Southeast European countries are advised to invest more and better in research and innovation, prioritizing investment and a 'smart specialization' of the region.

Djuro Kutlaca

The distinctive blue trams in Zagreb, Croatia, are equipped with an energy recovery system. When the driver brakes, the power generated is fed back into the electrical network.

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10 · Southeast Europe

Albania, Bosnia and Herzegovina, Croatia, Former Yugoslav Republic of Macedonia, Montenegro, Serbia, Slovenia

Djuro Kutlaca

INTRODUCTION

A heteroclitic region with a common goal

Southeast Europe[1] was home to 25.6 million inhabitants in 2013. The region is characterized by strong economic disparities, with GDP per capita being three times higher in the richest country (Slovenia) than in the poorest (Albania) [Table 10.1].

Countries are also at different stages of European integration. Slovenia has been a member of the European Union (EU) since 2004 and Croatia since 2013. Three countries have candidate status: the Former Yugoslav Republic of Macedonia since 2005, Montenegro since 2010 and Serbia since 2012. Albania was proposed for candidate status in June 2014. As for Bosnia and Herzegovina, it was identified as a potential candidate for EU membership as long ago as June 2003, during the Thessaloniki European Council Summit, but uncertainty hangs over the procedure for its membership. For all five non-member countries, European integration represents the only viable project for ensuring social and political coherence. Their integration would benefit Slovenia and Croatia too, as prosperous neighbours would offer the best guarantee of political stability and economic growth.

Following the disintegration of Yugoslavia in the 1990s, all Southeast European countries were confronted with the challenge of post-socialism. Unfortunately, this economic transition came at a cost; it fragmented and deteriorated countries' science systems, resulting in brain drain and obsolete infrastructure for research and development (R&D), as described in the *UNESCO Science Report 2005*. Like Croatia and Slovenia, all five non-EU countries have since completed their transition to open market economies. They remain burdened, however, with high unemployment rates, unacceptable levels of corruption and underdeveloped financial systems.

Economies shaken by the global recession

Croatia, Greece and Slovenia have been more badly affected by the global financial crisis than their neighbours (Table 10.1), having experienced negative average growth rates between 2009 and 2013. Across the region, recovery has been fragile and partial, with unemployment rates rising steeply in Croatia, Greece, Serbia and Slovenia and remaining high in the other countries. Like the Eurozone, the Western Balkans are experiencing what the International Monetary Fund (IMF) terms 'low-flation', a combination of durably poor economic growth and low inflation rates which raise the spectre of deflation. With a deficit of 12.7% and 14.7% respectively in 2013, according to Eurostat, Greece and Slovenia are among the seven countries which failed to respect the 3% deficit ceiling imposed by the Eurozone's[2] Stability Pact.

1. Excluding Greece; Greece is mentioned at times in the present chapter for comparative purposes but, having been a member of the European Union since 1981, it is covered in Chapter 9.

2. The Eurozone comprises the 19 EU countries which have adopted the single currency of the euro.

Table 10.1: **Key socio-economic indicators for Southeast Europe, 2008 and 2013**

	Inflation, consumer prices (annual %)		Annual average GDP growth rate		GDP per capita, current $PPP		Unemployed (% of labour force)		Employment in industry (% total employment)		Gross fixed capital formation * (% of GDP)		Exports of goods and services % of GDP)		FDI net inflows (% of GDP)	
	2008	2013	2002–2008 (%)	2009–2013 (%)	2008	2013	2008	2013	2008	2012	2008	2012	2008	2012	2008	2012
Albania	3.4	1.9	5.5	2.5	8 874	10 489	13.0	16.0	13.5	20.8[-2]	32.4	24.7	29.5	31.3	9.6	10.0
Bosnia and Herzegovina	7.4	-0.1	5.6	-0.2	8 492	9 632	23.9	28.4	–	30.3	24.4	22.1	41.1	31.2	5.4	2.0
Croatia	6.1	2.2	4.4	-2.5	20 213	20 904	8.4	17.7	30.6	27.4	27.6	18.4	42.1	43.4	8.7	2.4
Greece	4.2	-0.9	3.6	-5.2	29 738	25 651	7.7	27.3	22.3	16.7	22.6	13.2	24.1	27.3	1.7	0.7
FYR Macedonia	8.3	2.8	4.1	1.5	10 487	11 802	33.8	29.0	31.3	29.9	23.9	21.2	50.9	53.2	6.2	2.9
Montenegro	8.8	2.1	5.6	0.2	13 882	14 318	16.8	19.8	19.6	18.1	27.7	16.9	38.8	42.4	21.6	14.1
Serbia	12.4	7.7	4.9	0.0	11 531	12 374	13.6	22.2	26.2	26.5	20.4	26.3[-1]	31.1	38.2[-1]	6.3	0.9
Slovenia	5.7	1.8	4.5	-1.9	29 047	28 298	4.4	10.2	34.2	30.8	27.5	19.2[-1]	67.1	71.3[-1]	3.3	-0.5

n = data refer to n years before reference year.

Source: World Bank's World Development Indicators, January 2015

The effects of the crisis can be observed in the Western Balkans through the changing structure of exports in 2009–2010. Some studies show that intraregional Western Balkan trade is relatively concentrated, with the top six products representing 40% of total imports: four commodity products (mineral fuels, iron, steel and aluminium) and two other industrial product types: beverages and electrical machinery and equipment. The main export market for all Western Balkan economies is the EU. This high level of dependence is exacerbated by EU trade preferences and the prospect of EU membership for Western Balkan countries (Bjelić *et al.*, 2013).

Easing into EU integration via regional trade

All seven countries have been party to the Central European Free Trade Agreement (CEFTA) at one time. CEFTA was launched in 1992 to help countries prepare for EU integration and counted Poland, Hungary, the Czech Republic and Slovakia among its initial members. Slovenia joined in 1996 and Croatia in 2003 but their membership automatically ended once they became EU members (see Chapter 9).

On 19 December 2006, the five remaining countries of Southeast Europe joined CEFTA, as well as the United Nations Interim Administration Mission in Kosovo[3] on behalf of Kosovo. Despite its professed objective of helping countries integrate the EU, a certain number of trade barriers remain today. In construction, there are limitations on cross-border supplies and on the acceptance of foreign licenses. In land transport, trade is limited by heavy regulations, market protectionism and the presence of state-owned monopolies. Most restricted of all is the legal sector, where the only services open to non-nationals are advisory services. By contrast, information technology (IT) services are only lightly regulated, with trade in this sector depending largely on other factors, such as demand for such services and the level of intellectual property protection. Of note is that the barriers and regulations differ from one country to another. This means that CEFTA countries with restricted trade in services can learn from their neighbours with more open systems how to liberalize these services.

Since 2009, Parties to CEFTA have been systematically identifying barriers to trade and proposing solutions, including via the development of a database to help pinpoint the correlation between barriers to market access and trade volume.

3. This designation is without prejudice to positions on status and is in line with United Nations Security Council Resolution 1244 and the International Criminal Court Opinion on the Kosovo Declaration of Independence made in February 2008.

TRENDS IN STI GOVERNANCE

Slovenia could serve as a model for its neighbours

All seven countries of Southeast Europe share a common desire to adopt the EU's science-oriented innovation model. They can be grouped into four categories, according to the pace of transition: Albania and Bosnia and Herzegovina show the slowest and most uncertain dynamics, despite ongoing support from UNESCO for Albania and the EU for Bosnia and Herzegovina. The Former Yugoslav Republic (FYR) of Macedonia and Montenegro fall into the second category: they are still searching for an appropriate innovation system. The third group consists of Croatia and Serbia, which both have fairly developed infrastructure and institutions. Croatia is having to speed up its restructuration process since incorporating the EU, as it now needs to apply EU regulations and practices in terms of smart specialization (see below), regional governance, foresight exercises for priority-setting and innovation policy as a governance model, among other things.

Slovenia is in a category of its own; it is not only the most advanced country in an economic sense but also in terms of the dynamism of its innovation system: Slovenia devoted 2.7% of GDP to R&D in 2013, one of the highest ratios in the EU. Of course, the growth and innovation capacity of a country depends not only on the supply of R&D but also on the country's ability to absorb and diffuse technology, combined with demand for its generation and utilization (Radosevic, 2004). Aggregating these four dimensions gives the national innovation capacity (NIC) index. According to Kutlaca and Radosevic (2011):

> *Slovenia emerges as the clear regional leader. It is the only Southeast European economy which ranks around the EU average for the majority of NIC indicators. Slovenia is followed by Hungary, Croatia, Bulgaria and Greece. These countries are above the Southeast European average. The national innovation capacities of Serbia, Romania, the FYR of Macedonia and Turkey are least developed. If data were available for Bosnia and Herzegovina and for Albania, we suspect that these economies would belong to the lower segment of Southeast European countries.*

Slovenia could serve as a model for other Southeast European countries where universities still favour teaching over research and the structure of R&D systems remains oriented more towards scientific authorship than co-operation with industry and the development of new technologies.

The big challenge for Southeast European countries will be to integrate their R&D system into the economy. The *Western Balkans Regional Research and Development Strategy*

for Innovation should serve as a framework for collective reforms, in order to promote the Western Balkans' most urgent priority of nurturing innovation, economic growth and prosperity (Box 10.1). The strategy stresses the distance still to travel. '*The Western Balkans' economic and political transition in the 1990s had serious, often negative consequences for the region's research and innovation sectors. With economic reforms dominating the policy agenda, science, technology and innovation policies became a secondary priority, research capacity deteriorated and links with the productive sector disappeared*' (RCC, 2013).

Towards smart specialization

The goal of the *South East Europe (SEE) 2020 Strategy: Jobs and Prosperity in a European Perspective*[4] is to improve living conditions and bring competitiveness and development back into focus. Inspired by its namesake, the EU's *Europe 2020 Strategy*, the SEE strategy has been designed to favour regional co-operation, accelerate harmonization with the EU's regulatory framework and support the accession process.

The *SEE 2020 Strategy's* main targets are to more than double regional trade turnover from € 94 billion to € 210 billion, raise the region's GDP per capita from 36% to 44% of the EU average, reduce the region's trade deficit from 15.7% (on average between 2008 and 2010) to 12.3% of GDP and open up the region to 1 million new jobs, including 300 000 jobs for the highly qualified.

The *SEE 2020 Strategy* was adopted in Sarajevo on 21 February 2013, at the Ministerial Conference of the South East Europe Investment Committee. It had been under preparation by the Regional Cooperation Council since 2011, in collaboration with national administrations, within a project funded by the EU.

4. See: www.rcc.int/pages/62/south-east-europe-2020-strategy

Box 10.1: The Western Balkans' first innovation strategy

The first *Western Balkans Regional Research and Development Strategy for Innovation* was endorsed in Zagreb, Croatia, on 25 October 2013 by the ministers of science from Albania, Bosnia and Herzegovina, Croatia, Kosovo, FYR Macedonia, Montenegro and Serbia.

The proposed *Action Plan for Regional Co-operation* complements, strengthens and builds upon national strategies, policies and programmes, while recognizing the different levels of development of research systems and their contribution to development. The action plan proposes five regional initiatives:

- The Western Balkans Research and Innovation Strategy Exercise (WISE) Facility provides regional technical assistance to support the implementation of reforms in Western Balkan countries, including via training. The WISE facility serves as a platform for policy exchange, public policy dialogue, capacity-building and policy advocacy;
- A research excellence fund to promote collaboration between local scientists and the scientific diaspora, along with further integration of young scientists in the European Research Area;
- A programme to encourage the development of 'networks of excellence' in areas consistent with the 'smart specialization' of the region and the rationalization of resource use, focusing research on areas with greater economic impact;
- A technology transfer programme for public research organizations, to facilitate their collaboration with industry, including joint and contract research, technical assistance, training, technology licensing and the creation of spin-offs from public research organizations; and
- An early-stage start-up programme to provide pre-seed funding (proof of concept and prototype development) and business incubation and mentoring programmes to help bridge the 'valley of death' stage in bringing an idea to the marketplace and help develop a pipeline for venture capital investors.

The strategy was developed between December 2011 and October 2013 within an EU project, in collaboration with UNESCO and the World Bank. The project was co-ordinated jointly by the Regional Cooperation Council, European Commission and government officials from the aforementioned countries, who formed the Project Steering Committee.

The process was launched by the Joint Statement of Sarajevo, signed on 24 April 2009 by the ministers of science from the Western Balkans, the EU Commissioner for Science and Research and the Czech Republic Presidency of the European Council, under the auspices of the Secretary-General of the Regional Cooperation Council.

The European Commission and Regional Cooperation Council oversaw the implementation of the project, which was financed through one of the EU's Multi-beneficiary Instruments for Pre-accession Assistance (IPA).

Source: World Bank and RCC (2013)

Box 10.2: **Southeast Europe defines its energy future**

Southeast Europe's first *Energy Strategy* was adopted by the Ministerial Council in October 2012 and covers the period to 2020. The aim is to provide sustainable, secure and affordable energy services. The countries of the region adopted this *Energy Strategy* in order to implement energy market reforms and promote regional integration, as signatories to the Energy Community Treaty, which entered into force in July 2006.

As the European Commission put it in a report to the European Parliament and Council (2011), *'The very existence of the Energy Community, only ten years after the end of the Balkan conflict, is a success in itself, as it stands as the first common institutional project undertaken by the non-European Union countries of South East Europe."*

The Energy Community Secretariat has its seat in Vienna, Austria. The Parties to the treaty establishing the Energy Community are the European Union plus eight Contracting Parties, namely: Albania, Bosnia and Herzegovina, Kosovo, FYR Macedonia, Moldova, Montenegro, Serbia and Ukraine. With the decision, in December 2009, to authorize the accession of Moldova and Ukraine to the Energy Community, the geographical concept of the Western Balkans, with which the process was initially linked, lost its raison d'être. Today, the mission of the Energy Community has thus evolved into importing the EU energy policy into non-EU countries.

Southeast Europe's *Energy Strategy* to 2020 proposed a choice of three possible scenarii for future action: current trends, minimal investment costs and a low emissions/sustainability scenario which presumed that the region would progress on a sustainable development path.

The SEE 2020 Strategy: Jobs and Prosperity in a European Perspective sets the region on the EU's sustainable growth path by making sustainable growth one of the five pillars of the region's new development model (see below). It states that '*sustainable growth requires sustainable and accessible transport and energy infrastructure, a competitive economic base and a resource efficient economy… The need to reduce our carbon footprint, while at the same time meeting the increasing level of energy consumption, requires new technological solutions, modernization of the energy sector and more and better dialogue with our neighbours. New market mechanisms need to be introduced that will be appropriate to accommodate new energy sources'*.

One of the *SEE 2020 Strategy*'s key targets is to develop and implement measures to increase efficient use of energy by achieving a minimum 9% energy-saving target by 2018, in line with its commitments to the Energy Community, through the adoption of the Energy Services Directive in 2009. A second target is to achieve a 20% share of renewable energy in gross energy consumption by 2020.

These energy targets complement those for the transport, environment and competitiveness dimensions of the sustainable growth pillar. For instance, rail and river transportation is to be developed; the volume of annual forestation is to be increased, partly in order to provide a larger carbon sink; and countries are to be encouraged to create an enabling environment for private sector participation in financing water infrastructure.

Source: www.energy-community.org

The strategy is built around five interrelated 'pillars of the new development model':

- *Integrated growth*: through regional trade and investment linkages and policies;
- *Smart growth*: through education and competencies, R&D and innovation, digital society, cultural and creative sectors;
- *Sustainable growth*: energy (Box 10.2), transport, environment, competitiveness;
- *Inclusive growth*: employment, health;
- *Governance for growth*: effective public services, anti-corruption, justice.

The reasoning behind the smart growth pillar is that innovation and a knowledge economy are the main drivers of growth and job creation in the 21st century. To support the building block of R&D and innovation, Southeast European countries are advised to invest more and better in research and innovation, prioritizing investment and a 'smart specialization' of the region. This implies advancing institutional and policy reforms and investing strategically in four areas:

- Improving research excellence and productivity by investing in human capital for research; upgrading and better using available infrastructure; improving the incentive regime for research performance; and advancing the Bologna Process[5] and further integration into the European Research Area;
- Facilitating science–industry collaboration and technology transfer by further aligning the regulation of intellectual property management in public research organizations;

5. See the *UNESCO Science Report 2010*, p. 150

developing technology transfer organizations (such as technology transfer offices), financial support for science–industry collaboration and for the development of proof of concept and building a closer, structural relationship with the business community;

- Promoting business innovation and innovative start-ups by improving the business environment, providing mentoring systems from prototype and pre-seed to growth and expansion and guaranteeing a proper supply of technology, science parks and incubation services that can host and nurture young firms;
- Strengthening the governance of national research and innovation policies, continuing capacity-building in key institutions, reforming career development to better reward research excellence, science–industry collaboration and technology transfer; reforming research institutes to improve performance; and increasing the transparency, accountability and impact evaluation of research and innovation policies.

The actions proposed within the smart growth pillar are those defined by the *Western Balkans Regional R&D Strategy for Innovation*.

A need for better statistics

With the exception of Croatia and Slovenia, there is a lack of statistical data on R&D systems in Southeast Europe and questions as to the quality of available data. The collection of data on R&D in the business enterprise sector is particularly problematic.

In October 2013, the UNESCO Institute for Statistics and UNESCO's Regional Office for Science and Culture in Europe, which is based in Venice, put the final touches to their strategy for helping the statistical systems of the Western Balkans adopt EU standards in monitoring national trends in research and innovation by 2018.

The strategy proposes launching a regional project which could be funded and implemented within the *Western Balkans Regional R&D Strategy for Innovation*. The project would provide opportunities for training and staff exchanges, while fostering networking among statistical offices. It would also provide national data to help assess the extent to which the *Western Balkans Regional R&D Strategy for Innovation* succeeds in boosting R&D activity by 2020.

UNESCO proposes establishing a Regional Co-ordination Mechanism in the area of STI statistics which could be hosted either by UNESCO's office in Venice or its antenna in Sarajevo and managed in close co-operation with the UNESCO Institute for Statistics and Eurostat.

Adhering to Horizon 2020 to accelerate EU integration

In July 2014, the remaining five non-EU countries in Southeast Europe announced their decision to join the EU's Horizon 2020 programme, which succeeds the EU's Seventh Framework Programme for Research and Technological Development (2007–2013), in which they also participated. The relevant association agreements, which apply retroactively from 1 January 2014, allow entities from these five countries to compete for R&D funding under the Horizon 2020 programme.

Meanwhile, all seven Southeast European countries are developing bilateral scientific co-operation with their European neighbours and participating in a number of multilateral frameworks, including the European Cooperation in Science and Technology (COST) programme, which fosters co-operative networking by funding researchers' participation in conferences, short-term scientific exchanges and the like. Another example is Eureka, a pan-European intergovernmental organization which fosters market-driven industrial R&D through a bottom-up approach that allows industry to decide which projects it wishes to develop. Southeast European countries also participate in the North Atlantic Treaty Organization's Science for Peace and Security programme and are members of various United Nations bodies, including the International Atomic Energy Agency.

TRENDS IN R&D

Still a long way to go towards competitive business

Most Southeast European countries are faced with stagnating or falling investment in R&D. The exception is Slovenia, which almost doubled its R&D effort to 2.65% of GDP between 2007 and 2013, despite being hit by recession (Figure 10.1).

Differences in gross domestic expenditure on research and development (GERD) become clearer when population size is taken into account (Figure 10.2). For example, in 2013, Slovenian investment per capita in R&D was 4.4 times that of Croatia and 24 times that of Bosnia and Herzegovina.

In all but Slovenia, the government remains the main source of funding (Figure 10.3). Increasingly, the academic sector is funding and performing R&D, while the business sector continues to play a modest role. This confirms that countries are still in the process of restructuring their R&D systems to make them more innovative and competitive (Table 10.2). Even in Slovenia, the combination of negative growth and an indebted public banking sector has shaken investor confidence (Table 10.1 and page 291).

Figure 10.1: **GERD/GDP ratio in Southeast Europe, 2003–2013 (%)**

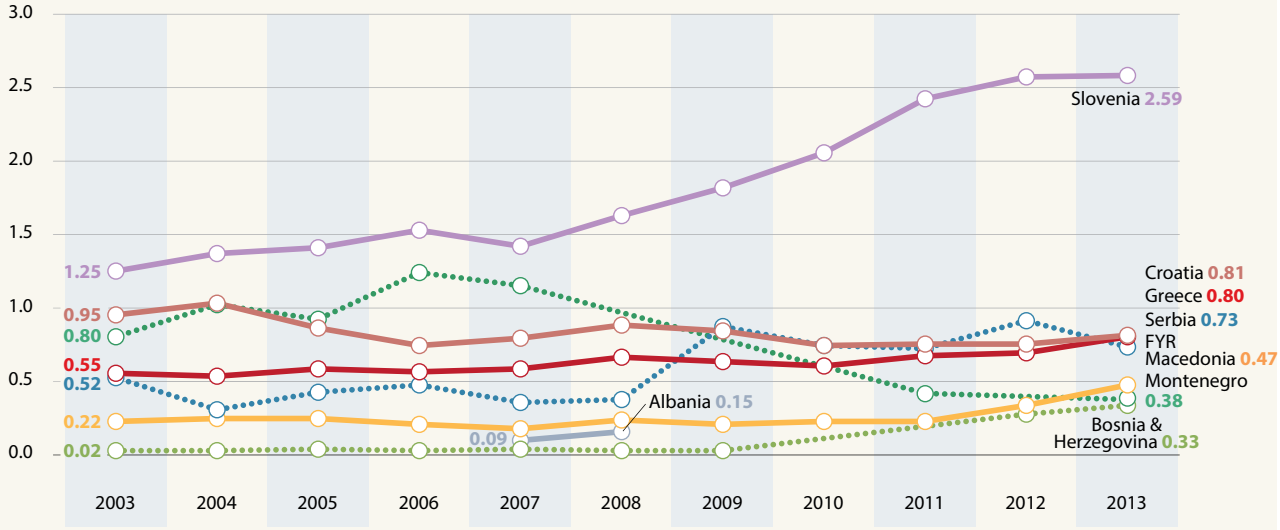
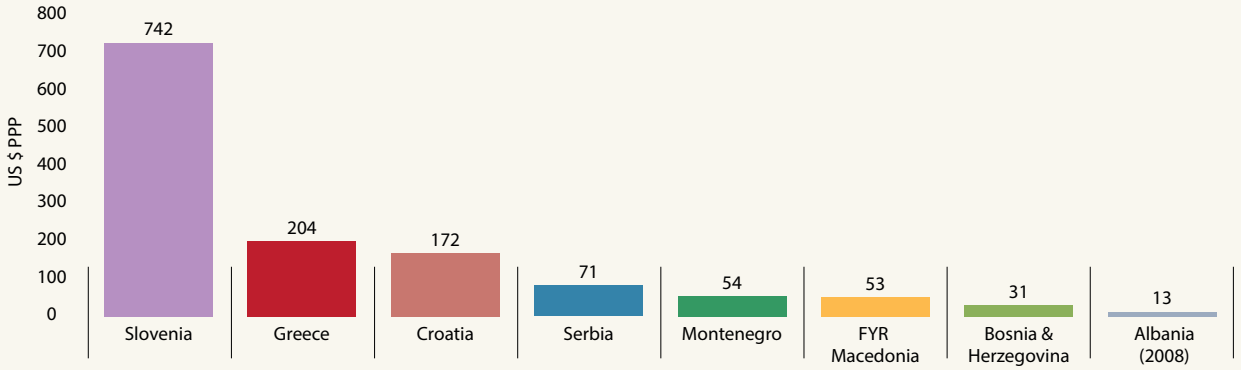
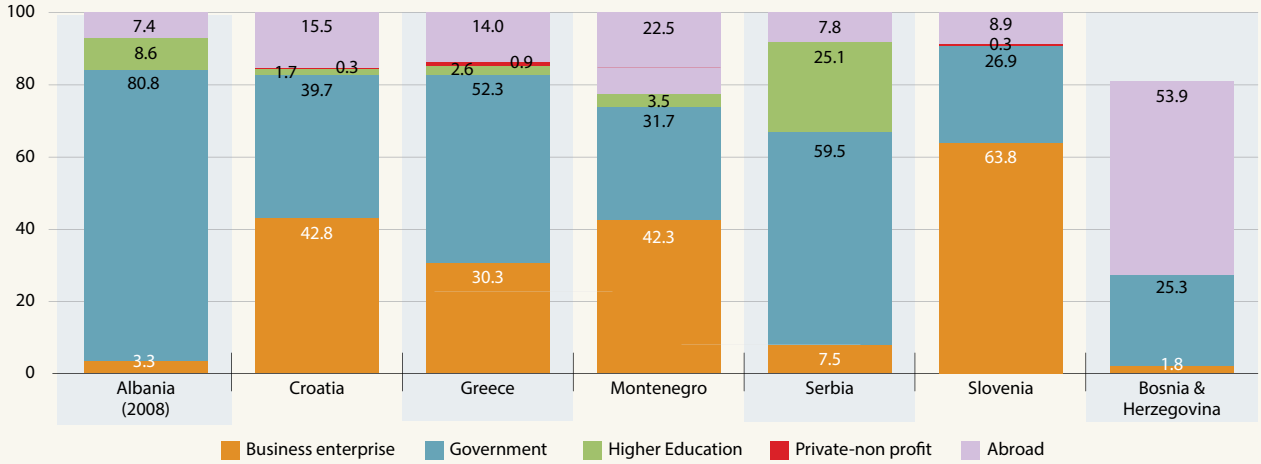


Figure 10.2: **GERD per capita in Southeast Europe, 2013 (%)**



Source: UNESCO Institute for Statistics, August, 2015

Figure 10.3: **GERD in Southeast Europe by source of funds, 2013 (%)**



Note: The total for Bosnia & Herzegovina does not add up to 100%, as a further 19% has not been attributed. There are no recent data for FYR Macedonia.
Source: UNESCO Institute for Statistics, August 2015

A region still struggling with brain drain

During the transition to a market economy, Southeast European countries suffered severe brain drain. Sluggish economic growth in recent years has not staunched the flow, even in Slovenia. All countries in the region rank poorly for their capacity to retain and attract talent, according to the Global Competitiveness Report (WEF, 2014). Only three countries rank in the top 100 out of 148 countries for their ability to retain talent: Albania, Greece and Montenegro. Of these, Greece slips to 127th place for its capacity to attract talent, a consequence of the debt crisis the country has been experiencing[6] since 2008 (Table 10.3). The Government of Albania made a concerted effort to attract talent through its Brain Gain Programme in 2008–2009 by opening up 550 vacancies in higher education to international recruitment and committing state funds to this programme for the first time (Republic of Albania, 2009).

6. Government debt represented 121% of GDP in 2008. In return for an emergency bail-out package from the European Central Bank which swelled Greece's total debt burden to 164% of GDP in 2012, the government has been obliged to make drastic cuts in public expenditure.

More graduates means a bigger research base

The strong growth in the number of tertiary graduates over the period 2005–2012 has logically translated into a greater number of researchers (Figures 10.4 and 10.5). The majority of employment opportunities tend to be in academia. In Bosnia and Herzegovina and Slovenia, the surge in researchers has been spectacular but this rise is above all a consequence of better statistical coverage (Table 10.4). For Slovenia, the rise can be explained by a massive injection of R&D funding in recent years. In all but Croatia and Slovenia, demand for business sector R&D is low. In Albania and Bosnia and Herzegovina, it is almost non-existent (Figure 10.3).

Table 10.2: **Global competitiveness in Southeast Europe, 2012–2014**

	Ranking out of 144 countries			Stage* of development
	2012	2013	2014	2014
FYR Macedonia	80	73	63	Efficiency-driven
Montenegro	72	67	67	Efficiency-driven
Slovenia	56	62	70	Innovation-driven
Croatia	81	75	77	Transition from efficiency-driven to innovation-driven
Greece	–	91	81	Innovation-driven
Bosnia & Herzegovina	88	87	–	Efficiency-driven
Albania	89	95	97	Efficiency-driven
Serbia	95	101	94	Efficiency-driven

*See the glossary on page 738 *Source:* WEF (2012, 2013, 2014) *Global Competitiveness Reports.* World Economic Forum

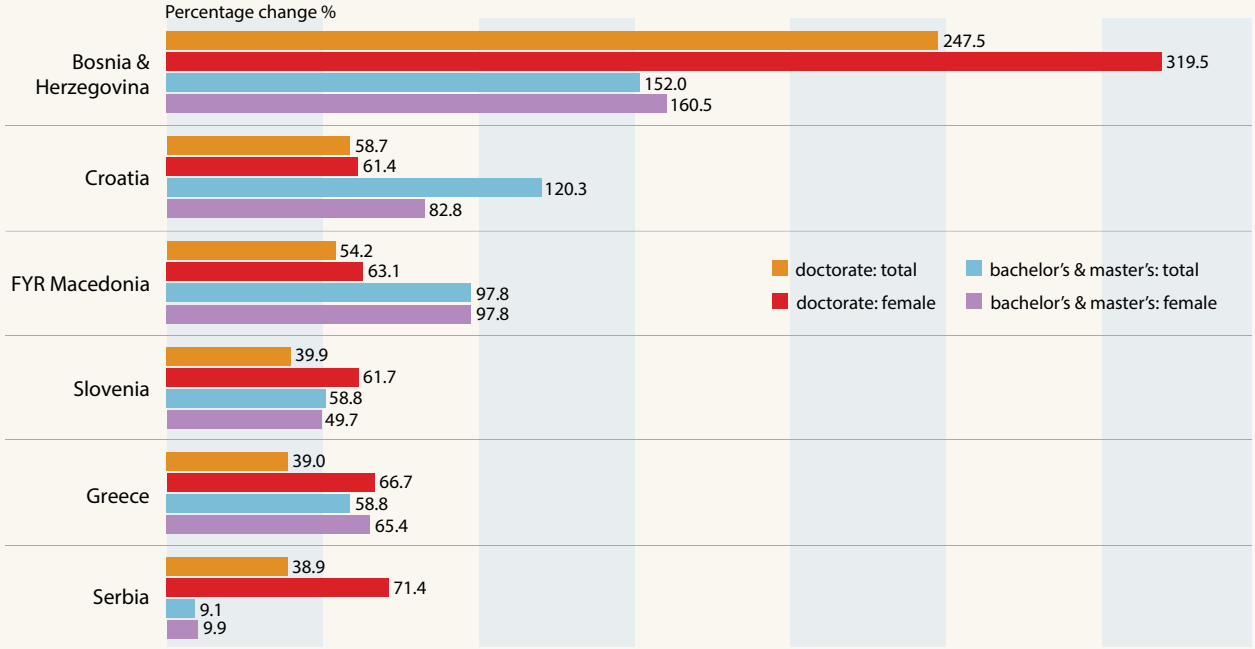
Table 10.3: **Capacity of Southeast Europe to retain and attract talent, 2014**

Country's capacity to retain talent			Country's capacity to attract talent		
Country	Value	Rank (148 countries)	Country	Value	Rank (148 countries)
Albania	3.1	93	**Albania**	2.9	96
Bosnia & Herzegovina	1.9	143	**Bosnia & Herzegovina**	1.9	140
Croatia	2.1	137	**Croatia**	1.8	141
Greece	3.0	96	**Greece**	2.3	127
FYR Macedonia	2.5	127	**FYR Macedonia**	2.2	134
Montenegro	3.3	81	**Montenegro**	2.9	97
Serbia	1.8	141	**Serbia**	1.6	143
Slovenia	2.9	109	**Slovenia**	2.5	120

Source: WEF (2014) *Global Competitiveness Report 2014–2015;* for Bosnia and Herzegovina: WEF (2013) *Global Competitiveness Report 2013–2014*

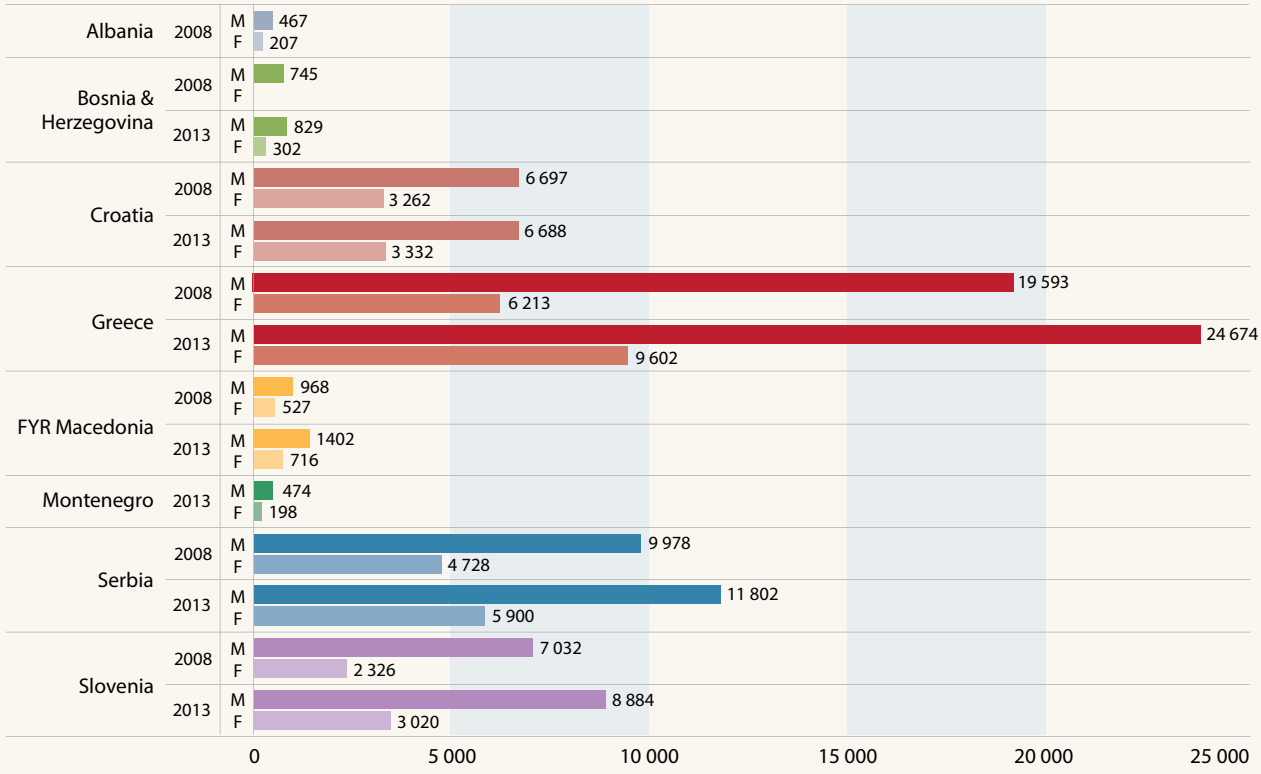
Figure 10.4: **Growth in number of tertiary graduates in Southeast Europe, 2005–2012**

Selected countries



Note: For Bosnia & Herzegovina and Serbia, the period covered is 2007–2012 and for Greece, 2007–2011.
Source: UNESCO Institute for Statistics, April 2015

Figure 10.5: **Number of researchers in Southeast Europe, 2008 and 2013**



Source: UNESCO Institute for Statistics, April 2015

The share of women researches in Southeast Europe is much higher than the EU average. Within the region, all but Greece and Slovenia have maintained or attained gender parity since 2005, or are on the verge of attaining it, as in the case of Albania (Table 10.4).

A region where engineering dominates research

The majority of researchers tend to be engineers in Croatia, Greece, Serbia and Slovenia. In FYR Macedonia, most researchers work in engineering, followed by medical sciences. Researchers in Montenegro tend to be employed in medical sciences and those in Albania in agriculture. It is interesting to note that about one in three engineers are women. Slovenia stands out as being the only case where women represent just one in five engineers. In medical sciences and the humanities, there even tend to be more women researchers than men (Table 10.5). This also happens to be the case for agriculture in Montenegro, Serbia and Slovenia, for natural sciences in Montenegro, Serbia and FYR Macedonia and for social sciences in Slovenia.

Researchers tend to gravitate towards the government or higher education sectors in all but Slovenia, where industry is the biggest employer (Figure 10.6). Given the current problems with collecting data on industrial R&D, this picture may change somewhat once the statistics improve.

Table 10.4: **Researchers in Southeast Europe (HC) per million inhabitants by gender, 2005 and 2012**

	Total population ('000s) 2012	Per million inhabitants 2005	Per million inhabitants 2012	Total 2005	Total, 2012	Women, 2005	Women, 2012	Women (%), 2005	Women (%), 2012
Albania	3 162	–	545^{-4}	–	1 721^{-4}	–	763^{-4}	–	44.3^{-4}
Bosnia & Herzegovina	3 834	293	325^{+1}	1 135	1 245^{+1}	–	484^{+1}	–	38.9^{+1}
Croatia	4 307	2 362	2 647	10 367	11 402	4 619	5 440	44.6	47.7
Greece	11 125	3 025	4 069^{-1}	33 396	45 239^{-1}	12 147	16 609^{-1}	36.4	36.7
FYR Macedonia	2 106	1 167	1 361^{+1}	2 440	2 867^{+1}	1 197	1 409^{+1}	49.1	49.1^{+1}
Montenegro	621	1 028	2 419^{-1}	633	1 546^{-1}	252	771^{-1}	39.8	49.9^{-1}
Serbia	9 553	1 160	1 387	11 551	13 249	5 050	6 577	43.7	49.6
Slovenia	2 068	3 821	5 969	7 664	12 362	2 659	4 426	34.8	35.8

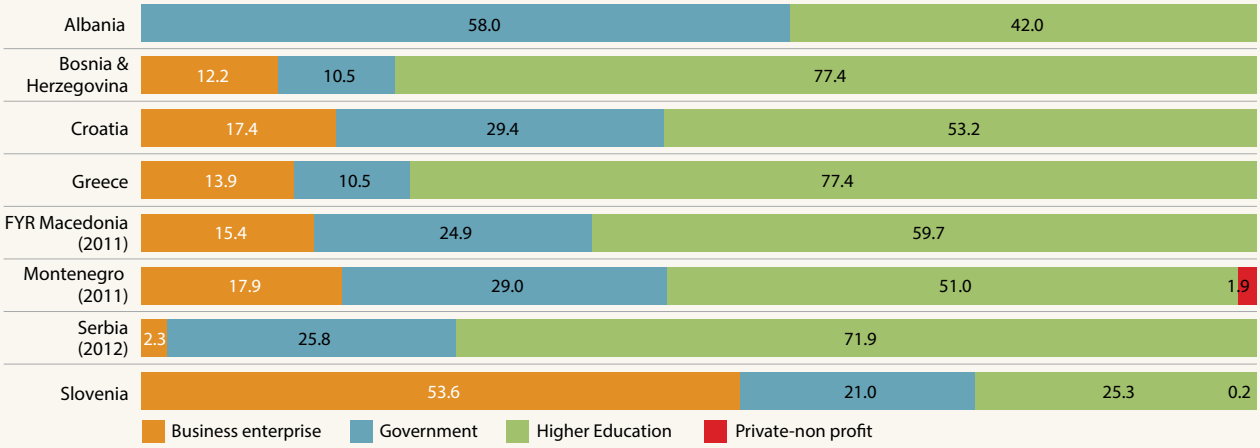
+n/-n = data refer to *n* years before or after reference year
Source: UNESCO Institute for Statistics, April 2015

Table 10.5: **Researchers in Southeast Europe (HC) by field and gender, 2012**

	Natural sciences	Women (%)	Engineering and technology	Women (%)	Medical and health sciences	Women (%)	Agriculture	Women (%)	Social sciences	Women (%)	Humanities	Women (%)
Albania, 2008	149	43.0	238	30.3	156	60.3	330	37.9	236	37.7	612	52.1
Bosnia & Herzegovina, 2013	206	43.7	504	29.6	31	58.1	178	42.7	245	54.7	68	19.1
Croatia	1 772	49.7	3 505	34.9	2 387	56.1	803	45.8	1 789	55.6	1 146	55.4
Greece, 2011	6 775	30.7	15 602	29.5	9 602	43.0	2 362	33.1	5 482	38.0	5 416	54.1
FYR Macedonia, 2011	–	–	567	46.4	438	65.1	103	49.5	322	50.0	413	64.2
Montenegro, 2011	104	56.7	335	37.0	441	58.5	66	54.5	291	46.0	309	51.8
Serbia	2 726	55.2	3 173	35.9	1 242	50.4	1 772	60.0	2 520	47.9	1 816	57.2
Slovenia	3 068	37.5	4 870	19.5	1 709	54.2	720	52.8	1 184	49.8	811	52.5

Source: UNESCO Institute for Statistics, April 2015

Figure 10.6: **Researchers (FTE) in Southeast Europe by sector of employment, 2013 (%)**



Source: UNESCO Institute for Statistics, April 2015

Figure 10.7: **USPTO patents granted to Southeast European countries, 2005–2008 and 2009–2012**

In terms of research output, there has been a marked improvement in Croatia and Slovenia in the number of patents and in Slovenia for royalty payments since the *UNESCO Science Report 2010*. Other countries have witnessed more modest progress (Figure 10.7 and Table 10.6).

Most countries have a good publishing record, a sign of their solid integration in the international scientific community. Again, Slovenia dominates with 33 times more publications per million inhabitants than Albania and more than twice as many as Croatia. Of note is that output has climbed steeply in all countries since 2005 (Figure 10.8). Serbia almost tripled its output between 2005 and 2014, moving up from third to first place in terms of sheer volume. There is a good balance in most countries between scientific fields, with engineering and the physical sciences rivalling life sciences.

Table 10.6: **Patents, publications and royalty payments in Southeast Europe, 2002–2010**

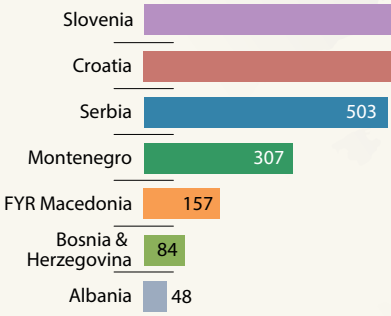
	Royalty payments and receipts (US$ per capita)		University–industry research collaboration 1 (low) – 7 (high)		Patents granted by USPTO per million inhabitants
	2006	2009	2007	2010	2002–2013
Albania	2.39	6.39	1.70	2.20	0.3
Bosnia & Herzegovina	–	4.87	2.40	3.00	3.9
Croatia	50.02	55.25	3.60	3.40	45.9
Greece	–	–	–	–	52.4
FYR Macedonia	6.64	12.91	2.90	3.50	25.6
Serbia	–	28.27	3.10	3.50	2.8
Slovenia	85.62	159.19	3.80	4.20	135.1

Note: Data are unavailable for Greece and Montenegro.
Source: UNESCO Science Report 2010 and World Bank Knowledge for Development database, accessed October 2014

Figure 10.8: **Scientific publication trends in Southeast Europe, 2005–2014**

Slovenia has by far the greatest publication density

Publications per million inhabitants in 2014



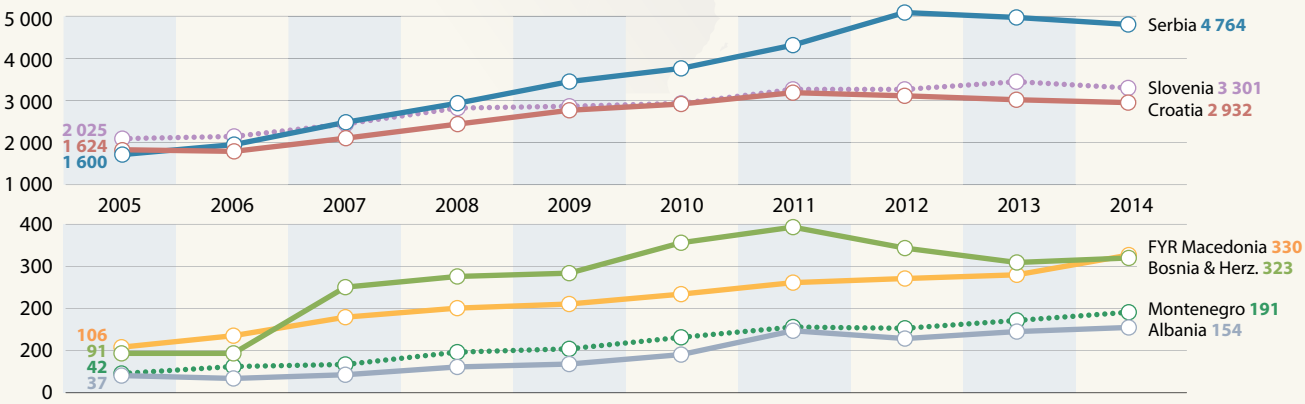
0.97

Average citation rate for Slovenia, 2008–2012; the OECD average is 1.08

0.79

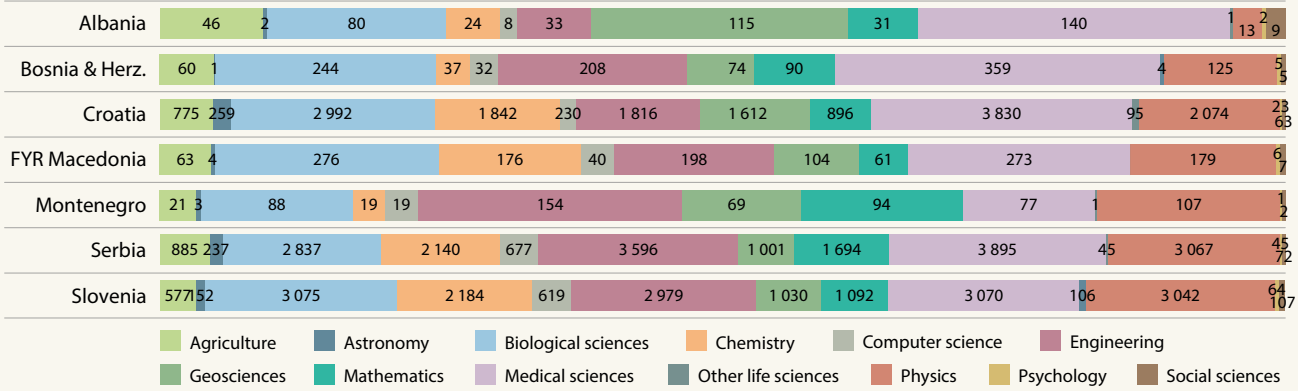
Average citation rate for the other six Southeast European countries; the OECD average is 1.08

Output has grown rapidly in all countries since 2005



Most articles concern life sciences, physics and engineering

Totals by field, 2008–2014



Note: Totals exclude unclassified articles.

The main collaborators are in Europe and the USA

Main foreign partners,2008–2014 (number of papers)

	1st collaborator	2nd collaborator	3rd collaborator	4th collaborator	5th collaborator
Albania	Italy (144)	Germany (68)	Greece (61)	France (52)	Serbia (46)
Bosnia & Herz.	Serbia (555)	Croatia (383)	Slovenia (182)	Germany (165)	USA (141)
Croatia	Germany (2 383)	US A (2 349)	Italy (1 900)	UK (1 771)	France (1 573)
FYR Macedonia	Serbia (243)	Germany (215)	USA (204)	Bulgaria (178)	Italy (151)
Montenegro	Serbia (411)	Italy (92)	Germany (91)	France (86)	Russia (81)
Serbia	Germany (2 240)	USA (2 149)	Italy (1 892)	UK (1 825)	France (1 518)
Slovenia	USA (2479)	Germany (2 315)	Italy (2 195)	UK (1 889)	France (1 666)

Source: Thomson Reuters' Web of Science, Science Citation Index Expanded; data treatment by Science–Metrix

COUNTRY PROFILES

ALBANIA

Business R&D is almost non-existent

Before the global financial crisis, Albania was one of the fastest-growing economies in Europe, enjoying annual real growth rates of 6% on average. After 2008, this rate halved and macro-economic imbalances emerged, including rising public debt (60% of GDP in 2012). Poverty levels, which had halved to about 12.4% of the population between 2002 and 2008, climbed back to 14.3%. Unemployment rose from 13.0% in 2008 to 16.0% in 2013 – and even 26.9% for youth. Economic growth dipped to 1.3% in 2013, reflecting the deteriorating situation in the Eurozone and difficulties in the energy sector. The World Bank forecasts that Albania's economy will grow by 2.1% in 2014 and 3.3% in 2015.

According to the latest Erawatch report on Albania (2013), which cites the Ministry of Finance, foreign direct investment (FDI) flows into the country tripled between 2006 and 2012, from about € 250 million to € 900 million. Despite this, FDI was estimated at 7.7% of GDP in 2011, about 1.2% lower than in 2010. The presence of multinational companies in the Albanian economy is boosting revenue considerably. Foreign investors are obviously attracted by the lower production costs and potentially higher profit margins than in a more developed economy. However, the rapid growth of FDI inflows to the country is also attributable to the improved business environment and the opportunities created by the privatization of state enterprises. FDI tends to be concentrated in low technology areas of manufacturing and services.

Albania devoted 0.15% of GDP to GERD in 2008, just 3.3% of which came from the business enterprise sector. The *National Strategy for Science, Technology and Innovation 2009–2015* states that GERD was close to € 15 million in 2009, which corresponds to less than 0.2% of GDP. The strategy foresees total cumulative funding for research over 2009–2015 of € 151.95 million, nearly half of which will go to the academic sector (€ 69.45 million). The only programme funding research *per se* is that managed by the Ministry of Education and Science (€ 30 million). Some € 3.3 million will be used to equip laboratories through the World Bank Research Infrastructure project and a similar amount will finance the running costs of the Agency for Research, Technology and Innovation (€ 3.25 million).

The *National Strategy for Science, Technology and Innovation 2009–2015* is Albania's main strategy for research and innovation. It was adopted in July 2009 after being developed by the Ministry of the Economy, Trade and Energy, in response to a UNESCO assessment of Albania's strengths and weaknesses and, in particular, its lagging position in Europe and the Balkan region. New programmes and funds focus on improving research infrastructure, expanding graduate and postgraduate programmes and creating sustainable linkages between academia and the private sector. This strategy introduces competitive-based funding criteria (for projects and grants) into the main policy instruments. The strategy also outlines specific targets for R&D, such as raising GERD to 0.6% of GDP by 2015, introducing innovation into 100 companies and carrying foreign co-operation funding to 40% of GERD. Some 12% of GERD came from abroad in 2007 and 7% in 2008.

Endowed with a budget of € 10.31 million, the *Business Innovation and Technology Strategy 2011–2016* is linked to the *National Strategy for Science, Technology and Innovation 2009–2015.* It introduces support measures for reaching the targets described in the preceding paragraph. Some € 4.8 million has been set aside for an Innovation Fund which awards grants to small and medium-sized enterprises (SMEs) for product development and process improvement through technology adoption, among other types of support. This strategy is to be mainly funded by foreign donors, with 76.5% expected to come from the EU and other donors (€ 7 893 million). SMEs will receive assistance in adopting new information and communication technologies (ICTs), which the strategy considers as being a major driver of modernization and innovation.

The *Business Innovation and Technology Strategy* was launched in 2010 by the Ministry of the Economy, Trade and Energy. It complements the ministry's Strategic Programme for Innovation and Technological Development of SMEs *for 2011–2016,* which was approved in February 2011. The programme is supported by a EuropeAid project, as it is recognized that Albanian firms have a weak technological capacity to upgrade by absorbing existing advanced technologies.

The *Business Innovation and Technology Strategy* and its *Action Plan* are being implemented by the Business Relay and Innovation Centre, which is hosted by the Albanian Investment Development Agency[7] and has been operational since June 2011. The four main thrusts of this strategy for 2011–2016 are the: Innovation Fund; Business Innovation Services; Business Incubator Programme; and Albanian Cluster Programme.

A need for a more targeted approach to business innovation

It is a pity that Albania is not taking a more targeted approach to business innovation and technological development, which is only implied in the *National Strategy for Science, Technology and Innovation 2009–2015*. Albania's innovation system also faces a number of structural challenges: a lack of reliable and comparable statistics on R&D and innovation;

7. See: http://aida.gov.al/?page_id=364

limited co-operation between the public and private sectors; delays and inefficiencies in implementing strategies and programmes; and persistent weaknesses in human resources development. The 2013 Erawatch report on Albania observes that weaknesses in human resources development are exacerbated by the slow growth in brain circulation and the training of new researchers and PhD-holders in S&T fields.

In June 2013, Albania adopted its second *National Strategy for Development and Integration 2013–2020,* the purpose of which is to move Albania closer to EU integration. This strategy defines new priority sectors for research which are deemed important for meeting societal challenges and for stimulating growth and productivity to absorb high unemployment.

These sectors are:

- ICTs;
- agriculture (veterinary, zoo-technical), food and biotechnology;
- social sciences and Albanology;
- biodiversity and environment;
- water and energy;
- health; and
- materials science.

BOSNIA AND HERZEGOVINA

Low R&D spending even before the recession

Bosnia and Herzegovina is composed of three individual entities: the Federation of Bosnia and Herzegovina, the Republic of Srpska and Brčko District. The state-level Ministry of Civil Affairs co-ordinates science policy and international co-operation through its Department of Science and Culture. The co-ordination of SME policies at state level is done by the Ministry of Foreign Trade and Economic Relations but the country's complex constitutional structure means that responsibility for policy implementation and funding is devolved to each individual entity.

When R&D data were first collected in 2003, they did not cover the entire country. The first national figures appear in the latest survey by the UNESCO Institute for Statistics; they show that GERD progressed from 0.27% to 0.33% of GDP between 2012 and 2013, or from PPP$ 97.0 million to PPP$ 120.5 million. These data come against a backdrop of negative economic growth in 2012 and a rise in unemployment from 24% to 29% of the adult population between 2008 and 2013 (Table 10.1).

The latest available data for the Federation of Bosnia and Herzegovina show that civil engineering, mechanical engineering and electrical engineering received a slightly higher priority in its cantons of Sarajevo, Tuzla and Zenica–Doboj than in the country's other entities in 2010 (Jahić, 2011).

As for the data published by the Bureau of Statistics of the Republic of Srpsk, these indicate a budget of € 13.4 million for R&D in 2011, corresponding to 0.3% of the entity's GDP. This breaks down into the following priority economic sectors:

- exploration and exploitation of the Earth (25%);
- general advancement of knowledge (23%);
- environment (10%);
- agriculture (9%);
- industrial production and technology (9%);
- culture, recreation, religion and mass media (5%).

A multiplicity of strategies and conflicting targets

Since 2009, Bosnia and Herzegovina has adopted no fewer than three strategies for STI: a national strategy and two state-level strategies. These propose conflicting targets.

Adopted in 2009, the *Strategy for the Development of Science in Bosnia and Herzegovina 2010–2015* fixes the ambitious target of increasing GERD to 1% of GDP by 2015. This growth is predicated on forecast economic growth of 5% per year by 2015. The government estimates that such growth would be sufficient to pay the salaries of 3 000 researchers and 4 500 other research personnel in Bosnia and Herzegovina (Council of Ministers, 2009). This strategy also envisages that the business enterprise sector will contribute one-third of GERD by 2015. This sector performed about 59% of GERD in 2013 but financed only about 2% – although the destination of 19% of GERD was unspecified in the government's reply to the UNESCO Institute for Statistics' survey.

After the disintegration of Yugoslavia in the 1990s, the young republic had a high ratio of business to government funding of R&D of 2:1 or even 3:1. The strategy adopted by the Federation of Bosnia and Herzegovina in 2011 envisages returning to this ratio. It also fixes a target of raising GERD to 1% of GDP by 2013 and to 2% by 2017.

As for the Republic of Srpska, its strategy for STI (2012) envisages raising GERD from 0.25% GDP in 2010 to a minimum of 0.5% of GDP by 2016 and to 1% by 2020, in line with its *Europe 2020* strategic goals (Republic of Srpska, 2012). This strategy optimistically envisages that business spending on R&D will represent 60% of the entity's GERD by 2016 (0.3% of GDP).

According to Jahić (2011), the most important structural challenges facing Bosnia and Herzegovina are to:

- harmonize the long-term goals of STI strategies at national and entity levels and to balance public and private sector R&D;
- foster domestic demand for R&D;
- increase collaboration with the business sector;
- facilitate knowledge and technology transfer;
- transform the role of predominantly teaching-oriented universities into the main performers of research.

A desire to increase R&D spending

The priorities for developing the national innovation system in the next five years have been identified as being to:

- stimulate scientific excellence and enable the transfer of knowledge and results of scientific discoveries to industry and business (Council of Ministers, 2009);
- strengthen co-operation with the EU to fund scientific research, together with funds allocated Ministry of Civil Affairs' budget for co-financing of international projects (Council of Ministers, 2009);
- enhance the commercialization of research results and the competitiveness of products and processes by adopting policies and funding that support industrial R&D (Republic of Srpska, 2012);
- enhance the role of intermediaries to facilitate industrial research and raise the share of business spending on R&D (Government of RS, 2012);
- adhere to the 2006 *UNESCO Guidelines for a Science and Research Policy in Bosnia and Herzegovina* (Papon and Pejovnik, 2006) and gradually increase GERD to 2% of GDP by 2020 (Federation of Bosnia and Herzegovina, 2011).

CROATIA

EU funds should be a boon for Croatian R&D

Croatia is a relative newcomer to the EU, having obtained membership on 1 July 2013. Before the global financial crisis, the Croatian economy was growing by 4–5% annually. In 2009, it fell into recession (-7%) but has since recovered somewhat. The economy is expected to grow by 0.5% in 2014 and Croatia's prospects for 2015 are viewed with optimism, as exports and investment are projected to pick up in the Eurozone. The privatization of large state-owned enterprises and the availability of EU funds, which represent about 2% of GDP in net terms, should also help Croatia's growth prospects in the medium term.

Unemployment remains one of the highest in Europe, however, at 17.7% in late 2013 and even over 40% for youth. Public debt is estimated to have risen above 64% of GDP in 2013 and external debt will likely be close to 103% of GDP, according to the World Bank.

There is one economic sector which has weathered the storm of the past few years. Croatia's natural beauty draws in millions of tourists each year, earning revenue which represents about 15% of GDP. Croatia remains one of Europe's ecological treasures, with 47% of its land and 39% of its marine area designated as specially protected areas.

Despite the recession, GERD ratio dipped only slightly between 2009 and 2013, from 0.84% to 0.81% of GDP. An analysis of longer term trends reveals that Croatia's GERD has dropped since 2004, when it represented 1.05% of GDP.

Just over one-third of GERD came from the business enterprise sector in 2013 (42.8%) and as much as 15.5% from abroad. This means that Croatia has some way to go before it achieves the target ensconced in the national *Science and Technology Policy 2006–2010* of devoting 1% of the public purse to R&D. Nor is the situation likely to improve in the near future, as the government has decided to trim the budget for the Ministry of Science, Education and Sports from 9.69% of the state budget in 2012 to 8.75% in 2015, according to the 2012 Erawatch report on Croatia. In fact, two-thirds of government budget outlays for R&D are used to pay the salaries of researchers in public institutions and universities. The remaining resources fund research project grants, equipment and so on. Only about 5.7% of the budget outlay is allocated to competitive research grants and a further 1.4% to technological projects.

The Ministry of Science, Education and Sports is the main funding body but four other mechanisms also contribute research funding (EU, 2013):

- the Croatian Science Foundation, which was established in 2001 to foster scientific excellence;
- the Business Innovation Agency of Croatia (BICRO), which supports technology transfer from academia to industry and the setting-up of start-ups and spin-off companies. BICRO supports the implementation of various EU programmes in Croatia, including the Instrument for Pre-Accession Assistance and the programme for the Development of Knowledge-based Enterprises (RAZUM). In May 2010, BICRO launched the Croatian segment of the EU's Proof of Concept programme, which ensures pre-commercial funding for technical and commercial testing of innovative concepts. The Croatian Institute of Technology was merged with BICRO in February 2012 to ensure that EU structural instruments in the areas

of research, development and innovation are invested effectively.

- the Unity through Knowledge Fund, which supports co-operation between local researchers and the diaspora, as well as between the public and private sectors via a Research in Industry and Academia grant scheme set up in 2007;
- the Science and Innovation Investment Fund, which was set up in 2009 to foster technology transfer and academic entrepreneurship via the commercialization of universities' research results.

Croatia also has two non-funding agencies: the Agency for Science and Higher Education, which is responsible for setting up a national network for quality assurance; and the Croatian Agency for Mobility and the EU Programme, which organizes programmes in lifelong learning and mobility in the EU.

The Ministry of Entrepreneurship and Crafts and the Ministry of the Economy complement the Ministry of Science, Education and Sports when it comes to funding innovation-based entrepreneurship and business infrastructure.

A shift from project to programme financing

The most important change in Croatia's national innovation system in recent years has been a shift from project to programme financing. The Law on Science and Higher Education provides the legal basis. Adopted by parliament in July 2013, it makes provision for a new model of 'programme contracts' between the Ministry of Science, Education and Sports and research-performing organizations. The main objective is to put an end to the current practice of funding a large number of small scientific projects with a high acceptance rate of more than 80% of proposed projects. In addition, the law transfers responsibility for allocating competitive research grants from the ministry to the Croatian Science Foundation, which has been charged with devising a new scheme for competitive projects and programmes based on the model of EU collaborative research (EU, 2013).

The Second Science and Technology Project was launched in 2012 with an estimated budget of € 24 million for 2012–2015. This project sets out to improve the efficiency of public R&D institutions, bring BICRO and the Unity for Knowledge programme in line with EU regulations and prepare submissions to the EU's structural funds and cohesion funds.

No explicit policy for regional development

No explicit regional research policy currently exists in Croatia, mainly due to insufficient resources which prevent counties and municipalities from taking a more active part in developing institutional capacity. Croatia is nearing completion of its *National Research and Innovation Strategy on Smart Specialization*, which is designed to support innovation and business competitiveness. Such a strategy is a prerequisite for securing support for infrastructure development from the European Regional Development Fund, one of the EU's structural funds. The Ministry of Regional Development and European Funds is expected to play a greater role once the first European Regional Development Funds become available.

According to the Innovation Union Scoreboard (EU, 2014)[8], Croatia is a *moderate innovator* which performs below the EU average. This group of countries includes Poland, Slovakia and Spain. The priority areas defined by the *Science and Technology Policy 2006–2010* were all related to innovation: biotechnologies, new synthetic materials and nanotechnologies. However, business expenditure on R&D has stagnated at 0.36% of GDP in 2008 and 0.35% in 2013, even though this sector performed 50.1% of R&D in 2013.

Croatia has a very generous system of tax breaks for R&D compared to countries of the Organisation for Economic Cooperation and Development (OECD), corresponding to a subsidy of about 35 cents for every dollar spent on R&D. In 2012, Croatia's ranking in the Innovation Union Scoreboard receded slightly, however, after businesses suffered a drop in sales of innovative products they had recently put on the market.

An environment that is not conducive to innovation

Croatia tends to be more productive in scientific publishing than in patenting, with a ratio of about 100 articles to every registered patent. The higher education sector applied for 13 patents in 2010, which was around 23% of all patent applications for Croatia that year.

Today, Croatia faces five main structural challenges:

- its R&D policy is obsolete and lacks vision, not to mention a coherent and integrated policy framework; the *National Research and Innovation Strategy on Smart Specialization* due to be adopted in 2015 should go some way towards tackling this challenge;
- the business environment is not conducive to innovation;
- with the exception of a few big spenders, private companies show little interest in R&D;
- reform of the research and higher education system has been sluggish so far; and
- the regional research and innovation system remains weak.

8. See also the glossary on page 738

Box 10.3: **A first incubator in Croatia for bioscience start-ups**

The Incubation Centre for Bioscience and Technology Commercialisation (BIOCentar) is the first centre of its kind in Croatia and the wider region. It is due to open its doors in 2015 on the campus of the University of Zagreb. The centre will cover about 4 500 m^2 for a cost of about HRK 140 million (*circa* US$ 23 million).

Once operational, the incubator will support the creation and development of spin-off companies from research done by public institutions and universities. The centre will provide small and medium-sized enterprises in the field of bioscience and biotechnology with the infrastructure and services they need to develop their business.

BIOCentar is Croatia's first major infrastructural project and a greenfield investment financed though the EU's Instrument for Pre-Accession Assistance.

The University of Zagreb is one of three universities which serve as technology transfer offices in Croatia, the others being the University of Spit and the University of Rijeka. The technology transfer office at the University of Rijeka has recently grown into a fully fledged Science and Technology Park.

Source: EU (2013)

The *National Strategy for the Development of Croatian Innovation Development 2014–2020* has been prepared by local experts in co-operation with the OECD. It defines the five strategic pillars for the future development of Croatia's innovation system and some 40 guidelines for their implementation:

- enhancement of business innovation potential and the creation of a regulatory environment supportive of innovation;
- greater knowledge flows and interaction between industry and academia;
- a strong S&T base and more efficient technology transfer among research institutions; see also Box 10.3;
- the development of human resources for innovation;
- better governance of the national innovation system.

In December 2012, the Ministry of Science, Education and Sports adopted a *Science and Society Action Plan*. It proposes equalizing the gender ratio for researchers in management structures in particular, with a minimum of one woman to every three men on national councils, key committees, scientific and political bodies, etc. (EU, 2013).

FORMER YUGOSLAV REPUBLIC OF MACEDONIA

A need for better governance of innovation

The Former Yugoslav Republic of Macedonia has not weathered the economic crisis too badly. Initial sluggish growth is now being driven by construction and exports, with projected growth of 3% in 2014 and 2015. Public debt also remains moderate, at 36% of GDP in 2013.

The country was granted EU candidate status in 2005 and has been in a 'high level accession dialogue' with the European Commission since March 2012. It is one of the poorest countries in Europe, with annual GDP per capita of € 3 640, just 14% of the EU27 average. Unemployment peaked at 31.4% in 2011 and was still extremely high in the first quarter of 2014, at 28.4% according to the State Statistical Office.

GERD is modest but the country's R&D effort has grown in recent years, from 0.22% of GDP in 2011 to 0.47% in 2013, according to the UNESCO Institute for Statistics. The public sector funds about two-thirds of R&D, according to Erawatch, which has also observed that private R&D funding dropped from € 3.32 million to € 2.77 million between 2009 and 2010, representing a contraction of 18.0% of GERD; in 2010, funds from abroad covered 16.7% of total R&D spending.

According to the EU's Innovation Union Scoreboard of 2014, the Former Yugoslav Republic of Macedonia is a *modest innovator*, well below the EU average. This places it on a par with the likes of Bulgaria, Latvia and Romania. The country's innovation performance did improve, however, between 2006 and 2013.

The structural challenges facing the Macedonian research system are as follows:

- inefficient governance of the innovation system;
- a lack of quality human resources for R&D;
- weak science–industry linkages;
- a low capacity for innovation among firms; and
- a non-existent national roadmap for building quality research infrastructure.

A strategy to boost research and innovation

The government has opted for a strategy of boosting R&D through tax incentives and subsidies. The tax incentives were introduced in 2008 by Scientific Subsidies and followed, in 2012, by Creative Subsidies. There is no evidence of the level of funds involved, however, or the impact of these measures on R&D.

In 2012, the government adopted the country's *Innovation Strategy for 2012–2020*, which had been prepared by the Ministry of the Economy. The same year, the Ministry of Education and Science prepared and adopted the *National Strategy for Scientific R&D Activities 2020* and the National Programme for Scientific R&D Activities 2012–2016. Both strategies clearly define national research priorities and propose an action plan for their implementation. Whereas the former takes a horizontal approach to fostering business innovation, including by proposing a more amenable regulatory environment, the national strategy and programme are more 'citizen-centric'.

Plans to raise R&D spending and develop a low carbon society

The primary goal of both the *National Strategy for Scientific R&D Activities 2020* and the National Programme for Scientific R&D Activities is to create a knowledge society by raising GERD to 1.0% of GDP by 2016 and 1.8% of GDP by 2020, with a 50% participation from the private sector. The *National Strategy* defines general thematic priorities which are mainly influenced by Europe's 2020 agenda. These same thematic priorities are defined more precisely by the National Programme for Scientific R&D Activities:

- The development of an open society and competitive economy via support for socio-economic development, economic policies, structural reforms, education, research, the information society and the overall development of the national innovation system;
- The development of a low carbon society through energy efficiency, renewable energy sources, sustainable transport and the use of clean technologies;
- Sustainable development, including sustainable management of natural resources, quality of air, water and land;
- Security and crisis management; and
- Socio-economic and cultural development.

MONTENEGRO

Greater spending on R&D but little impact on business

The global economic crisis exposed some pre-existing fissures in the foundations of Montenegro's economy which made it more vulnerable than anticipated to recession, with a contraction of 5.7% of GDP in 2009. Economic growth averaged 2.9% in 2010 and 2011 before slowing significantly in 2012, due to a sluggish use of credit, adverse weather conditions which reduced energy production, the bankruptcy of a major steel mill company (Nikšić) and a decline in production at a loss-making aluminium plant (KAP). In 2013, the economy returned to growth and inflation fell from 3.6% the previous year to 2.1%. Growth is expected to rise to around 3.2% from 2014–2016, supported by FDI in tourism and energy, as well as public investment.

In 2013, GERD represented 0.38% of GDP, a significant increase over previous years despite a highly restrictive budgetary policy. One of the main reasons for this increase is the implementation of a € 5 million call in 2012 for scientific and research projects covering the period 2012–2014. The call was announced by the Ministry of Science, in co-operation with the Ministries of Agriculture and Rural Development, Health, Information Society and Telecommunications, Sustainable Development and Tourism, Education and Sport, and Culture. Some 104 projects were selected out of 198 proposals.

The business sector funds four-tenths of R&D

As of 2013, the business enterprise sector funded 42% of GERD in Montenegro and three sectors concentrated the majority of R&D companies: agriculture, energy and transportation. These three sectors accounted for 22% of GERD in 2011. More than a third of GERD comes from the public purse (35.2% in 2013) and a further 23% from abroad, mainly from the EU and other international bodies.

In May 2012, Montenegro became a member of the World Trade Organization as a consequence of the government's commitment to opening the country to regional and international trade. In October 2011, the European Commission recommended opening accession negotiations with Montenegro, which were officially initiated on 29 June 2012.

A number of policy documents[9] have identified the main challenges facing the Montenegrin innovation system:

9. Including government documents such as *Montenegro in the 21st Century: In the Era of Competitiveness* (2010). *National Development Plan* (2013) and the *Strategy for Employment and Human Resource Development 2012–2015*, as well as external reviews by the OECD and World Bank and the Erawatch Country Report for Montenegro (2011).

- a small number of researchers;
- inadequate research infrastructure;
- a low level of scientific output;
- little mobility among researchers;
- insufficient commercialization of research and collaboration with the business sector; and
- a low level of company R&D expenditure and little application of research results in the economy.

A project devoted to strengthening higher education and research

In late 2012, the government adopted a new version of its *Strategy for Scientific Research Activity for 2012–2016*. The strategy defines three strategic goals:

- Develop the scientific research community;
- Strengthen multilateral, regional and bilateral co-operation;
- Foster co-operation between the scientific research community and the business sector.

The Higher Education and Research for Innovation and Competitiveness (HERIC) project should help to attain these goals. The aim of this project is to strengthen the quality and relevance of higher education and research in Montenegro. The project is being implemented from May 2012 to March 2017 with € 12 million in funding from a World Bank loan. There are four components: reform of higher education finance and the introduction of quality assurance norms; human capital development through the internationalization of training and research; establishment of a competitive research environment and, lastly; a component on project management, monitoring and evaluation.

One of the first initiatives taken by the Ministry of Science and the Ministry of Education to kick-start the HERIC project has been the establishment of the first pilot centre of excellence in late 2012. The Ministry of Science is also setting up the country's first science and technology park by 2015. The plan is for this park to comprise three units in Nikšić, Bar and Pljevlja, with the core centre in Podgorica co-ordinating the network.

SERBIA

A better performance in innovation

Serbia is slowly recovering from the global financial crisis. After a 3.5% contraction of GDP in 2009, the economy has managed to maintain positive growth since 2011. For the first time in years, GDP grew by 2.5% in 2013 but should shrink to just 1% in 2014, reflecting the impact of fiscal tightening, a lower inflow of investment and the ongoing fragile situation in the domestic financial sector. More robust growth rates of around 2–3% are forecast over the medium term.

Persistently high unemployment rates (22.2% in 2013 overall and about 50% for 15–24 year olds) and stagnant household incomes are ongoing political and economic headaches for the government. In June 2013, it revised the budget by raising the 2013 government deficit target from 3.6% to 5.2% of GDP. At the same time, the government adopted a programme of public sector reform, including an action plan for completing restructuring by the end of 2014, including the privatization of 502 state companies. Exports were the only driver of growth in 2012, boosted by 13.5% thanks to the opening of an assembly line in the second half of 2012 by Italian car-maker Fiat.

In 2013, Serbia's R&D effort amounted to 0.73% of GDP. The business enterprise sector contributed just 8% of the total, leaving the funding burden to be borne essentially by the government (60%) and higher education (25%) sectors. Foreign sources contributed 8% of GERD and private non-profit organizations virtually none of it. Non-profit organizations are the only category which benefits from a tax incentive for R&D in Serbia; they are exempted from paying tax on R&D services they provide to clients under non-profit contracts.

According to the Innovation Union Scoreboard (EU, 2014), Serbia is a *moderate innovator*, like Croatia. Serbia's innovation performance has improved, however, since 2010, according to this scoreboard, thanks to greater collaboration among SMEs and the efforts of various categories of innovator. Serbia performs very well in terms of youth education at the upper secondary level and employment opportunities in knowledge-intensive sectors. It also rates well for non-R&D innovation expenditure. It is relatively weak, on the other hand, in community design, community trademarks (despite strong growth) and business R&D expenditure. There has been strong growth in public R&D expenditure but this is countered by a decline in exports of knowledge-intensive services and in the number of non-EU PhD students in Serbia.

The key structural challenges facing Serbia's national innovation system today are:

- an absence of co-ordinated governance and funding;
- a linear understanding on the part of government of the innovation process, resulting in a highly fragmented innovation system; this is the main obstacle to networking the R&D sector with the rest of economy and society at large;
- persistent brain drain of highly educated individuals;

- an innovation system which is insufficiently attractive to private investment; the government needs to restructure the public R&D system and integrate the private sector into the national innovation system;
- lack of a culture of technological entrepreneurship in universities and the government sector;
- the absence of an evaluation culture; and
- a system which favours the supply side of R&D over the demand side.

The 1% GERD/GDP ratio goal within reach

In February 2010, Serbia adopted its *Strategy for the Scientific and Technological Development of the Republic of Serbia 2010–2015*. The overriding goal of this policy is to devote 1% of GDP to GERD by 2015, not counting investment in infrastructure, a goal which is currently within reach but requires additional effort. The strategy is guided by two basic principles: focus and partnership. Focus is to be achieved by defining a list of national research priorities; partnership is to be achieved through the strengthening of ties with institutions, companies and other ministries to allow Serbia to validate its ideas in the global market and enable scientists to participate in infrastructural and other projects in Serbia.

The strategy defines seven national R&D priorities, namely: biomedicine and human health; new materials and nanoscience; environmental protection and climate change mitigation; agriculture and food; energy and energy efficiency; ICTs; and better decision-making processes, as well as the affirmation of the national identity.

The *Strategy for the Scientific and Technological Development of the Republic of Serbia* launched the Serbian R&D Infrastructure Investment Initiative in January 2011 with a budget of € 420 million, half of which comes from an EU loan. Its priorities are to: upgrade existing capacities (*circa* € 70 million); adapt existing buildings and laboratories; purchase new capital equipment for research; develop centres of excellence and academic research centres (*circa* € 60 million); develop supercomputing via the Blue Danube initiative, as well as other ICT infrastructure (€ 30–80 million); create a campus for the technical science faculties of the University of Belgrade; build science and technology parks in Belgrade, Novi Sad, Niš and Kragujevac (*circa* € 30 million); and implement basic infrastructure projects, such as the construction of apartment buildings for researchers in Belgrade, Novi Sad, Niš and Kragujevac (*circa* € 80 million).

In 2012, basic sciences accounted for 35% of all research done in Serbia, applied sciences for 42% and experimental development for the remaining 23%, according to the UNESCO Institute for Statistics. The *Strategy* sets out to raise the ratio of applied sciences. This goal is supported by a new Programme for Co-funding of Integrated and Interdisciplinary Research for the Research Cycle, which emphasizes the commercialization of research results.

Another priority of the *Strategy* has been the creation of a national innovation fund to increase the monetary value of grants awarded to selected innovation projects. The fund is endowed with an initial treasury of € 8.4 million through the Innovation Serbia Project, which is financed by the EU pre-accession funds allocated to Serbia in 2011 and implemented through the World Bank.

A second programme finances the modernization of research facilities: the Programme for Providing and Maintaining Scientific Research Equipment and Scientific Research Facilities for the Research Cycle 2011–2014.

SLOVENIA

Despite recession, Slovenia's R&D effort has soared

With excellent infrastructure, a well-educated labour force and a strategic location between the Balkans and Western Europe, Slovenia has one of the highest levels of GDP per capita in Southeast Europe. On 1 January 2007, it became the first of the EU entrants of 2004 to adopt the euro. Slovenia has experienced one of the most stable political transitions to a market economy in Central and Southeast Europe. In March 2004, it became the first transition country to graduate from borrower status to donor partner status at the World Bank. In 2007, Slovenia was invited to begin the process for joining the OECD, which admitted it as a member in 2012.

However, long-delayed privatizations, particularly within Slovenia's largely state-owned and increasingly indebted banking sector, have fuelled investor concerns since 2012 that the country might need financial assistance from the EU and IMF. These woes have also affected Slovenia's competitiveness (Table 10.2). In 2013, the European Commission granted Slovenia permission to begin recapitalizing ailing lenders and transferring their non-performing assets into a 'bad bank' established to restore bank balance sheets. The strong demand among yield-seeking bond investors' for Slovenian debt helped the government to keep financing itself independently on international markets in 2013. The government has embarked on a programme of state asset sales to bolster investor confidence in the economy, which was poised to contract (by 1%) for the third year in a row in 2014.

Slovenia has managed the feat of raising GERD from 1.63% to 2.59% of GDP between 2008 and 2013, one of the highest ratios in the EU. Obviously, the fragile state of the economy

has facilitated this rise by keeping the GDP denominator low. However, the dynamism of R&D in the business enterprise sector has also been a contributing factor; the number of researchers employed by businesses rose by nearly 50% over this period: from 3 058 to 4 664 (in FTE). By 2013, the business enterprise sector was contributing two-thirds (64%) of GERD and foreign sources just under 9%. As a share of GDP, it has almost tripled, from 0.09% of GDP in 2008 to 0.23% in 2013, thanks largely to the influx of EU structural funds; these have gone largely towards funding centres of excellence and competency centres, which are considered part of the business enterprise sector. The structural funds have also made it possible to raise the number of academic researchers from 1 795 to 2 201 (in FTE) over the same period.

Slovenia's *Development Strategy* for 2014–2020 defines R&D and innovation as being one of three driving forces for the country's development, the others being the creation and growth of SMEs and, thirdly, employment, education and training for all ages. Half of the funds allocated within the *Development Strategy* to 2020 will be used to foster:

- a competitive economy with a highly educated labour force, internationalized economy and strong investment in R&D;
- knowledge and employment;
- a green living environment through the sustainable management of water resources, renewable energy, forests and biodiversity;
- an inclusive society which provides intergenerational support and high-quality health care.

Slovenia has also adopted a *Smart Specialization Strategy* for 2014–2020 outlining how the country plans to use research and innovation to foster the transition to a new model of economic growth. The strategy includes an implementation plan for restructuring the Slovenian economy and society on the basis of R&D and innovation with the support of the EU funds. The strategy represents Slovenia's contribution to the 'smart pillar' of the *Western Balkans Regional R&D Strategy for Innovation* (Box 10.2).

Slovenia performs above the EU average for innovation

Slovenia is considered an *innovation follower* by the Innovation Union Scoreboard (EU, 2014), which means that it performs above the EU average. Other countries in this category include Austria, Belgium, Estonia, France, the Netherlands and the UK. This reflects the findings of an evaluation undertaken by the EU of measures implemented by Slovenia between 2007 and 2013 to promote innovation, which revealed that strong linkages had formed between the academic sphere and the economy. This confirms that Slovenia has shifted from a linear model to a second-generation R&D system based on an interactive organizational model.

Slovenia's National Research and Development Programme 2006–2010 had focused on increasing the quality of Slovenian science through competitive grants and an emphasis on linking promotion to the number of articles an academic published. This approach resulted in a significant increase in the number of published articles. The priority research fields for 2006–2010 were: ICTs; advanced (new and emerging) synthetic metallic and non-metallic materials and nanotechnologies; complex systems and innovative technologies; technologies for a sustainable economy; and health and life sciences.

Current public funding disbursed via the Slovenian Research Agency focuses on scientific excellence *per se* and allows for a significant degree of bottom-up initiative in the selection of specific priorities. The proportions of funding for the various scientific fields have remained unchanged over the years; for example, in 2011, 30% went to engineering and technology, 27% to natural sciences; 11.8% to the humanities and between 9.6% and 9.8% to each of biotechnology, social sciences and medical sciences. Multidisciplinary projects and programmes received 1.5% of all funds disbursed.

Slovenia commissioned an OECD *Review of Innovation Policy in Slovenia* (2012) to inform the preparation of its own research and innovation strategy to 2020. The review recommended that Slovenia address, *inter alia,* the following issues:

- Maintain sustainable public finances, this being one of the most important prerequisites for dynamic public and private investment in innovation;
- Pursue efforts to reduce the administrative burden on businesses, including start-ups;
- Consider streamlining the current large array of technology funding programmes, as a smaller number of large programmes will be more effective;
- Develop and improve demand-side measures, such as innovation-oriented public procurement;
- Continue to foster the use of non-grant financial instruments such as equity, mezzanine capital, credit guarantees or loans;
- Start a full-scale university reform, making autonomy – firmly tied to accountability and performance – the key precept underlying reforms;
- Alleviate or remove labour legislation and policies that impede mobility between universities and among universities, research institutions and industry;

- Increase the number of researchers in industry, including by pursuing programmes which fund the transfer of young researchers to firms;
- Reduce explicit and implicit barriers to working in Slovenia for highly qualified people from all over the world; and
- Use EU structural funds, in particular, to pool resources in its centres of excellence so that these can form the core of Slovenia's future research excellence.

The *Research and Innovation Strategy of Slovenia 2011–2020* defines the current policy priorities as being to achieve:

- a better integration of research and innovation;
- a contribution from publicly funded science and scientists to economic and social restructuring;
- closer co-operation between public research organizations and the business sector; and
- greater scientific excellence, partly by improving the competitiveness of stakeholders and partly by providing the necessary human and financial resources.

The government has raised the R&D tax subsidy considerably, which represented 100% in 2012. The ceiling for tax credits for investment in R&D by private enterprises has been raised to € 150 million to the end of 2013. In addition, the Slovenian Enterprise Fund offers credit guarantees.

Since 2012, the government has launched a programme for the Formation of a Creative Nucleus (€ 4 million) and the Research Voucher Scheme (€ 8 million), both co-financed by EU structural funds. The first measure makes public and private research institutions and universities in less developed parts of Slovenia eligible for 100% government funding for the development of human resources, research equipment, infrastructure and the like, in order to foster the decentralization of research and higher education. The second measure introduces research vouchers to help enterprises commission research at R&D institutes and/or universities (both private and public) for a period of three years. With each research voucher being worth € 30 000–100 000, enterprises should be able to co-finance the industrial research needed to develop new products, processes or services.

CONCLUSION

Research systems need to be more responsive to social and market demands

It is unlikely that any of the last five countries in Southeast Europe will become EU members before at least 2020, as the EU's current priority is to consolidate the cohesion of its 28 existing members. It is generally admitted in Europe, however, that the EU membership of these five countries is ultimately inevitable, in order to ensure political and economic stability across the region.

All five countries should use this time to make their research systems more responsive to social and market demands. They can learn a lot from Croatia and Slovenia, which are now formally part of the European Research Area. Since becoming an EU member in 2004, Slovenia has turned its national innovation system into a driving socio-economic force. Slovenia now devotes a greater share of GDP to GERD than the likes of France, the Netherlands or the UK, thanks largely to the rise of the business enterprise sector, which today funds two-thirds of Slovenian R&D and employs the majority of researchers. Slovenia's economy remains fragile, however, and it has chronic problems in attracting and retaining talent.

Having only been an EU member since 2013, Croatia is still searching for the most effective configuration for its own innovation system; it is currently striving to follow the best practices of the EU and incorporate its body of law and institutional and empirical legacy into the national innovation system.

Like Croatia, Serbia is what the EU calls a *moderate innovator*. These two countries are poles apart, however, when it comes to the weight of business R&D funding; this accounts for 43% of GERD in Croatia but only 8% in Serbia (in 2013). The Serbian government's biggest challenge will be to overcome a linear understanding of the innovation process which has resulted in a highly fragmented innovation system; this fragmentation is the biggest obstacle to networking the R&D sector with the rest of the economy and society at large.

Albania, Bosnia and Herzegovina, the Former Yugoslav Republic of Macedonia and Montenegro are all faced with structural adjustments and political and economic challenges which tend to have relegated the reform of their respective innovation systems to a lower priority. All are suffering from sluggish economic growth, the ageing of researchers, severe brain drain, a lack of private sector R&D and a system which encourages academics to focus on teaching rather than research or entrepreneurship.

Countries will be able to draw on the *Western Balkans Regional Research and Development Strategy for Innovation* and the *SEE 2020 Strategy* as a framework for implementing the policy and institutional reforms that should allow them to promote the 'smart specialization' that will set them on the path to sustainable development and long-term prosperity.

KEY TARGETS FOR SOUTHEAST EUROPE

- Raise GDP per capita in the region to 44% of the EU average by 2020;
- Double turnover from regional trade from € 94 billion to € 210 billion;
- Open up the region to 300 000 new highly qualified jobs by 2020;
- Achieve minimum 9% energy savings in the region by 2018;
- Raise the share of renewable energy in gross energy consumption to 20% by 2020;
- Raise the GERD/GDP ratio to 0.6% in Albania and to 1% in Bosnia and Herzegovina and Serbia by 2015;
- Raise the GERD/GDP ratio to 1% in the FYR Macedonia by 2016 and to 1.8% by 2020 with a 50% private-sector participation.

REFERENCES

Bjelić, P.; Jaćimović, D. and Tašić, I. (2013) *Effects of the World Economic Crisis on Exports in the CEEC: Focus on the Western Balkans*. Economic Annals, 58 (196), January – March

Council of Ministers (2009) *Strategy for the Development of Science in Bosnia and Herzegovina, 2010–2015*. Council of Ministers of Bosnia and Herzegovina.

Erawatch (2012) Analytical Country Reports: Albania, Bosnia and Herzegovina, Croatia, FYR Macedonia, Montenegro, Serbia and Slovenia. European Commission, Brussels. See: http://erawatch.jrc.ec.europa.eu/erawatch/opencms/index.html

Federation of Bosnia and Herzegovina (2011) *Strategy for Development of Scientific and Development Research Activities in the Federation of Bosnia and Herzegovina, 2012–2022*. EU (2014) *Innovation Union Scoreboard 2014*. European Union.

EU (2013) *European Research Area Facts and Figures: Croatia*. European Union. See: http://ec.europa.eu

Jahić, E. (2011) *Bosnia and Herzegovina*. Erawatch country report. European Commission: Brussels.

Kutlaca, D. and Radosevic, S. (2011) Innovation capacity in the SEE region. In: *Handbook of Doing Business in South East Europe*, Dietmar Sternad and Thomas Döring (eds). Palgrave Macmillan: Netherlands: ISBN: 978-0-230-27865-3, ISBN10: 0-230-27865-5, pp. 207–231.

Kutlača, D.; Babić, D.; Živković, L. and Štrbac, D. (2014) Analysis of quantitative and qualitative indicators of SEE countries' scientific output. *Scientometrics*. Print ISSN 0138-9130, online ISSN 1588-2861. Springer Verlag: Netherlands.

Lundvall, B. A. (ed.) [1992] *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*. Pinter: London.

Peter, V. and Bruno, N. (2010) *International Science and Technology Specialisation: Where does Europe stand*? ISBN 978-92-79-14285-7, doi 10.2777/83069. Technopolis Group. European Union: Luxembourg.

Radosevic, S. (2004) A two-tier or multi-tier Europe? Assessing the innovation capacities of Central and East European Countries in the enlarged EU. *Journal of Common Market Studies*, 42 (3): 641–666

Republic of Albania (2009) *National Strategy of Science, Technology and Innovation 2009–2015*. See: http://unesdoc.unesco.org/images/0018/001871/187164e.pdf

Republic of Montenegro (2012) Strat*egy for Scientific Research Activity of Montenegro 2012–2016*. See: www.gov.me.

Republic of Montenegro (2008) Strategy for Scientific Research Activity of Montenegro 2008–2016.

Republic of Serbia (2010) *Strategy of Scientific and Technology Development of the Republic of Serbia 2010–2015*. Ministry of Science and Technological Development.

Republic of Slovenia (2013) *Smart Specialisation Strategy 2014–2020*. Ministry of Economic Development and Technology. Background Information to Peer-Review Workshop for National Strategy, 15–16 May 2014, Portorož, Slovenia.

Republic of Srpska (2012) Strategy of Scientific and Technological Development in the Republic of Srpska 2012–2016: www.herdata.org/public/Strategija_NTR_RS-L.pdf.

UIS (2013) *Final Report on Quality of Science, Technology and Innovation Data in Western Balkan Countries: a Validated Input for a Strategy to Move the STI Statistical Systems in the Western Balkan Countries towards the EU: International Standards, Outlining an Action Plan for Further Actions*. UNESCO Institute for Statistics: Montreal.

WEF (2014) *The Global Competitiveness Report 2013–2014*. World Economic Forum. Printed and bound in Switzerland by SRO-Kundig.

World Bank and RCC (2013) *Western Balkans Regional R&D Strategy for Innovation*. World Bank and Regional Cooperation Council.

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