33 million budget to support four main investment activities:

- A human resources program supporting the return of Serbian researchers from the diaspora. One of the projects aims to attract researchers back for a period of time by providing them with good working conditions, financial means, necessary equipment, and adequate accommodation. Other plans are for networking of researchers in Serbia and the diaspora, visits of eminent Serbian researchers, and incentives for researchers in the diaspora to establish their own enterprises in Serbia;

- The "Petnica" research center is a unique institution with a 26-year long history in training more than 14,000 young researchers, many of whom have become leaders of R&D activities in Serbia today. In the next 3 years, accommodation and modern labs at Petnica will be substantially expanded to enable continued training of young researchers (app. €7.6 million);

- A mathematical high school campus will be built to improve learning and living conditions; and,

- A new science and innovation center in Belgrade will be built to popularize science among the young and the public at large (app. €20 million).

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

**Private Sector R&D and Innovation**

86. One of the key challenges of the STD system in Serbia is how to increase R&D and innovation activities in and from the business sector. Official figures for the 2007-2010 period\(^\text{36}\) show that the business share in total R&D expenditures varied between 11 and 18 percent, compared to a 54.1 - 63.7 percent average share in the EU.

87. The new Law on Innovation Activity creates better legal conditions for private investment in R&D. An Innovation Fund was established to provide funding for innovations, particularly through cooperation with international financial institutions, organizations, donors, and the private sector. The objective of the Fund is to promote innovation in priority areas of science and technology and to support commercialization of technology transfer, thus enabling new technologies to reach the market.

\(^{36}\) Official statistics may underestimate true R&D expenditures in the private sector. Recent statistical surveys in Serbia suggest that total R&D investments in the business sector are comparable to government investments.
However, a recent survey of the competitiveness of Serbian industry showed that the environment for R&D is not yet favorable: 48 percent of respondents from the manufacturing industries replied that the existing environment is largely unfavorable for R&D and innovation activities; as many as 81 percent of companies believe the state does not encourage investment in R&D through its measures; and 39 percent believe that the available infrastructure is not conducive to R&D and innovation.

On the other hand, government policies seek to support private sector participation in R&D and innovation activity. The Industrial Policy recognizes: (i) the role of employers in improving the education system; and, (ii) the importance of quality assurance in the educational process as a critical driver of competitiveness in the private sector and industry in Serbia. The SME development strategy aims to create a framework for a sustainable, internationally competitive, and export-oriented SME sector in compliance with the principles of an entrepreneurial economy based on knowledge and innovation.

**Technology Transfer and Science-Industry Collaboration**

The main forms of research partnerships between research institutions and the private sector in Serbia are: (i) bilateral contracts between public research organizations and enterprises for carrying out joint R&D work; (ii) student grants (scholarships) provided by companies with an interest in attracting young graduates with particular skills or qualifications.

National programs supporting collaboration between industry and R&D institutions include three specific projects: (i) Supporting SMEs to Invest in Innovation (run by former MoERD); (ii) Supporting the Development of Competitiveness of SMEs and Innovation (run by NARD); and (iii) Innovation Projects (run by MES). The National Program for Business Incubators and Cluster Development in Serbia 2007-2010 provides policy support for cluster development, and is an integral component of the institutional infrastructure for encouragement of innovation. The clusters are an important element of the innovation system in Serbia.

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**Box 3: International donors and cluster development strategies**

LEDIB, a Danish program for local economic development in the Balkans, supported the establishment of Cluster House (www.clusterhouse.rs) as a non-partisan, non-governmental, and non-profit business membership organization for technical assistance in the development of clusters and business associations. The EU funded the project Support to Enterprise Competitiveness and Export Promotion (SECEP), which supports development of clusters through trainings, workshops, and B2B events designed to bring together cluster managers and cluster member companies from different sectors and different parts of the country to learn together, share knowledge and ideas, and explore ways of collaborating on joint projects.

A United States Assistance for International Development (USAID) funded Serbia Enterprise Development Project (SEDP) supports entire sectors, rather than clusters, to improve their performance. SEDP operated in: processed, frozen, and fresh food; apparel; contract and branded apparel; ICT software development and ICT software packages; pharmaceutical clinical research; laboratory and pre-clinical research; spa destinations; convention tourism; and, services for independent travelers in tourism.

Some challenges related to the clusters identified by international donors include: (i) inadequate infrastructure; (ii) small size of clusters (small number of firms gathered in a cluster and small value of production); (iii) absence of good corporate governance and professional cluster management; (iv) weak value

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chain; (v) ambiguous and divided strategy and policy in clusters; and, (vi) insignificant levels of cooperation between the business sector and educational-research institutions, as well as between the public and private sectors in general.

**Fiscal Policies Promoting R&D and Innovation**

93. Current fiscal policies offer tax incentives, credits, and grants for new investments and jobs, including investments in R&D-related work opportunities. Incentives for investments in R&D are offered in the form of tax credits in the range of 5,000-10,000 euros per job for an investment over 250,000 euros and a minimum of 10 jobs created. Other major tax incentives for enterprises include:

- **Corporate Income Tax Holiday**: Companies are exempt from corporate income tax for a period of 10 years starting from the first year in which they report taxable profit if they invest more than 8 million euros in fixed assets and employ at least 100 additional employees throughout the investment period.

- **State Grants**: Offered to greenfield and brownfield projects in all industries, except for primary agriculture, the hospitality industry, retail, and the production of synthetic fibers and coal. For standard-scale projects in manufacturing, export-related services sector, and tourism, the government provides non-refundable state grants between 2,000 and 10,000 euros per new job created within 3 years, including for research and investment. For large investments that exceed 200 million euros, with the minimum of 1,000 new jobs created within 3 years, the state may cover 20 percent of the investment cost. Investments of over 50 million euros that create a minimum of 300 new jobs within 3 years can be subsidized up to 20 percent of the project's value.

- **Tax Reductions**: The amount of tax payable can be reduced by 20 percent to 80 percent of the amount invested in fixed assets for the respective tax period. This reduction cannot exceed 50 percent of the total tax liability for a single year. If not used entirely in the course of 1 year, this tax credit can be carried forward for a maximum period of 10 years.

5. **RESEARCH AND INNOVATION INFRASTRUCTURE**

94. Based on the Law on Innovation Activity (2005), the following innovation organizations were financed and registered: 3 Innovation Centers; 20 Research and Development Centers; 51 Development and Production Centers; 2 Science and Technology Parks; 3 Business and Technology Incubators; 79 innovations organizations and 127 researchers-innovators. In the period 2007-2009, 208 projects for research organizations and 70 projects for researchers-innovators, involving a total of 295 researchers, received financing through public calls. The total funding for the 3-year period was 7.2 million euros.

95. Since 2006, 18 business incubators have been established across Serbia. The first Science and Technology Park in Serbia was established at the beginning of 2012, in an area of 15,000 square meters in Zvezdara in Belgrade. The construction is funded by the European Investment Bank, and the project partners are the Ministry of Education and Science, the Municipality of Zvezdara, and Project Implementation Unit - PIU "Research and Development." Also under construction is a Science and Technology park in Novi Sad, and
preparation is underway to initiate construction of science and technology parks in Niš and Kragujevac, all funded from the EIB “Public sector research and development” project.

The Business Technology Incubator of Technical Faculties Belgrade LLC has been also established as a partnership between the four technical faculties of the University of Belgrade (Civil, Mechanical, Electrical, and Technological/Metallurgical Engineering), the Municipality of Palilula, and the Democratic Transition Initiative, with support from the Organization for Security and Cooperation in Europe (OSCE).  

As in most other countries in the Western Balkans, public-private cooperation for innovation in Serbia is weak. Although relevant legal (such as Law on Innovation Activity) and policy documents (i.e., STD Strategy 2011-2015) recognize the importance of public-private collaboration, a specific law in this area did not exist until the Law on Public Private Partnerships and Concessions was adopted in December, 2011.

### Innovation centers

- **Innovation Center, Faculty of Mechanical Engineering, Belgrade University (ICMF)**. The major aim of the Centre is the application of scientific, technical, and technological knowledge and invention in order to create and release new and improved products, processes, or services.

- **Innovative Center for Information Technologies, Faculty of Mechanical Engineering, University of Kragujevac (ICIT)**. The Center’s goal is to implement programs in: (i) development of innovations and entrepreneurship; (ii) education in new technologies and entrepreneurship; and, (iii) development and commercialization.

- **Innovation Center for Information Technologies, Faculty of Mechanical Engineering, University of Niš (ICIT)** was established in 2002 at the Faculty of Mechanical Engineering at University of Niš, with the support of the Ministry for Science, Technology, and Development. ICIT is focused on development of frameworks for application of ICT in industry and support of SMEs in implementation of innovative research results.

- **Technology Transfer Center at the University of Novi Sad (TTC)**, at the Faculty of Engineering was established as a result of the TEMPUS project. The Belgrade University has also recently established a technology transfer office, through an EU-funded project.

### Supporting Institutions: the IPR System and Certification Institutes

A modern innovation system includes organizations for support, networking, and financing of research, development, and innovation. In Serbia, this subset of organizations includes the Intellectual Property Office, the Serbian Institute for Standardization, Office for Measures and Precious Metals, National Information Technology and Internet Agency, Accreditation Board of Serbia, agencies for small and medium-sized enterprises and entrepreneurship, Telecommunications Agency, chambers of commerce, innovation centers, business and technology incubators, technology and industrial parks, foreign agencies for support of technological and economic development, etc.

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38 The results of its activity so far include: 600 m² of renovated business space; 21 small enterprises tenants of the incubator, 100 young people engaged in the incubator and enterprises-tenants, 500 students completed entrepreneurship trainings, 14 new technologies/services developed in innovation projects, 5 clusters/networks established, and 1 service center developed for legal, accounting and financial services.
Intellectual Property Rights System

A National Strategy for Intellectual Property Rights was adopted in June, 2011. In the area of copyright and neighboring rights, the Law on Optical Disks was adopted in July, 2011 and the Law on Copyright and Related Rights was adopted in December, 2009, followed by implementing legislation. The Law was harmonized with the European Union (EU) and the World Trade Organization (WTO) regulations through amendments that entered into force in January, 2012. The Commission for Copyright and Related Rights was established in December, 2010, and is empowered to decide on tariffs if no agreement is reached with collective rights management organizations. Currently, three organizations in Serbia are authorized for collective management of copyright and related rights.

100. The Intellectual Property Office (IPO), established in 2003, is the national coordinator for intellectual property rights. With a strong in-house education and information center, IPO has become the leading promoter of reforms in this area; however, it is financially dependent on the state budget. In the area of industrial property and copyright, Serbia has harmonized its legislation with the provisions of international law, especially with the relevant EU regulations. Moreover, Serbia became a member of EPO in October, 2010.

Standardization and Quality Certification Institutes

101. According to the Law on Standardization (2009) and the Amended Founding Act of the Institute for Standardization of Serbia (2009), the Institute for Standardization of Serbia (ISS) is the only recognized national standardization body in the Republic of Serbia, an institution that is a legal entity and operates in accordance with the regulations governing the legal status of the public services. The founder of the Institute is the Government of Serbia. ISS is following a strategy to adopt and implement primarily European standards and obtain full-membership status in the European organizations for standardization: CEN and CENELEC.

ISS represents Serbia in international and European organizations for standardization, such as:

- International Organization for Standardization (ISO) – ISS is a full member since 1950;
- International Electrotechnical Commission (IEC) - ISS is a full member since 1953;
- Worldwide System for Conformity Testing and Certification of Electrotechnical Equipment and Components (IECEE) – ISS is a full member since 1965;
- European Committee for Standardization (CEN) – ISS is an affiliate member since January, 2008; and,
- European Committee for Electrotechnical Standardization (CENELEC) – ISS is an affiliate member since October 1, 2005.

102. The Institute also acts as the national contact point for standards and related documents for the Codex Alimentarius Commission (National Codex Contact Point). Codex Alimentarius Commission is a joint body of the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO), which deals with agricultural and food products.
6. **Integration with ERA and International Collaboration**

103. The STD Strategy 2010-2015 aims at further Serbian integration into ERA and alignment with the EU acquis on research and innovation policy. Serbia is actively participating in the work of all ERA governance bodies, demonstrating its commitment to integrate into ERA and contribute to the Innovation Union.

104. Joint participation is pursued by companies and public research organizations in the EU FP5, FP6, FP7, and the Competitiveness and Innovation Framework Program. The first involvement of Serbia in the EU Framework Programs was through FP5 and FP6. Serbian participation was in the form of partnerships in project consortia. Under FP6 (2002-2006), Serbian partners participated in 86 projects and received total funding of 12 million euros. The total value of the projects in which Serbia has been a partner totals 170 million euros.

105. EUREKA. Serbia has been a member of EUREKA since June, 2002, first under the leadership of the Ministry of Science and Technological Development and currently by the MES. EUREKA is a pan-European network offering funding opportunities to companies and research organizations for market-driven research projects. Serbia has completed 36 projects, with 27 ongoing and 12 seeking international partners. Serbia has expressed interest in becoming associated with the Seventh Euratom Research Framework Program (2013-2014) for nuclear research and training activities. Further, it has started accession negotiations with the European Organization for Nuclear Research. Serbia is interested in accession to CERN because of one of the greatest scientific experiments in human history – the Large Hadron Collider accelerator, in which 40 Serbian scientists participate. Membership negotiations should last for approximately 1 year, after which Serbia should obtain the status of an associate member. It is expected that Serbia will become a full member of CERN within 2 to 5 years. Additionally, Serbia has participated in Community Assistance for Reconstruction, Development and Stabilization (CARDS) since 2006; the CIP/EIP Program since 2009-2010; and, Project EEN -- Enterprise Europe Network, which has been operating in Serbia since 2009-2010.

106. Seventh Research Framework Program (FP7): The Republic of Serbia signed a Memorandum of Understanding (MoU) with the European Commission on June 13, 2007 for association in FP7, which enabled research organizations from Serbia to participate fully in the program. In March, 2008, the Ministry of Science and Technological Development established a Bureau for International Projects, with the goal to support preparation of project proposals to FP7. The major tasks of this Bureau are: (i) information service (details about calls and deadlines); (ii) regular training workshops; (iii) revision of the first drafts of proposals; and, (iv) consultations. Serbia presented a total of 836 proposals for the FP7 period 2007-2010. The success rate, or share of proposals retained for funding, was 14 percent on average for the period and 29 percent for 2010, around the average ratio for the SEE economies (28 percent). Meanwhile, the financial volume of FP7 grants received by Serbia amounted to a total of 16.4 million euros in the period 2007-2009, which was 60 percent of the requested amount of 27.4 million euros. The received share is slightly lower than the average for the region (64 percent), while the relatively low amount of requested funding indicates limited R&D activity in Serbia. The amount Serbia requested is at the level requested by FYR Macedonia but significantly lower than requested funding from Greece, Slovenia, and Croatia.

107. The European Cooperation in Science and Technology (COST): Serbia became an independent member of COST in 2007. The national COST Office is hosted by the Ministry of Education and Science. COST is an inter-governmental framework for European Cooperation in Science and Technology. The program provides a platform for Serbia to cooperate on a particular project and exchange expertise with European scientists,
allowing for coordination of nationally funded research on a pan-European level. Serbia is active across all COST domains, having participated in 228 Actions and being an Action Chair for the COST Domain of Physics and Nanosciences.

108. The TEMPUS Program has provided support to modernization and reform of the system of higher education in Serbia since 2001. All public universities have participated in TEMPUS projects and the private universities have also increased their interest. Since 2001, study programs have been upgraded in agriculture, urban and regional planning, economics, the applied sciences, electrical and electronic engineering, European studies, international relations, political science, food science and technology, forestry, health care, the humanities, information technology, computer science, engineering, management and business, mechanical engineering, media studies and journalism, the medical sciences, the natural sciences, mathematics, physics, regional environmental policy, tourism and leisure, and veterinary science. During the period 2000-2006, TEMPUS in Serbia was funded through CARDS. From 2007, with the start of phase IV, funding for TEMPUS and the program Erasmus Mundus has come from the funds of the EU IPA.

7. CONCLUSIONS: POLICY CHALLENGES AND PENDING REFORMS

109. Serbia has made some significant progress in recent years in the area of research and innovation policy. New legislation was adopted to regulate higher education, innovation, scientific and research activities, and intellectual property rights, along with a National Strategy for science and technological development for 2010-2015. The critical issues of brain drain and reforms of the Serbian Academy of Sciences and Arts have been addressed. Significant resources have been devoted to upgrading research infrastructure and the STD system. In May, 2010, a bill was adopted allocating 400 million euros to fund science and technology infrastructure at the national level for a period of 4 years.

110. Nevertheless, funding of the STD sector remains low compared to that of new EU members, and is also low compared to the EU2020 3 percent target. The exceptional legal and investment efforts notwithstanding, public and private expenditures on research (e.g., GERD) remain well below 1 percent of GDP. What is more, limited resources are spread over a very large number of research organizations dominated by basic research and applied research specializations that are not aligned with the structure and needs of the real economy. As the strategy rightly emphasized, due to brain drain, dated research infrastructure, limited financing, weak integration with ERA and the global research community, and an aging research population, Serbia does not have a critical mass in any of the STD areas.

111. Consequently, important challenges remain. With as many as seven STD priorities, limited funding, and only partial progress toward true performance-based allocations, Serbia’s STD system is not likely to produce innovation outcomes that would have an impact on economic growth. To improve its innovation performance and successfully transition to a modern knowledge economy, Serbia will need substantially greater investments in R&D, with a stronger focus. Improved performance can only be achieved if the new investment initiatives into R&D infrastructure are complemented with the right selection of STD priorities, based on a “smart

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Footnote:
39 Lifelong learning courses have been developed in the fields of agriculture and the food sciences, education and teacher training, environmental policy, justice, and transport policy. Tempus has also supported strategic planning, international relations, quality assurance, library management, university management systems, university-industry links, open and distance learning, regional cooperation, credit systems, quality assurance, and lifelong learning.
specialization” approach, and include much improved measurement of STD performance, both on the human capital side and the research outcome side.

112. The present competitive allocation system is more backward than forward-looking, as it is based only on past publications and superficial evaluation project proposals. It is also biased, since it over-rates scientific and research publications (output), does not look at results (true impact - research excellence), and ignores patents and all other types of outputs relevant for applied research and innovation. In addition, the present allocation system underrates the importance of the research-business nexus, and the need for early stage innovation financing.
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## Table A 1: Country Profile Indicators

<table>
<thead>
<tr>
<th>ECONOMY &amp; BUSINESS ENVIRONMENT</th>
<th>SERBIA</th>
<th>WBC</th>
<th>EU-27</th>
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<tr>
<td>GDP (2010)</td>
<td>€27,968 M</td>
<td>€15,523 M</td>
<td>€12,279,401 M</td>
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<td>GDP per Capita (2011)</td>
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<td>€4,454</td>
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<td>Population (2011)</td>
<td>7,261,000</td>
<td>22,832,917</td>
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<tr>
<td>Exports to GDP ratio (2010)</td>
<td>21.3</td>
<td>19.2% 40</td>
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<tr>
<td>Imports to GDP ratio (2010)</td>
<td>42.8</td>
<td>40.3% 41</td>
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<tr>
<td>Trade to GDP ratio (2010)</td>
<td>64.1</td>
<td>60.5% 42</td>
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<td>Net Foreign Direct Investment, % GDP (2011)</td>
<td>5.53 (inflows)</td>
<td>4.92 (inflows)</td>
<td>2.86 (outflows)</td>
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<th>HUMAN CAPITAL AND RESEARCH &amp; DEVELOPMENT</th>
<th>SERBIA</th>
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<td>GDP on R&amp;D Expenditure, % GDP (2009)</td>
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<td>Percentage of R&amp;D Expenditures performed by the Private Sector (2010)</td>
<td>14.3 (2009)</td>
<td>-</td>
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<td>Researchers*44 per Million population (2010)</td>
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<th>SERBIA</th>
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<tr>
<td>Percentage of Enterprises with Internationally Recognized Quality Certification (2009, Enterprise Survey)</td>
<td>21.8</td>
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<td>Percentage of Firms Using Technology licensed from Foreign Companies (2009, Enterprise Survey)</td>
<td>14.7</td>
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<td>Royalties &amp; License Fees Payments, % GDP (2011)</td>
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<td>Internet Users per 100 People (2011)</td>
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<td>Mobile Cellular Subscriptions per 100 People (2011)</td>
<td>125</td>
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<td>Intellectual Property Protection Ranking 2012 (of 144 countries) 54</td>
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<th>S&amp;T OUTPUTS AND INNOVATION PERFORMANCE</th>
<th>SERBIA</th>
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<td>Utility Patents Filed in the US per Million Pop (2009)</td>
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</tr>
<tr>
<td>S&amp;T Journal Articles per Million Pop (2009)</td>
<td>160</td>
<td>12558</td>
<td>496</td>
</tr>
<tr>
<td>High-technology Exports, % Manufactured Exports (2010)</td>
<td>-</td>
<td>4.349</td>
<td>15.3</td>
</tr>
<tr>
<td>Global Innovation Index Rank 2012 (of 125 countries) 56</td>
<td>95</td>
<td>6054</td>
<td>2452</td>
</tr>
<tr>
<td>Trademark Applications per Million Population*5 (2010)</td>
<td>666</td>
<td>1,83254</td>
<td>13055</td>
</tr>
</tbody>
</table>

**Note:** If not indicated otherwise, indicators are from World Development Indicators (see footnotes). "-" means Not Available.

40 Excluding Kosovo (This designation is without prejudice to positions on status, and is in line with UNSC 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.)
41 Ibid
42 Ibid
43 Average of UNESCO’s available data for Albania, Bosnia and Herzegovina, Croatia, Serbia and FYR Macedonia for 2008-08.
44 Full-time equivalents – one person-year for example 30% time spent on R&D would count as 0.3 FTE.
45 Average of UNESCO’s data on Albania, Bosnia & Herzegovina, Croatia, Macedonia, and Serbia.
46 World Bank calculations
47 Global Competitiveness Report 2012.
48 Average of Global Competitiveness Report ranks for Albania, Bosnia, Croatia, FYR Macedonia, Montenegro, and Serbia.
49 Average of Global Competitiveness Report data on EU 27 countries
50 Average of Enterprise Survey data on Albania, Bosnia, Croatia, Kosovo, FYR Macedonia, Montenegro, and Serbia.
51 Average of World Development Indicators data on Albania, Bosnia, Croatia, Macedonia and Serbia.
52 Average of World Development Indicators data on Albania, Bosnia, Croatia, Macedonia and Serbia.
53 Average of World Development Indicators data on internet users per 100 people in Albania, Bosnia & Herzegovina, Croatia, FYR Macedonia, Montenegro, and Serbia.
54 Global Competitiveness Report 2012.
55 Average of Global Competitiveness Report ranks for Albania, Bosnia, Croatia, FYR Macedonia, Montenegro, and Serbia.
56 Average of Global Competitiveness Report data on EU 27 countries
57 Average of USPTO data on Albania, Croatia, Macedonia, and Serbia.
58 Average of World Development Indicators data on Albania, Bosnia, Croatia, Kosovo, Macedonia, Montenegro, and Serbia.
59 Average of World Development Indicators’ available data for Albania, Bosnia and Herzegovina, and Croatia for 2010.
60 GII 2012 (INSEAD and WIPO).
61 Average of ranks of 6 Western Balkan countries – Albania, Bosnia and Herzegovina, Croatia, Macedonia, Montenegro and Serbia.
62 Average of ranks of the EU 27
63 World Intellectual Property Organization
### Table A 2: Available budget resources by main category of research and innovation activity

<table>
<thead>
<tr>
<th>Category of research or innovation activity</th>
<th>Approximate total annual budget for 2010 (in Euro)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Governance &amp; horizontal research and innovation</td>
<td>Total MES budget allocated for the category was €4.77m</td>
<td>Total MES budget was €112m in 2010</td>
</tr>
</tbody>
</table>
| Research and Technologies | Total budget allocated was €96.14m | • Investments in R&D in Serbia from public sources are prioritized and budgeted in the framework of multi-annual plans to ensure stability and long-term impact. Project financing based on open competition for R&D projects is a decades-long practice in Serbia, with competitive rather than institutional funding of R&D activities.  
• Infrastructure and equipment – no investments in 2009-2010, new program launched for 2011-2014 with approximately €400 million over four years. |
| Human Resources (education and skills) | Total budget allocated was €5.59m | • The MES program for development of human resources in R&D consists of the following sub-programs: development of human capital, program of return of Serbian researchers from diaspora.  
• "Petnica" research center and mathematical high school campus buildings, and new science and innovation center in Belgrade (for popularizing science among the youth and public at large).  
• The MES program for development of human resources in R&D for the period 2011-2014 is approximately €33m. |
| Promote the creation and sustain growth of innovative enterprises | No budget in 2010 | • The MINI GRANT Program has up to €1.5m in 2011.  
• The cost-sharing grant awarded under the MINI GRANTS Program will cover 85 percent, (up to €85,000) of the total approved project cost. |
| Markets and innovation culture | Total budget allocated for this category was €1m | • MFE grant scheme - €0.4m  
• NARD grant scheme - €0.6m  
• MFE and NARD cover 50 percent of the grant.  
• The last call of the MES program was in 2009 with a budget of €1.4m, no calls in 2010, new calls started in September 2011. |

Source: Pro Inno Europe/ Inno Policy Trendchart (2011)

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64 Average of World Development Indicators data on Albania, Bosnia, Croatia, Macedonia, Montenegro and Serbia.
65 Total trademark applications per million population in the EU 27 from World Development Indicators.
### Table A 3: Innovation budgets of the main government departments and agencies

<table>
<thead>
<tr>
<th>Name of the organization</th>
<th>Innovation budget managed</th>
<th>Estimated share of budget earmarked for specific policy measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Ministry of Education and Science (MES)</td>
<td>€1.4m in 2009</td>
<td>Approx. €1.4m earmarked for the Program for co-financing of the Innovation projects in 2011, probably will be realized in 2012 (situation in November 2011).</td>
</tr>
<tr>
<td>The Ministry of Economy and Regional Development (MoERD)</td>
<td>€0.4m in 2010</td>
<td>Program for Supporting SMEs to Strengthen Innovation Activities in 2011</td>
</tr>
<tr>
<td>The National Agency for the Regional Development (NARD)</td>
<td>€0.6m in 2011</td>
<td>Approx. €0.6m earmarked for the Program for Supporting SMEs and Entrepreneurs to Strengthen Innovation Activities in 2011</td>
</tr>
<tr>
<td>Innovation Fund (IF)</td>
<td>€1.5m in 2011</td>
<td>€1.5m in 2011 for new program starting in 2011</td>
</tr>
</tbody>
</table>

Source: Pro Inno Europe/Inno Policy Trendchart (2011)
<table>
<thead>
<tr>
<th>Country</th>
<th>Number of eligible proposals with at least one applicant in country</th>
<th>Number of proposals retained for funding (Main listed) in calls with closure in reference year</th>
<th>Success rates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All FP7 2007 2008 2009 2010</td>
<td>All FP7 2007 2008 2009 2010</td>
<td>All FP7 2007 2008 2009 2010</td>
</tr>
<tr>
<td>AL - Albania</td>
<td>148 77 29 32 10</td>
<td>24 6 5 9 4</td>
<td>16% 8% 17% 28% 40%</td>
</tr>
<tr>
<td>BA – BiH</td>
<td>155 78 24 41 12</td>
<td>23 8 4 6 5</td>
<td>15% 10% 17% 15% 42%</td>
</tr>
<tr>
<td>BG - Bulgaria</td>
<td>1,872 882 474 421 92</td>
<td>315 132 69 87 27</td>
<td>17% 15% 15% 21% 29%</td>
</tr>
<tr>
<td>HR - Croatia</td>
<td>878 331 233 252 61</td>
<td>138 50 34 35 19</td>
<td>16% 15% 15% 14% 31%</td>
</tr>
<tr>
<td>MK - FYR Macedonia</td>
<td>271 113 66 68 23</td>
<td>47 19 14 7 6</td>
<td>17% 17% 21% 10% 26%</td>
</tr>
<tr>
<td>EL - Greece</td>
<td>7,466 3,004 1,913 2,193 339</td>
<td>1,278 469 286 439 81</td>
<td>17% 16% 15% 20% 24%</td>
</tr>
<tr>
<td>ME - Montenegro</td>
<td>111 51 27 26 7</td>
<td>24 8 9 3 4</td>
<td>22% 16% 33% 12% 57%</td>
</tr>
<tr>
<td>MD - Moldova</td>
<td>90 34 30 18 7</td>
<td>18 3 8 5 2</td>
<td>20% 9% 27% 28% 29%</td>
</tr>
<tr>
<td>RO - Romania</td>
<td>2,928 1,353 712 722 137</td>
<td>456 192 105 125 34</td>
<td>16% 14% 15% 17% 25%</td>
</tr>
<tr>
<td>RS - Serbia</td>
<td>836 323 198 263 49</td>
<td>114 40 27 33 14</td>
<td>14% 12% 14% 13% 29%</td>
</tr>
<tr>
<td>SI - Slovenia</td>
<td>2,094 911 504 574 102</td>
<td>373 148 88 109 28</td>
<td>18% 16% 17% 19% 27%</td>
</tr>
<tr>
<td>TR - Turkey</td>
<td>2,559 849 753 758 196</td>
<td>428 115 93 154 66</td>
<td>17% 14% 12% 20% 34%</td>
</tr>
<tr>
<td>UNMIK/Kosovo</td>
<td>8 0 2 6 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum SEE countries</td>
<td>19,416 8,006 4,965 5,374 1,035</td>
<td>3,238 1,190 742 1,012 290</td>
<td>17% 15% 15% 19% 28%</td>
</tr>
<tr>
<td>EE - Estonia</td>
<td>990 434 244 252 55</td>
<td>242 97 62 69 14</td>
<td>24% 22% 25% 27% 25%</td>
</tr>
<tr>
<td>LV - Latvia</td>
<td>595 249 148 161 36</td>
<td>130 47 34 38 10</td>
<td>22% 16% 33% 12% 57%</td>
</tr>
<tr>
<td>MD - Moldova</td>
<td>90 34 30 18 7</td>
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