

Overview

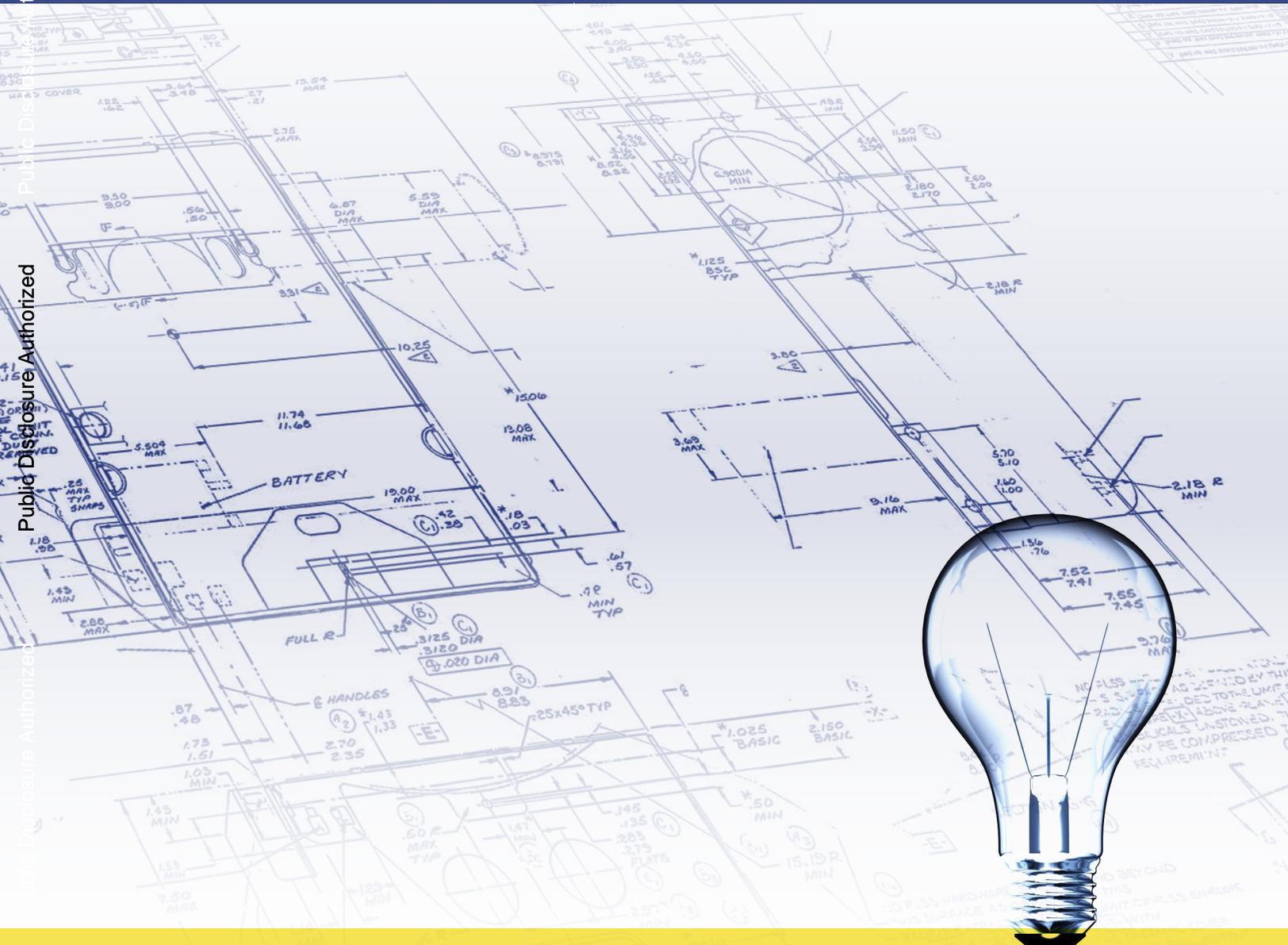
of the Research and Innovation Sector in the Western Balkans

Public Disclosure Authorized

Public Disclosure Authorized

Public Disclosure Authorized

Public Disclosure Authorized



WESTERN BALKANS REGIONAL R&D STRATEGY FOR INNOVATION

**Overview of the Research and Innovation Sector in the
Western Balkans**

World Bank Technical Assistance Project (P123211)

October, 2013

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). This paper synthesizes the analysis of the research and innovation sector that underlies the strategy.

This *Overview of the Research and Innovation Sector in the Western Balkans* was prepared by the World Bank team led by Paulo Correa (Lead Economist, World Bank) and Pluvia Zuniga (Senior Economist, World Bank) and comprised of Donato De Rosa (Sr. Economist, World Bank), Dusan Vujovic, Qursum Qasim, Andrew Myburgh, Petter Lundkvist, and Hari Subhash (World Bank Consultants). The Paper was prepared under the guidance of Ellen A. Goldstein (Country Director, ECCU4), Mamta Murthi (Country Director, ECCU5), Gerardo Corrochano (Sector Director, ECSPF and Innovation, Technology and Entrepreneurship Global Practice), and Lalit Raina (Sector Manager, ECSF3).

The note was prepared during January 2012–June 2013 and relied upon data available until December, 2012.

Contact Person: Paulo Correa (pcorrea@worldbank.org)

The findings, interpretations, and conclusions expressed herein are those of the authors and do not necessarily reflect the views of the International Bank for Reconstruction and Development/World Bank and its affiliate organizations, or those of the Executive Directors of the World Bank or the governments they represent.

CONTENTS

Acronyms and Abbreviations	v
1. Introduction	1
2. Framework	3
3. Research Sector.....	5
<i>Human Resources</i>	7
<i>Research Funding</i>	8
<i>Research Facilities</i>	10
4. Technology Transfer System	11
5. Enterprise Sector	15
6. Institutional and Policy Framework.....	17
<i>Research Career Policy</i>	18
<i>Allocation of Research Funds</i>	18
<i>Policy Coordination and Institution Building</i>	19
<i>Regional Cooperation</i>	19
7. Conclusion	21
References	23
Boxes	
Box 1: The Brain Drain in the Research Sector	7
Box 2: The Legal Framework for Technology Transfer: Recent Developments	11
Box 3: The Competition Environment in the Western Balkans.....	15
Box 4: Public Research Organizations.....	17
Figures	
Figure 1: Research and Innovation in the Western Balkans	3
Figure 2: Scientific Output Papers Produced per 10,000 Population in the Western Balkans, Adjusted for Quality, 2003–10	6

Figure 3: Quality and Quantity of Scientific Output in the Western Balkans and Comparator Countries, 2003–10	6
Figure 4: Tertiary Enrollment Rate, 2009	8
Figure 5: R&D Expenditures per Capita (Predicted and Actual), 2007–11	9
Figure 6: Gross Expenditures on R&D per US Registered Patent in Selected Countries.....	9

ACRONYMS AND ABBREVIATIONS

BICRO	Business Innovation Center of Croatia	GDP	gross domestic product
CARDS	Community Assistance for Reconstruction, Development and Stabilisation	GERD	gross expenditure on R&D
COST	European Cooperation in Science and Technology	IP	intellectual property
CREST	Scientific and. Technical Research Committee	IPR	intellectual property rights
EC	European Commission	PROs	public research organizations
EDIF	Enterprise Development and Innovation Facility	QS	Quacquarelli Symonds
ERA	European Research Area	STI	Strategy for the Development of Science
EU	European Union	UNESCO	United Nations Educational Scientific and Cultural Organization
FDI	foreign direct investment	USPTO	United States Patent and Trademark Office
FITD	Fund for Innovation and Technological Development	R&D	research and development
FP7	Framework Program 7	R&I	research and innovation
FTE	Full time equivalent	UNESCO	United Nations Educational, Scientific, and Cultural Organization
		WBRIS-TA	Western Balkans Regional R&D Strategy for Innovation Technical Assistance
		WISE	Western Balkans Research and Innovation Strategy Exercise

INTRODUCTION

This Overview of the research sector in the Western Balkans is a companion piece to the *Western Balkans Regional R&D Strategy for Innovation*. The strategy aims to strengthen the region's research capacity, enhance intra-regional cooperation, promote collaboration with business sectors, explore possibilities for financing R&D from EU funding schemes and other external sources, and help integrate the region into the European Research Area (ERA) and Innovation Union.

The strategy has been developed through a coordinated effort launched by the Joint Statement of Sarajevo, signed on April 24, 2009, by ministers from the Western Balkans responsible for science and research, the EU commissioner for Science and Research, and the Czech Republic Presidency of the Council of the European Union, under the auspices of the Regional Cooperation Council secretary general. In June 2011, the World Bank signed an agreement with the European Commission (EC) to provide technical assistance for the development of a Western Balkans Regional R&D Strategy for Innovation.

That regional R&D strategy was prepared between December 2011 and October 2013 under the joint auspices of the Regional Cooperation Council, the European Commission, and government officials from Albania, Bosnia and Herzegovina, Croatia, Kosovo,¹ FYR Macedonia, Montenegro, and Serbia (the Project Steering Committee).

This core team was joined by representatives of leading universities, research institutes, and the business sector (Advisory Board) and met on four different occasions to discuss and develop the strategy and its corresponding Action Plan for Regional Cooperation. More detail on the

strategy can be found in the companion document *Western Balkans Regional R&D Strategy for Innovation*.

This Overview provides the background and analysis that informed the development of the strategy. It is informed by consultations with the Advisory Board, as well as by the research commissioned for the preparation of the strategy. The background work includes four studies on the different components of the research sector, a policy questionnaire, and seven country studies reviewing key policies, institutions, and performance of the national research sectors.

This overview outlines the performance of the research and innovation sector, and describes the major drivers of this performance. It starts by presenting a framework of the different components of research and innovation in the Western Balkans. This leads into Section 2 discussing the performance of the research sector, which has been improving, but still lags international benchmarks. This reflects a number of challenges facing the sector, including the effects of a substantial brain drain, insufficient funding and a mismatch between research facilities and economic needs.

Section 3 discusses the technology transfer system and its important role in the performance of the research and innovation sector as a whole. The contribution of technology transfer in the region is limited, as reflected for example in the limited interaction between the research and enterprise sectors. The enterprise sector is discussed in Section 4. This sector's involvement in R&D has declined

¹ 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

since the 1990s as economies shifted out of research intensive sectors. This has left a core set of firms that are engaged in research and development. There is scope to implement a number of policies that could strengthen this core, including increased fiscal support for research and development, and increased support for start-ups.

Section 5 describes the policy and institutional framework, pointing out a number of areas where this could be

strengthened. This includes improving the career path for researchers, providing more funding through competitive processes as opposed to block grants, and continuing to strengthen policy co-ordination. Strengthening regional co-operation, especially in co-ordination with the EU, is important in order to reinforce the research and innovation sector. In doing this, the region can build off a fairly long history of bilateral cooperation with the European Union. The final section concludes.

2

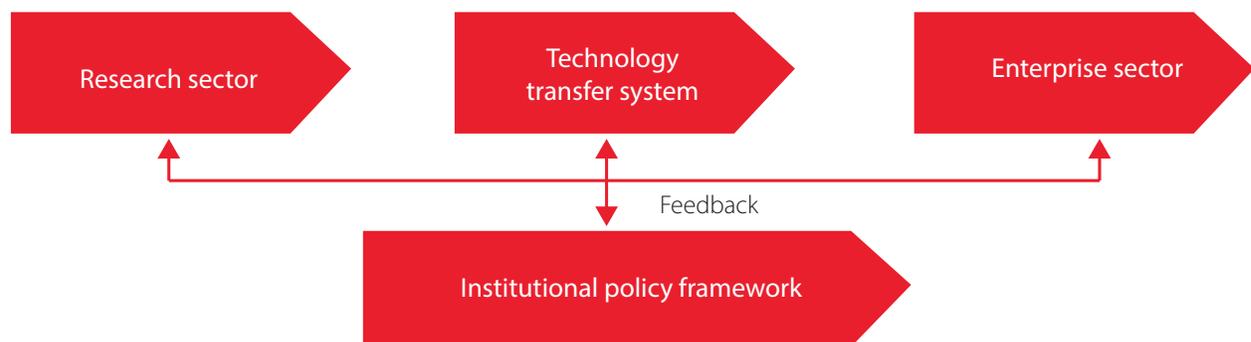
FRAMEWORK

For analytical purposes, the research and innovation sector in the Western Balkans can be considered in four parts, as illustrated in Figure 1:

- The *research sector* consists of universities public research organizations (PROs) and private institutes. These institutions invest in R&D and the development of academic knowledge. The quality of their performance has a major impact on development as these institutions are a major source of ideas and knowledge for the economy.
- The *technology transfer system* is the set of institutions that transfer know-how, technical knowledge, or technology from the research sector to the enterprise sector. This often does not happen since substantial transaction costs beset the transfer of knowledge. Mechanisms to overcome transaction costs include patenting inventions, facilitating collaboration on R&D, and knowledge sharing.²
- The *enterprise sector* is made up of the public and private firms that improve processes, adopt new technologies and innovations and introduce them into the economy. A vibrant enterprise sector has an important role to play driving the demand for knowledge from the research sector, as well as a source of new ideas through research and innovation. Drivers of the sector's vibrancy include levels of competition, and the presence of startups. The enterprise sector absorbs knowledge from the research sector and from a range of other sources, such as the import of capital goods, foreign direct investment (FDI), and the adoption of product and process standards.
- The *institutional and policy framework* encompasses the policies on issues that affect the performance of the different components, such as the approaches to funding, research, and the development of human resources.

² Correa and Zuniga 2013

FIGURE 1: Research and Innovation in the Western Balkans



Source: Own elaborations.

The scheme proposed in Figure 1 is simplification of the complex reality of research and innovation. For instance, the boundaries between the different components are not clearly defined. There are important feedback effects: an effective research sector can strengthen innovation in the enterprise sector, but, at the same time, a successfully

innovating enterprise sector can improve the performance of the research sector. Therefore, it does not aim to represent the process through which research is transformed into innovations nor imply that the innovation process can be represented by a “linear model”.

3

RESEARCH SECTOR

The research sector in the Western Balkans is characterized by lagging scientific performance, resulting from the insufficient supply of inputs—human resources, research funding, and facilities—and a regulatory regime that does not encourage performance.

While scientific performance has been improving, it still lags behind the EU-27 and Eastern Europe in both quantity (absolute and relative terms, per inhabitant or gross domestic product) and quality (normalized impact of publications, number of citations, and h-index).³

The number of scientific publications during 2006–10 increased significantly, led by a sharp surge in the performance of Croatia and Serbia. There was an increase in the number of papers published, as well as an improvement in their quality (as measured by normalized impact). This trend can be seen in Figure 2, which shows the number of quality-adjusted papers produced by countries in the region. Nevertheless, despite this strong improvement during the late 2000s, the Western Balkans still trail the rest of Eastern and Central Europe.

Scientific publications are concentrated in Croatia and Serbia and in the universities. Croatia and Serbia published more than 10,000 documents during the period 2003–10, compared to less than 2,500 publications in total for the rest of the region, amounting to less than 100 publications per country annually. Publication activity from universities represents 60 percent of total publications and citations in the region. In contrast, governmental and health institutions (hospitals) produce less than 20 percent of the regional total.

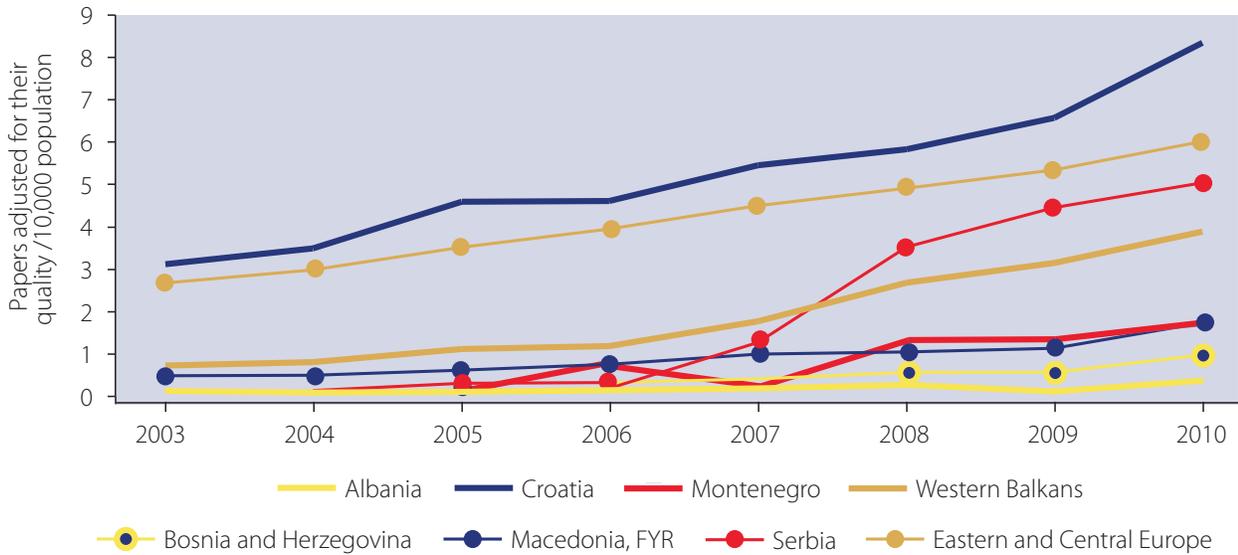
Figure 3 compares the quantity and quality of papers produced by countries in the Western Balkans to the average for the region and to countries in Eastern and Central Europe.

- Despite the progress over the 2000s, the average normalized number of citations per document for countries in the Western Balkans (0.67) in 2003–10 was less than the world average (1) and about half the EU-27 average (1.27).
- Albania, a country with a relatively small volume of scientific publications, has high-quality publications relative to the rest of the region. With 4.03 cites per document, it is the leader in the Western Balkans in the 2003–10. While Serbia holds the highest normalized impact average for the period (0.74), followed by Albania (0.72).
- Croatia has the largest quantity of publications per population, but their quality is below the average for the region. That said, the quality has improved dramatically over the 2000s, increasing from a normalized citation score of 0.52 in 2003 to 0.71 in 2010. There are other positive indicators, according to the Innovation Union 2013 report; Croatia, for instance, has a higher number of international scientific co-publications per million population than the EU average.⁴

³ The distinction between quantity and quality is essential: medicine by far is the main area of publication activity but ranks lower in impact. SCIMAGO Research Group 2012. European Commission 2009.

⁴ Innovation Union Scoreboard 2013, http://ec.europa.eu/enterprise/policies/innovation/files/ius-2013_en.pdf.

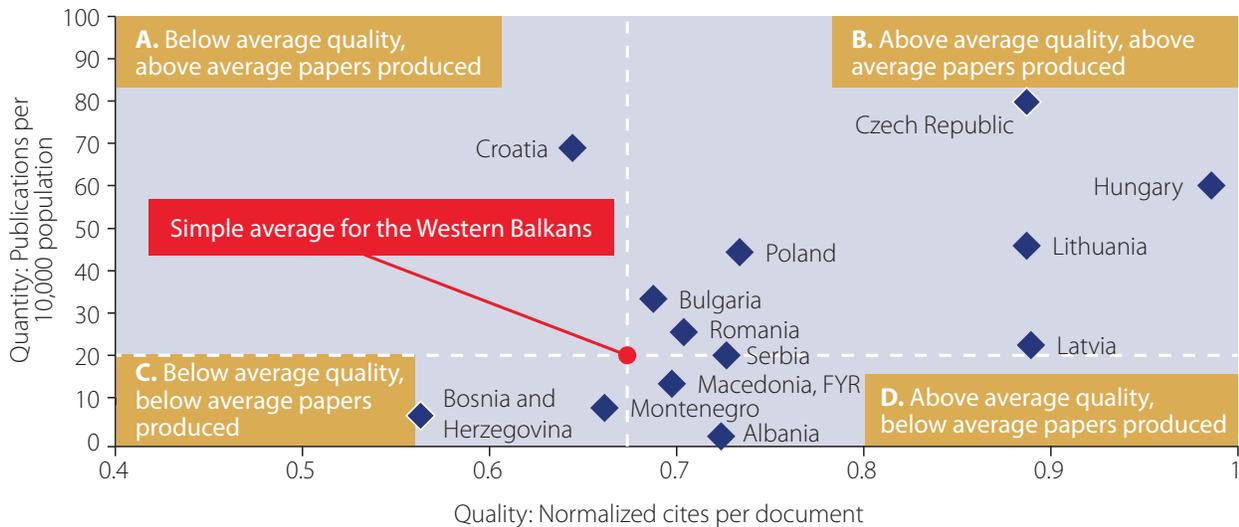
FIGURE 2: Scientific Output Papers Produced per 10,000 Population in the Western Balkans, Adjusted for Quality, 2003–10*



Source: SCIMAGO Research Group 2012; World Development Indicators.

* The countries included in Eastern and Central Europe are Albania, Bulgaria, Bosnia and Herzegovina, Czech Republic, Estonia, Croatia, Hungary, Kosovo*, Lithuania, Latvia, FYR Macedonia, Montenegro, Poland, Romania, Serbia, Slovak Republic, and Slovenia.

FIGURE 3: Quality and Quantity of Scientific Output in the Western Balkans and Comparator Countries, 2003–10



Source: SCIMAGO Research Group 2012; World Development Indicators.

Human Resources

The migration of large numbers of scientists, engineers, and technicians during the 1990s was one of the dramatic events for the research sector in the region. Systematic and comparable data on the scientific diaspora in the Western Balkans remain scarce.⁵ As discussed in Box 1, brain drain affected the region significantly. With the exception of Croatia and Serbia, where these trends recently seem to be reversing, brain drain is likely to affect generations of young researchers, compromising research capacity in the years to come.

On the positive side, enrollment rates in higher education have increased significantly in recent years. Tertiary enrollment in Croatia and Serbia are at the same level as Bulgaria (around 50 percent). As can be seen in Figure 4, tertiary enrollment in the region is above the regression line, suggesting that these countries are performing relatively well

Box 1: The Brain Drain in the Research Sector

- In Albania, according to a survey of over 40 research institutions and 10 public universities, more than 50 percent of all lecturers and research workers emigrated during the period 1991–2005.^a
- In Bosnia and Herzegovina, 23.9 percent of highly educated individuals emigrate, including 11 percent of medical doctors, one of the world's largest skilled emigration rates.^b
- In FYR Macedonia, data show a decrease of more than 70 percent in the number of researchers and scientists, mainly due to the emigration of highly skilled professionals between 1995 and 2000.^c
- In Kosovo*, 46 percent of emigrants, corresponding to 17 percent of the population, have achieved secondary education and about 10 percent have obtained higher education.^d
- In Serbia, an estimated 30,000 graduates left the country in 1990–2000, while 2,000 graduates went abroad in the following decade (most of them are professionals in information and communication technology and natural sciences).^e

Source: UNDP (2006); MIDWEB (2012); Torbakov (2012); Mustafa et al. (2007); and Kutlaca (2012).

^a UNDP 2006.

^b As presented by Mrs. Ana Judi, chief of section, Sector for Diaspora, Ministry for Human Rights and Refugees, in MIDWEB 2012.

^c Torbakov 2012.

^d Mustafa et al. 2007.

^e Kutlaca 2010.

relative to their level of income. Another positive indicator is that the share of graduates in the fields of engineering and, to some extent, science is similar to the EU-27 average.

There are a number of top researchers in the Western Balkans. Around 150 researchers in the region published more than 25 documents in the 2003–2010 period. Of these, fourteen researchers have received more than one thousand citations: nine in Croatia, two in Serbia and Montenegro respectively, and one in Bosnia and Herzegovina. A number of top researchers focus on science, with publications in the fields of Genetics, Nuclear and High Energy Physics, Applied Mathematics, Chemistry, Physics and Astronomy, and Medicine.⁶

Governments in the region are aware of the challenges stemming from the brain drain and have recently undertaken a number of initiatives to address the issue. These include several of the traditional measures, from creation of directory databases, “knowledge networks,” and discussion forums to the provision of visiting and post-doctorate fellowships, installation grants, and direct repatriation support. Croatia opted for developing a narrower program targeted to funding joint research between the local scientific community and the scientific diaspora (the Unity through Knowledge Fund).

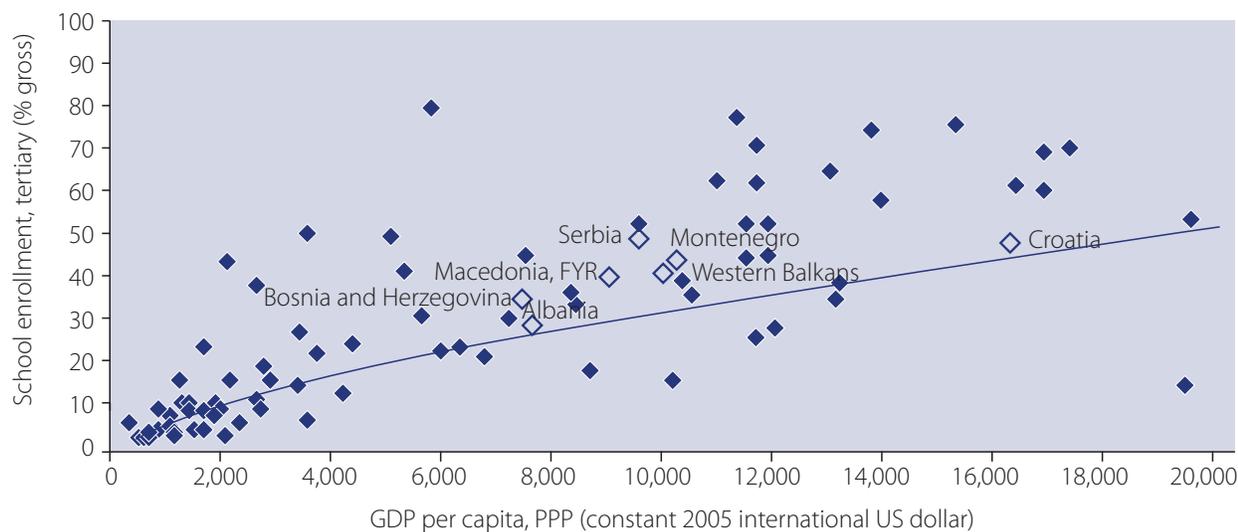
Current levels of international collaboration, which could help leverage the region's research capacity, are comparatively low, as illustrated by the limited involvement of the Western Balkans in the European Research Area. The participation of foreign scientists in local research organizations is also limited, demonstrating the difficulties that face the region in research mobility and in attracting new foreign researchers. Obstacles to regional mobility and mobility from other countries include visas, work permits, taxation, and social benefits.⁷ Interuniversity

⁵ Available statistics, however, indicate that migrants from the Western Balkans are more educated than the world average emigrant.

⁶ SCIMAGO Research Group 2012.

⁷ Only short-term visits (up to three months) are exempted from visas; a work permit is necessary whenever any payment is involved; and the current visa policy often gives priority to security issues and does not distinguish between researchers and economic migrants.

FIGURE 4: Tertiary Enrollment Rate, 2009



Source: World Development Indicators.

Note: To better illustrate the performance of countries in the Western Balkans, the axis has been cut at the values shown. The regression line is derived from all of the data not just the data shown.

mobility is difficult due to rigid programs and limited funding. A positive development is the extension of the Erasmus program to the Western Balkans through the establishment of ERAWEB which provides funding for students and teachers to study, teach and research abroad in Albania, Bosnia and Herzegovina, FYR Macedonia, Kosovo*, Montenegro, and Serbia.⁸

In some cases, immigration laws have been revised or specific measures have been adopted to accelerate validation of foreign-earned diplomas. Removing some legal barriers to mobility, as proposed by Albania’s Action Plan on Mobility of Researchers (2011–12), is a positive example.

Furthermore, researchers lack incentives and motivation to engage in quality research as exemplified by Kosovo*’s Institute of Public Health and Hydro Meteorological Institute, where low salaries and lack of funding inhibit engagement in substantive research initiatives.

Research Funding

Gross expenditures on R&D in the Western Balkans have declined dramatically in the past two decades. In the

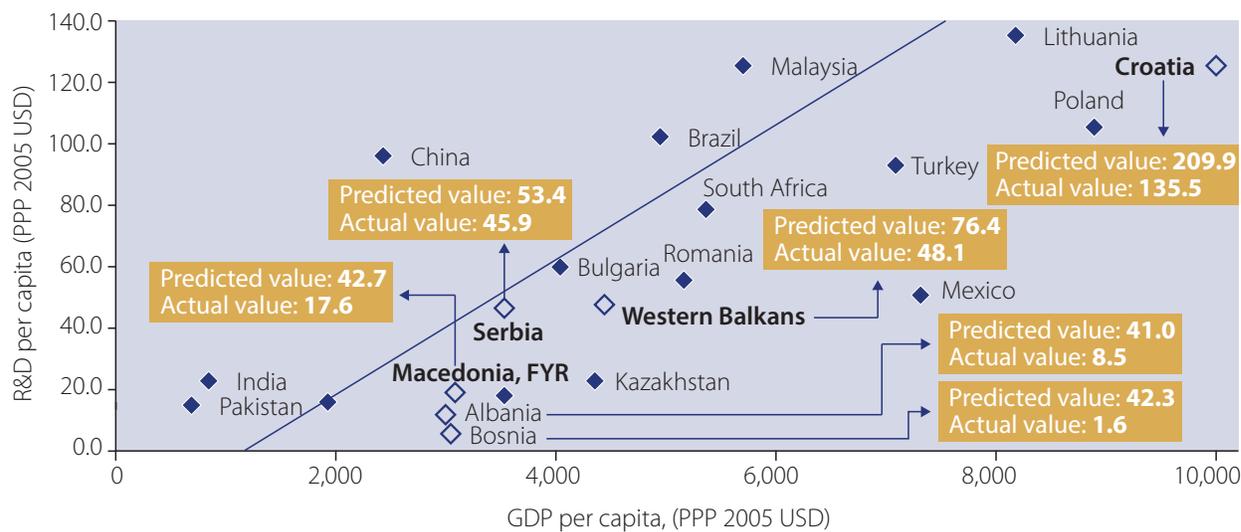
same period, other emerging economies, such as China and Turkey, have systematically increased investments in the sector. Current levels are insufficient to have a meaningful impact on the current growth model: the region is investing approximately €495 million in R&D per year, about the same as the second-largest U.S. research university in 2011.

The Western Balkans is investing less in R&D than would have been expected at its level of development. The region’s R&D intensity, 0.33 percent of gross domestic product (GDP), is much lower than that of Bulgaria and Romania when they joined the EU in 2007 (at about 0.5 percent).

The level of R&D investment in the Western Balkans is compared to income in Figure 6. This graph shows that in the Western Balkans, as in the region as a whole, the actual value of R&D per capita falls below the predicted value, based on a regression of R&D per capita on GDP per capita. For example, regression analysis predicts that, based on its level of income, Albania should be spending

⁸ <http://erasmus-westernbalkans.eu/>.

FIGURE 5: R&D Expenditures per Capita (Predicted and Actual), 2007–11



All values in PPP 2005 USD and averages of available data points between 2007-11.

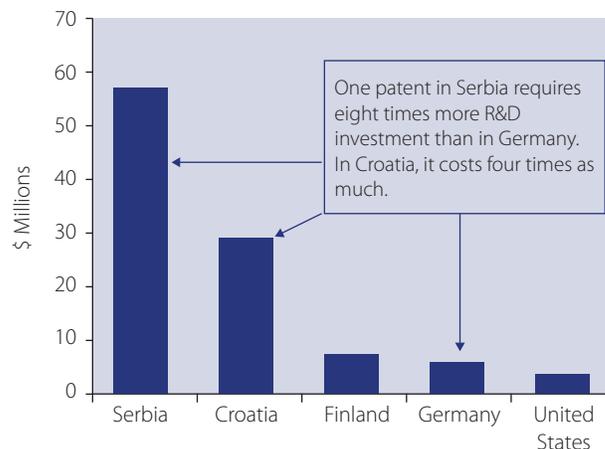
Source: UNESCO Statistics; World Development Indicators.

\$41 per person. Even though Croatia spends fifteen times more than Albania, it should be spending 60 percent more than its current level of \$135.

The difference between Croatia and Albania is an illustration of the significant variance of R&D intensity within the region. The differences between the largest R&D intensities (Croatia, Serbia) and the smallest (Bosnia and Herzegovina) are in the order of magnitude of almost 30.⁹ Comparable data does not exist for Kosovo*. However, the data that does exist suggests that relatively little is spent on R&D. It is estimated that the country only spends 0.1 percent of its budget on scientific research; despite the Law on Scientific Research Activity stating that up to 0.7 percent can be spent.

While several BRIC countries and rapidly emerging economies in Asia have made a strong push in the field of R&D, transition economies are lagging behind. Bosnia and Herzegovina is a case in point. With investments in R&D considered less important during the country's transition to independence and despite a near quadrupling of GDP per capita from 1998 to 2008, GERD has seen a fall from 1.85% of GDP in the late 1980s, to less than 0.1% in recent years. Similar trends are found in the rest of the region. While Croatia is at the other end

FIGURE 6: Gross Expenditures on R&D per US Registered Patent in Selected Countries



Source: USPTO, and UNESCO.

⁹ Data limitations affect the assessment of the situation in the R&D sector, including in terms of comparability and information update. Standard R&D statistics for Kosovo* are not available. In Bosnia and Herzegovina, FYR Macedonia, and Montenegro, data are often limited to a very short period. There are still implementation issues related to the harmonization of data generation in Croatia and Serbia. While firm-level data from different sources may be available for the region, the EU Community Innovation Survey is available only for Croatia. The main challenges for the development of a sound statistics system for the research sector are discussed in the report.

of the scale (both in terms of GDP and GERD per capita), its spending on R&D as a proportion of GDP fell by 30 percent during the 2000s. At 0.75 percent of GDP the country now trails other recent EU members: Slovenia (2.45 percent), the Czech Republic (1.84 percent), Estonia (2.38 percent), and Hungary (1.21 percent). In contrast to Croatia's experience, these countries' spending as a percentage of GDP increased by between 50 and 300 percent over the 2000s.

Research Facilities

Declining and unstable R&D funds have caused obsolescence and depreciation of research infrastructure in the Western Balkans over the past decade. In addition, infrastructure facilities designed to serve the former Yugoslavia are sometimes too large for the new national market they are supposed to serve, while also being too expensive to maintain with the limited resources available in national budgets.

On broad measures of the academic environment, even the leading universities in the Western Balkans have been falling behind their peers. On the Quacquarelli Symonds (QS) World University Rankings,¹⁰ the University of Zagreb fell from the top 501–550 universities in the world bracket in 2011 to the top 601–650 bracket in 2013. The University of Belgrade fell from 601+ in 2012 to 701+ in 2013. These falls suggests that the overall environment for research is not keeping up with other universities.

A significant diversification of the science base further deepens the fragmentation of already scarce resources. Moreover, research infrastructure is, in most cases, poorly shared across institutions.

Following the substantial EU experience over the past few decades, governments in the Western Balkans have been developing, or planning to develop, “centers of excellence” as a way to pool a critical mass of expertise and resources in selected fields. For instance, Kosovo*, is planning to implement competitive funding of five national Centers of Excellence in priority research areas. As part of the Serbian R&D Infrastructure Investment Initiative 2011–15 (€400 million), the country is investing in a center of excellence in nanoscience and new materials, an area of interest across the region. Albania's 2010–15 strategy proposes the creation of four or five Centers of Excellence in Science. Croatia, FYR Macedonia, and Montenegro are currently investing in similar initiatives. With the support of the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Venice Office, other networks in southeastern Europe have been created, including the Southeast European Astronomical Research Network, the Human Genetics and Biotechnology Network, and the Network for Risk Assessment and Mitigation.

¹⁰ <http://www.topuniversities.com/university-rankings/world-university-rankings>

4

TECHNOLOGY TRANSFER SYSTEM

Technology transfer is a particular challenge in the Western Balkans, and collaboration between public research organizations and industry tends to happen on an ad hoc basis, driven by occasional opportunities and short-term objectives. Robust industry-science interactions are essentially missing.

Patenting activity, which can be used to gauge the level of effort put into protecting intellectual property rights

resulting from research, has historically been low. The Western Balkans applied for 38 patents in the United States in 2012, compared to an average of 25 patents for the leading U.S. research universities and institutions.¹¹ Licensing revenues and fees received by the Western Balkans from foreign countries are estimated at 0.09 percent of GDP, compared to 0.42 percent in the EU-27.

¹¹ AUTM 2012.

Box 2: The Legal Framework for Technology Transfer: Recent Developments

- The 2013 Law on Innovation Activity in FYR Macedonia created the Fund for Innovation and Technological Development, (FITD) which finances the government's interventions in technology transfer and commercialization, thus connecting research and the market.
- In its Innovation Law of 2010, Serbia made meaningful steps in strategic planning for innovation and technology transfer. The law enables the formation of organizations that support innovation activities and technology transfer centers, provides rights to inventors to participate in revenues, and makes provisions for IPR creation by research organizations. According to Article 32 of the law, ownership rights of IPR resulting from publicly funded research belong to the organization where the IPR was created. It also requires that inventors be compensated with at least 50 percent of the profits derived from exploitation of patents. In the rest of the region, there is no legal framework that defines ownership and commercialization rights for IPR generated at research institutions. In its Strategy for the Development of Science (STI Strategy) for 2010-15, Bosnia and Herzegovina proposed an action plan for development of innovation and technology transfer, intellectual property rights, commercialization, and use of scientific patents. The strategy encourages the protection of IPRs through appropriate legal acts and the provision of funds for these purposes.
- Croatia has no special legal regulations for IPRs and technology commercialization in universities, although there are ongoing efforts to create a national policy and strategy for IPR creation and management at research institutions. Based on this project as well as several TEMPUS programs such as the project Fostering Entrepreneurship in Higher Education, offices for technology transfer and the Rudjer Boskovic Institute, have been established across Croatia (WBC-Inco.net, 2011). The first steps were taken within the Community Assistance for Reconstruction, Development and Stabilisation (CARDS) 2003 project entitled "Intellectual Property Infrastructure for the R&D Sector." The new strategy on innovation, currently being drafted, will define principles for technology creation and commercialization:
- Common law applies to ownership of IPRs. The Labor Act defines ownership principles in the relations between inventors (employee) and employers. The law gives the rights of appropriation to the employers.
- There is no explicit legal framework, however, for spin-off creation by scientists (public servants or researchers) and participation in licensing revenues. Several universities have started to develop their own institutional IPR policies and guidelines. Examples are the University of Zagreb, University of Rijeka, and University of Split.^a

Source: UNDP (2006); MIDWEB (2012); Torbakov (2012); Mustafa et.al. (2007); and Kutlaca (2012).

^a http://technology.unizg.hr/_download/repository/Pravilnik_o_Uredu_za_transfer_tehnologije.pdf

Another structural limitation of the research and innovation sector in the Western Balkans is its economic efficiency, that is, its ability to create wealth from knowledge. As an illustration, consider the ratio between R&D expenditures and patents: a unit of Serbia's or Croatia's US registered patents has required over four times more R&D expenditures than a German patent (Figure 6). This outcome, in turn, results from weak academic and technology transfer performances.

Public research organizations are fairly active in collaboration, as revealed by a survey of more than 85 organizations.¹² In a science-industry collaboration ranking of 144 countries provided by the World Economic Forum, the Western Balkans' average stands at the 88th position, compared to the 40th of the EU-27.

On the positive side, patent applications from residents of the Western Balkans in the United States have increased in the past decade, primarily due to increased activity from Croatia. Patenting activity in domestic jurisdictions, a proxy for technological catch-up, has shown more dynamism. For example, FYR Macedonia kept a relatively stable volume of applications (averaging 50 per year) in 2000–2012. In addition, examples of technology transfer have emerged, of which the most significant are the spin-off process around the University of Novi Sad in Serbia and a handful of cases in the Rudjer Boskovic Institute, Croatia's largest research organization. A sizable number of public research organizations (9 out of the 21 that provided information on the topic for the "State of R&D Infrastructure and Technology Transfer Study") reported that they finance more than half their budgets from internal sources.

Measures have been adopted to improve conditions for technology transfer from research institutes and universities. In Serbia, changes in the higher education law and the Innovation Law of 2010 have been implemented to stimulate the creation of university spin-offs and intermediary organizations for the support of innovation activities and technology transfer. Investments in the development of technology transfer offices have been a priority in Croatia but are less common in the rest of the region.

The inadequate management of intellectual property (IP) and of the relationship between science and industry is one prominent reason for the poor performance of the Western Balkans' research sector in technology transfer. Half the entities surveyed by the World Bank could not provide data on their research outputs. A total of 45 organizations stated that they do not have a unit for knowledge transfer or commercialization, and only four stated that they employ staff with this specific responsibility.¹³ The lack of skills for technology transfer management is also an important handicap, despite a number of recent efforts to build capacity in this area, as in the support the EU Tempus Project provides to technology transfer offices in institutions of higher education.

The ability of research institutions to engage in technology transfer is often limited by the lack of a regulatory framework that encourages public research organizations and researchers to own and exploit results from government-funded research. Fundamental elements of such a framework are the incentives for researchers to participate in technology transfer activities, which involve economic or career-related benefits, and assignment of responsibility for IP management to the research organization. For example, in Kosovo's INKOS, a private R&D institute established by the Kosovo* Energy Corporation, the institute's unclear legal status prevents its management from making the long-term plans necessary for the institute's future, from investing in advanced research equipment, and from engaging in knowledge transfer activities.

Several initiatives to improve the legal framework for commercialization and technology transfer of intellectual property rights (IPR) have been undertaken in Albania, Bosnia and Herzegovina, Croatia, and Serbia, as can be seen in Box 2. Yet policy and legal frameworks for the ownership and commercialization of results from publicly funded research are weak or unclear, with resulting uncertainty over the expected benefits to institutions and

¹² See World Bank 2012.

¹³ See World Bank 2012.

researchers (for example, revenue and royalty sharing) from engaging in technology transfer activities. Most of the public research organizations in the Western Balkans (56 percent) stated that they had no clear IP ownership policy in place, and a clear policy for the distribution of royalties derived from commercialization activities is missing in most cases (70 percent of respondents).

Overall, public research organizations still lack a consistent institutional approach for technology transfer. Support for the development of “soft instruments” (financing instruments, nurturing services for knowledge-based start-ups, and technology transfer offices) is scarce.

FYR Macedonia’s open calls for joint projects constitute one example of public support for the collaboration between business and academia. The Business Innovation Center of Croatia (BICRO) has been providing matching grants to support the collaboration between science and industry and the development of proofs of concept for the past five years. Evidence suggests these programs have achieved positive results.

The lack of skills for technology transfer management is another important handicap, despite a number of recent

efforts to build capacity in this area, as the support the EU Tempus Project provides to technology transfer offices in institutions of higher education.

The provision of incubation services has recently increased, in part due to support from bilateral donors. Bosnia and Herzegovina, for example, has more than 10 organizations involved in the provision of entrepreneurship and small business services, as illustrated by the Innovation Center Banja Luka and the Innovation Center Mostar. The latter project, funded by the Norwegian government, seeks to combine a business development facility and innovation center with elements of a technology park at the southern industrial zone of the city of Mostar. Kosovo’s Innovation Center currently hosts eight companies, including several university spin-offs, and is planning to launch a virtual incubator soon.

The distribution of science and technology parks, infrastructure that can sometimes enable collaboration between science and industry, is uneven. In addition, the need for these campuses is often questionable, as is their success.

5

ENTERPRISE SECTOR

The enterprise sector that emerged from the transition has a low propensity to invest in research and innovation. This shortfall affects firm performance (sales growth, labor productivity, and the like) and reduces the demand for knowledge from public research organizations, contributing to the sluggish technology transfer described previously. In addition, the development of a vibrant sector of knowledge-based start-ups, one of the core elements of dynamism in modern economies, has yet to occur.

The economic liberalization of the 1990s shifted the productive structure of the Western Balkans away from manufacturing sectors—especially those more likely to invest in R&D, such as metal mechanics and pharmaceuticals—and toward services. Overall, the share of the manufacturing sector in GDP decreased until 2008, characterizing what some observers called a “de-industrialization” process. In addition, firms in the region seem much less integrated into global value chains than Central Europe.

The decreasing propensity to invest in research can be inferred from the declining trends in the employment of researchers by the business sector in the total pool of full-time equivalent (FTE) researchers between 1989 and 2011. For instance, in FYR Macedonia and Serbia, the share of FTE researchers fell to less than 2 percent in 2011. Croatia was an exception, with the share of FTE researchers in the business sector increasing almost four times (from less than 5 percent to about 19 percent).

More recently, some governments in the region, notably FYR Macedonia and Serbia, have made significant efforts

to attract FDI in the manufacturing sector. In the case of Serbia, this effort focused on the automotive sector and resulted in the investment in a new plant from Italy’s Fiat. While these initiatives can generate some immediate

Box 3: The Competition Environment in the Western Balkans

Most Western Balkan economies have adopted measures to improve competition and promote a market-based economy under the aegis of the Stabilization and Association Process aimed at promoting policies similar to the rest of the EU.

However, the legacies of a state-led economy coupled with smaller market sizes have caused the region to continue to lag behind other economies in competition, not just in the EU but around the world.

- All Western Balkan economies ranked outside the top 100 countries on the World Economic Forum’s indicator on “local competition intensity” in 2012–13.
- More worrisome, the level of competition also seems to have decreased in the past few years, as reflected by a drop in ranking from 2008–09 for all the Western Balkans, with Croatia experiencing the sharpest fall, from 93 in 2008–09 to 120 in 2012–13.
- Except for Serbia, most of the countries in the region have not experienced drastic drops in their rankings on “the effectiveness of competition policy,” indicating government willingness to promote competition. However, these policies have not yet translated into improvement in local competition.
- For instance, Bosnia and Herzegovina has made leaps in the effectiveness of antimonopoly policy, as shown by its improvement in ranking, from 133 in 2008–09 to 86 in 2012–13. However, it still ranks a paltry 138 on intensity of local competition.

Source: UNDP (2006); MIDWEB (2012); Torbakov.

results, the general declining trend of FDI in the region indicates the limitations of this instrument for promoting modernization and innovation.

The supply of risk capital in the early stages of enterprise development is absent or at an embryonic stage. Markets in the Western Balkans are relatively better supplied with later-stage and expansion financing. However, given the characteristics of the equity industry, it is unlikely that those funds will trickle down to earlier stages of the innovation chain.

With the exception of initiatives in Croatia and Serbia, innovation financing is almost nonexistent and represents an obstacle to the development of a solid deal flow in the region. Yet schemes to promote finance for innovation have been introduced in recent years:

- Albania, through its Investment Development Agency, has established a Business Relay Innovation Center, a new grant program promoting innovation in private businesses.
- BICRO programs have been providing conditional loans to prototype and product development in Croatia.
- The recently created Science and Innovation Investment Fund will finance knowledge-based start-ups in Serbia.
- At the regional level, the recent creation of the Enterprise Development Innovation Facility (EDIF), with three financial instruments (a venture capital fund, a guarantee mechanism, and an equity fund to finance the expansion of companies) is another important initiative.

Only Croatia and Serbia provide fiscal incentives for the acquisition of scientific equipment or business expenditures in R&D. In FYR Macedonia, there was a policy of zero corporate tax on all profits re-invested in the development

of a company during 2006–10. Such an approach does not differentiate between R&D and other investments but encourages all profit-oriented companies to re-invest the profit into their development, where R&D may be included.

Governments have also tried to create a business environment that is more conducive to innovation. Yet, as suggested by the World Bank's Doing Business Indicators and the European Bank for Reconstruction and Development's Structural Reform Index, the Western Balkan region still has to advance reforms in areas that are important to innovation, such as contract enforcement, competition, access to finance, and labor market regulation. FYR Macedonia is an outlier, having made vigorous progress in addressing the cost of doing business. As discussed in Box 3 countries in the region have historically had low levels of competition, these have not been improved by competition policy reforms (2012); Mustafa et.al. (2007); and Kutlaca (2012).

Yet, there are significant positive impacts of investment in research and innovation on firm performance:¹⁴

- Innovative firms grow 15 percent faster in sales and 8 percent faster in labor productivity than non-innovative firms.
- Firm R&D expenditures contribute significantly to sales (14 percent) and growth in labor productivity (7 percent).
- When firm R&D, training, and infrastructure services are compared, R&D is shown to have the highest correlation with sales growth.

¹⁴ Seker 2012.

6

INSTITUTIONAL AND POLICY FRAMEWORK

The transition of the research and innovation sector in the Western Balkans had two important consequences for the sector's institutional and policy framework. First, it left the process of restructuring and consolidation of public research organizations unfinished. Second, it did not change critical aspects of the research and innovation policy framework, including how public funds and policy on research careers are managed. This legacy adds substantial complexity to the challenges of improving governance in national innovation policies.

One of the key aspects of the restructuring of public research organizations in the Western Balkans is the shift in researchers' employment from research institutes to institutions of higher education. Distribution of R&D funds also showed a change in the same direction, although this was of much smaller magnitude. In addition, research facilities are often under the control and ownership of research institutes, which has an important impact on the distinctions these organizations make between research and education.

The partial restructuring of the research sector has also resulted in an unsustainable fragmentation of the research institutes, with negative effects on research infrastructure and fund allocation. For instance, in Croatia there are more than 30 research institutes, compared to fewer than 5 in most Scandinavian countries. The process of restructuring research institutes has been going on for some time but has proven to be technically and politically complex.

One positive experience seems to be the restructuring of the agricultural research and extension services in Albania, where the Ministry of Agriculture, through the Department for Extension Service and Information,

finances applied research, technology transfer, training, and advisory services for farmers. Elsewhere, a command-and-control type of regulation is still in place, with little delegation to managers; this situation is exacerbated by unclear distribution of responsibilities and scarce use of performance-based instruments.

Research institutes also lack the legal framework needed to efficiently manage intellectual property, including spin-off companies. As a result, the region is at odds with modern public management practices adopted by sister organizations in the EU.

The Western Balkan countries are still working to consolidate universities as single entities, both legally and institutionally, and to define appropriate legal frameworks.

Box 4: Public Research Organizations

- The share of research institutes in the employment of FTE researchers in the Western Balkans decreased by half, from 50 to 25 percent of the total, in 1989–2011.
- Meanwhile, the share of higher education institutions in the employment of FTE researchers increased from 43 to 64 percent of the total in the same period.
- While R&D activities are financed and performed predominantly by research institutes, this has been gradually changing, with an increasing share being performed by institutions of higher education.
- In Bosnia and Herzegovina and Montenegro, institutions of higher education currently account for the largest share (around 80 and 65 percent of total gross expenditures on R&D, respectively) in 2011.

Source: UNDP (2006); MIDWEB (2012); Torbakov (2012); Mustafa et.al. (2007); and Kutlaca (2012).

Educational systems represent a mixture of the standard system inherited from the Socialist past and highly diverse policies and institutional frameworks established more recently. Overall, universities in most of the region act in a setting far less secure than those in EU countries.

Many new higher education laws try to create a modern, integrated environment that also promotes well-developed management structures and processes. Yet administrative offices have limited managerial responsibilities because these continue to lie exclusively within university departments. Universities that have been integrated by law are nonetheless still struggling with the tradition of strong faculties, which used to operate autonomously and have been full legal entities since the mid-1960s.

The region has entered the Bologna Process and is currently implementing reforms in that direction. Albania, Croatia, and Serbia have advanced in this respect. Yet there is some difficulty in implementing reforms.

Research Career Policy

A common problem of public research organizations lies in the incentives that current policies for research careers provide for research excellence and technology transfer. Structures, job classifications, and promotion rules are still overly rigid and do not sufficiently reward scientific performance, diverting the attention of researchers to objectives other than research excellence and knowledge transfer. In particular, promotion is often based solely on the number of publications rather than on their impact factors and number of citations worldwide. There is essentially no proper encouragement for researchers to participate in technology transfer activities.

Allocation of Research Funds

Block or institutional funding continues to be the dominant mechanism for allocation of research funds in the region, although competitive funding has gained some traction in recent years. Funding does not always adhere to the use of merit-driven criteria following international

standards and a formal system of international peer review, instead following other methods that have been preferred traditionally. Yet there is visible progress. For example, Montenegro has recently instituted a system of external evaluation of performance and scientific projects when researchers apply for funds.

A related issue is priority setting in the use of funds. The first consideration is the distribution of resources between basic and applied research.¹⁵ While aggregate data are unavailable, preliminary evidence suggests that the region emphasizes basic research.¹⁶ In Bosnia and Herzegovina, however, research activity seems to focus more on preproduction development. By comparison, leading economies, such as Denmark, Israel, Japan, the Republic of Korea, and the United States, have kept their recent funding allocations for basic research at or below 15 percent.

The need for broad reforms has inspired some Western Balkan countries to adopt wholesale reform through new science laws, an approach that has been hard to sell politically.

A second issue is the sector allocation of research funds. When scientific performance is taken into account, the region shows an emphasis on four areas: agricultural and biological sciences, environmental sciences, physics and astronomy, and chemistry. Yet medicine is by far the main area of publication activity in the Western Balkan countries, although it ranks low in impact compared to other areas. This speaks to the need to increase research efforts where there is science of high quality.¹⁷ In addition, the EC has advocated the application of research funds to promote a “smart specialization” by regions and countries.¹⁸

¹⁵ See, for example, Arnold and Giarracca (2012).

¹⁶ See the Policy Questionnaire for details.

¹⁷ Applied research is less risky, likely to bring fewer results (less spillover). But in the shorter term, while basic research is riskier, it is more likely to yield results (spillovers) in the long run. In developing economies, discount rates tend to be higher, placing a higher value on short-term results. In addition, as capital is expensive, emphasis on activities that are less risky is recommended.

¹⁸ Research and innovation for smart specialization strategies (RIS3) has been established by the European Commission as one of the ex ante conditionalities for the accession to structural funds in the 2014–20 period (COM 2011, 615).

Concentrating efforts in fields related to the economic needs and potential of a country or region could bring development dividends in the short term.

Policy Coordination and Institution Building

The Western Balkan countries have been very active in efforts to coordinate policies and establish organizations with implementation capacity. However, policy coordination and institution building remain a key challenge in the region:

- FYR Macedonia has established a national council to coordinate the country's innovation policy, which has been very active. The country has approved a national innovation strategy and has enacted new legislation to allow for public support to innovation financing.
- In Albania, reforms have been undertaken to improve the strategic governance of research and innovation policies. A coordinating agency under the Council of Ministers has been created to support, monitor, and assess science, technology, and innovation programs and projects, using funds from the state budget, international programs, and the private sector intended for R&D and innovation.
- In 2012, the government of Montenegro established a new Council for Scientific and Research Activity that includes representatives from the public and private sectors, research institutes, and academics. A new law governing scientific research activity was adopted in December 2010, setting out conditions for state funding for both public and private institutions in priority areas in line with the Seventh Framework Program (FP7).
- The region has made less progress in designing, monitoring, and evaluating research and innovation policies and programs. The simple monitoring of program inputs and outputs is undertaken only occasionally and on an ad hoc basis. The result is that very little is known about the disbursement of budgetary resources. There is a generally low level of awareness of the importance of systematic assessment and rigorous impact evaluation. The regional capacity to implement such evaluations urgently needs improvement.

- One exception is Serbia, which has been functioning well in evaluation since the inception of the Innovation Fund.¹⁹
- Another exception is Croatia, which has evaluated the BICRO program and the Unity through Knowledge Fund, with the findings supporting behavioral additionally of the programs.

Regional Cooperation

The European Union and the Western Balkans have a fairly long history of bilateral cooperation in R&D. Cooperation in R&D has been part of the Stabilization and Association Agreements negotiated by the EU and the Western Balkans within the framework of the Stabilization and Association Process that followed the peace negotiations in the region. Cooperation with the EU has achieved many important results:

- The implementation of the Stabilization and Association Agreements provides a natural framework for the progressive compliance with the EU *Acquis Communautaire* in the field of R&D (chapter 25, "Science and Research").
- The region participates in the FP7 and is actively involved in the European Cooperation in Science and Technology (COST) and Eureka programs.
- The association status also entitles participants to nominate representatives as observers in the corresponding FP7 committees as well as in the Scientific and Technical Research Committee (CREST) and other ERA governing bodies. Through association with the FP7, the region gained access to the EU's Joint Research Center and can take advantage of the capacity building and training on EU-related policies.

The experience of regional cooperation on R&D in the Western Balkans is limited and needs to be strengthened. Between 2005 and 2010, governments in the Western Balkans were supported by EU funds, predominantly through the Framework Program coordination and support

¹⁹ Radas et al. 2011.

actions, in their efforts to integrate into the ERA and rebuild the once-strong cooperation in R&D.²⁰

²⁰ Two examples are the FP6 Southern European Research Area (SEE-ERA.NET) project, a networking project aimed at integrating EU member states and southeast European countries into the ERA by linking research activities to existing national, bilateral, and regional research, technology, and development programs, and the FP7 WBC-INCO.NET, a project aimed at coordinating research policies within the Western Balkans.



CONCLUSION

The contribution that the “knowledge factor” can make to the region’s economic growth is being hindered by a combination of unfinished reforms and incomplete development of overall framework conditions, key institutions, policies, and programs:

- Reforms and policies have been essentially partial, small in scale, and short-lived due either to a lack of second-round financing for the projects or political changes following elections.
- Reform initiatives, even when supported by international organizations, have thus far failed to alter the structural deficiencies of the research and innovation sector in the Western Balkans.
- Several interventions, however, have had a similar focus, duplicating the services provided.
- Fragmentation and limited coherence are sometimes observed even among initiatives supported by international donors.

To unleash the innovative potential of the region and address the EU-related opportunities and requirements in research and innovation, the region needs to invest in more and better research and innovation. This requires a two-pronged approach, namely, advancing institutional and policy reforms and undertaking strategic investments that will:

- Improve the research base and conditions for research excellence
- Promote science-industry collaboration and technology transfer
- Enable business innovation and innovative start-ups
- Strengthen the governance of national research and innovation policies

In working to achieve these objectives, there is value from taking a regional approach. Apart from the region’s common history and heritage, economic factors favor a deeper collaboration among. The small size of the regional economies limits individual research and innovative potential. This suggests that pooling regional resources to create critical mass might pay major economic dividends.

A regional approach is proposed in the *Regional Research and Development (R&D) Strategy for Innovation*. The strategy proposes a number of programs that build on the recent experience on regional cooperation in the area of research and innovation among the Western Balkan countries through bilateral agreements and initiatives funded by the EU. The comprehensive, sector-wide approach adopted by the Strategy complements the treatment of other regional initiatives, notably the Danube and Adriatic Ionic Strategies.

REFERENCES

- Arnold, E., and F. Giarracca. 2012. "Getting the Balance Right: Basic Research, Missions and Governance for Horizon 2020". Brighton: Technopolis Group.
- AUTM. 2012. "AUTM US Licensing Activity Survey, Highlights" AUTM: Deerfield, IL: Dec. 10, 2012
- Correa, P. and Zuniga, P. 2013. "Public Policies to Foster Knowledge Transfer from Public Research Organizations" Innovation, Technology and Entrepreneurship Global Practice, Washington, DC: March 2013
- EC (European Commission). 2013. "Innovation Union Scoreboard 2013". Available at: http://ec.europa.eu/enterprise/policies/innovation/files/ius-2013_en.pdf
- . 2011. "Regulation of the European Parliament and of the Council COM(2011)615". Brussels: EC.
- Kutlaca, D. 2010. "Circulation of Scientific Talent and Communication with Diasporas." Paper presented at the EREF "Workshop on Knowledge Transfer for Development," Istanbul, Turkey, May 12, 2010.
- MIDWEB (Migration for Development in the Western Balkans). 2012. "Roundtable Report: Best Practices in Professional and Socio-Economic Reintegration of Skilled Migrants." Skopje: MIDWEB, http://www.migrantservicecentres.org/userfile/Roundtable_Skopje_report.pdf.
- Mustafa, M., Kotorri, M., Gashi, P., Gashi, A., and Demukaj, V. 2007. "Diaspora and Migration Policies", Prishtina: Riinvest Institute (<http://www.riinvestinstitute.org/publikimet/pdf/50.pdf>)
- Radas, S., I.-D. Anić, I. Božić, J. Budak, and E. Rajh. 2011. "Evaluation of the Innovation Programs Financed by the World Bank in Croatia." Institute of Economics, Zagreb.
- SCIMAGO Research Group. 2012. "The State of Scientific Performance in the Western Balkan Countries." Background paper for Western Balkans Regional R&D Strategy for Innovation Technical Assistance. World Bank, Washington, DC.
- Seker, M. 2012. "An Evaluation of Innovation Activities in West Balkans." Background paper for Western Balkans Regional R&D Strategy for Innovation Technical Assistance Project. World Bank, Washington, DC.
- Torbakov, G. 2012. "Best Practices in Professional and Socio-economic Reintegration of Skilled Migrants." Paper presented at the "Forum on Migration for Development in the Western Balkans," Skopje: June 7, 2012.
- UNDP. 2006. "From Brain Drain to Brain Gain: Mobilising Albania's Skilled Diaspora, Policy Paper for the Government of Albania" Prepared by the Centre for Social and Economic Studies, in collaboration with the Development Research Centre on Migration, Globalisation and Poverty, University of Sussex, Tirana: April 2006
- University of Zagreb. 2009. "Pravilnik o Uredu za Transfer Tehnologije" (Regulations on the Technology Transfer). Available at: http://technology.unizg.hr/download/repository/Pravilnik_o_Uredu_za_transfer_tehnologije.pdf
- World Bank. 2012. "An Assessment of R&D Infrastructure and Technology Transfer Activities in Research Institutions in the Western Balkans". Background Paper for the Western Balkans regional R&D Strategy for Innovation Technical Assistance Project, World Bank, Washington, DC.

World Bank. 2013. "The Status of the Western Balkans Research and Innovation Sector: An Overview. Summary Report for the Western Balkans Regional R&D Strategy for Innovation Technical Assistance Project." Washington, DC: World Bank.

World Bank. 2013a. "Western Balkans Regional R&D Strategy for Innovation." Washington, DC: World Bank.

World Development Indicators (database). World Bank, Washington, DC, <http://data.worldbank.org/data-catalog/world-development-indicators>.

Web Sites:

<http://erasmus-westernbalkans.eu/>

<http://www.topuniversities.com/university-rankings/world-university-rankings>

