Chapter 9.

Science, technology and innovation in South East Europe

This chapter on science, technology and innovation (STI) assesses the policy settings, strategies, processes and institutions in six South East European economies. After a brief overview of innovation trends and performance in South East Europe, the chapter then focuses on five essential sub-dimensions. The first sub-dimension, governance of STI policies, assesses whether governments take an overarching strategic view and co-ordinate policies across all relevant ministries. The second, public research system, looks at how they are funded and managed in order to foster research excellence. The third, innovation in firms, measures the degree to which business innovation is promoted and supported financially and institutionally. The fourth, public-private knowledge transfers and linkages, examines policies to facilitate science-industry collaboration and technology transfer to overcome barriers between academia and business. The final sub-dimension, human resources for innovation, focuses on specific measures aimed at creating appropriate incentives and mobility for researchers to foster research excellence and co-operation with industry. The chapter includes suggestions for enhancing the policies in each of these sub-dimensions in order to spread the diffusion of innovation and new technology more widely, which in turn would foster the competitiveness of these economies.

Main findings

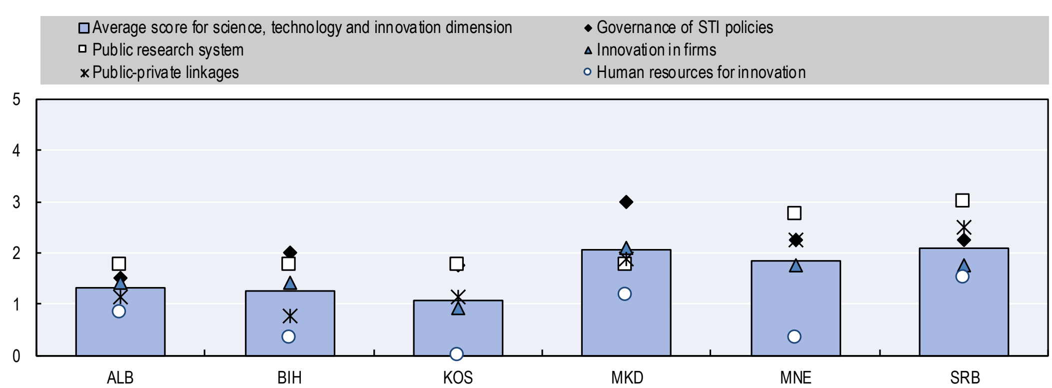
Overall science, technology and innovation (STI) outcomes remain modest in the six South East Europe (SEE) economies assessed here: Albania, Bosnia and Herzegovina, the Former Yugoslav Republic of Macedonia, Kosovo,* Montenegro and Serbia. Investment in research and development (R&D) is very low, particularly in the business sector. Scientific outputs and production of high-technology goods and services lag as a consequence. Foreign direct investment (FDI) rarely targets knowledge-intensive sectors, due to skills gaps, fragmented labour markets and low levels of integration into global knowledge flows and value chains. The situation is aggravated by endemic brain drain.

Nevertheless, as the World Bank Enterprise Surveys have found, small and medium-sized enterprises (SMEs) in the six SEE economies do have a strong propensity to innovate, albeit in non-technological ways (World Bank, 2013). This assessment found a dynamic information and communications technology (ICT) service sector, and medium-high technology automotive and machine tool industries.

Future challenges will include finding resources to increase investment in R&D, and improving the overall governance of innovation at the policy and institutional level, finding ways to foster technology diffusion and absorption, and developing business-academia linkages and incentives to individuals to unleash their creative potential.

In recent years, some of the SEE governments have adopted increasingly holistic STI strategy frameworks. However, this development is still in its infancy, as evidenced by average scores of between 1 and 2 on this dimension (Figure 9.1). These signify that on average the SEE economies are still in the process of adopting relevant frameworks, rather than advancing their implementation.

Figure 9.1. **Science, technology and innovation: Dimension and sub-dimension average scores**



Note: See the methodology chapter for information on the *Competitiveness Outlook* assessment and scoring process.

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Governance of STI policies is relatively advanced, with three of the economies having adopted an STI strategy (the Former Yugoslav Republic of Macedonia, Montenegro and Serbia). Implementation in the Former Yugoslav Republic of Macedonia

* This designation is without prejudice to positions on status, and is in line with United Nations Security Council Resolution 1244/99 and the Advisory Opinion of the International Court of Justice on Kosovo's declaration of independence.

is well co-ordinated, but the two other economies are less advanced. Public research system policies are also relatively advanced, while support for business investments is less so. The promotion of public-private linkages is mostly at the pilot stage. The area of human resources for innovation is the least advanced, with very few policies to facilitate and encourage individual researchers to innovate and transfer their innovation to the private sector.

Comparison with 2016 assessment

STI policy has gained prominence in the six SEE economies in the last two years. Serbia and Montenegro have established holistic STI strategies, with Serbia establishing a ministerial-level council to co-ordinate STI policy in Serbia, while the innovation fund of the Former Yugoslav Republic of Macedonia has started operation. Kosovo has taken steps towards drafting an innovation law. The first venture capital fund in the region – South Central Ventures, established under the Enterprise Innovation Fund (ENIF)[1] – has realised its first eight portfolio investments in SEE (South Central Ventures, n.d.). Incubator infrastructure has expanded to all six economies. Serbia and Montenegro have set up science and technology parks (STPs), but they have yet to develop activities to facilitate knowledge transfer and linkages between business and academia.

Achievements

The six assessed SEE economies have taken positive steps towards establishing strategic approaches to STI policy. The Former Yugoslav Republic of Macedonia, Montenegro and Serbia have adopted holistic innovation strategies, while Albania, Bosnia and Herzegovina,[2] and Kosovo have prepared drafts for adoption.

The Former Yugoslav Republic of Macedonia and Serbia have strengthened horizontal co-ordination with ministerial-level councils to co-ordinate STI policy in both economies.

Independent and professional innovation funds have been established in Serbia and the Former Yugoslav Republic of Macedonia to implement competitive innovation grant instruments.

Start-ups benefit from an infrastructure of incubators and accelerators, and the first venture capital funding. All six economies have established incubator infrastructure offering events such as hackathons, start-up weekends, mentoring and training. South Central Ventures, a venture fund financed by the European Investment Fund, the European Commission and the SEE governments, has started operations in all six economies.

The first science and technology parks have been established in Bosnia and Herzegovina, Montenegro and Serbia. However, these parks have yet to develop strong ties to academia.

Serbia has established rules governing the intellectual property split between individuals and institutions; at least 50% of profits from an invention goes to the researcher, which should encourage researchers to patent their discoveries.

Remaining challenges and key recommendations

- **Increase and consolidate financial support for research and development.** Overall financial support is a small fraction of that offered in comparable transition countries, particularly for business innovation. Introducing performance-based contracts for institutions would increase the efficiency of government spending in this area. Financial support for business innovation (and in some cases, public-sector research) largely depends on donor financing or loans, threatening sustainable development of the innovation ecosystem over time. Funding instruments are fragmented across ministries for education, science and economy, and various agencies.

- **Place more emphasis on technology diffusion and absorption policies.** In the absence of government support for technology extension services, the European Bank for Reconstruction and Development's (EBRD) Advice for Small Businesses programme is active across the six economies and has effectively enhanced SMEs' technological development. However, the SEE governments have not implemented such instruments, which are crucial for technology absorption in middle-income economies, enabling the SEE economies to catch up with more advanced ones. Cross-border technology transfer to SMEs is yet to be developed, for example, through collaboration with international networks such as Fraunhofer.

- **Use procurement to encourage innovation.** While government demand for innovative products and services may be limited, existing procurement can be adapted to encourage innovative solutions by using functional requirements rather than technical specifications, as they can spur innovative solutions while enhancing competition and preventing bid rigging.

- **Develop a structured approach to creating links between business and academia.** Strong barriers remain between the business and academic communities. In particular, they could consider: 1) introducing the "third mission" of co-operation with industry in higher education institutions (HEIs); 2) introduce private-sector representation on the governance boards of HEIs and public research organisations (PROs); 3) develop "triple helix"[3] type events to create opportunities for business and academia to meet; 4) use innovation vouchers to initiate small-scale collaboration; and 5) develop collaborative grants for more mature projects.

- **Provide incentives for individuals to unleash their creative potential.** Except in Serbia, there are no clear rules on splitting intellectual property rights between an individual researcher and their institution. Researchers are not evaluated on their co-operation with business, and there are no schemes to promote mobility between the public and private sectors, such as industrial master's or PhDs, entrepreneurial leave of absence, or subsidies for employment transfer.

- **Make better use of the SEE economies' highly educated diaspora and tackle the brain drain.** More than 30% of highly educated people have left the region. While bringing them back might seem difficult in the short term, steps could be taken to improve connections and knowledge flows through programmes like the Unity for Knowledge scheme in Croatia.

- **Improve the creation of STI-related statistics to enable the development of evidence-based policies.** The economies collect very few statistical indicators relevant to science, technology and innovation, and only Serbia and the Former Yugoslav Republic of Macedonia are covered by the European Innovation Scoreboard (EIS).

Context

The knowledge created through R&D performed by businesses, the public sector and foreign firms is a determinant of long-term productivity growth (Guellec and Van Pottelsberghe de la Potterie, 2004). Because wider society reaps a greater return on business R&D than the business does itself, some degree of public intervention is justified (Hall, Mairess and Mohnen, 2010). Innovation can also come from sources other than R&D – notably non-technological innovation.

Science, technology and innovation (STI) policy spans the entire innovation value chain: from the creation of fundamental knowledge in basic research to applied research and technology. This enables the transfer of knowledge to the economic sphere, and finally to innovation, fostering the creation of new products, processes, marketing and organisational models. The effect of public R&D on productivity depends in large part on the intensity of the business R&D effort, which facilitates the commercialisation of innovation. Therefore, governments need to support both public and private research, development and innovation (RDI) activities, and facilitate flows of knowledge between the two sectors.

A strong justification for government spending on R&D can be found in its high social rate of return. A recent meta-analysis found a mean social return of 170% to the entire society (Appelt, forthcoming). In Croatia, it was estimated at 73%, more than double the rate of return on infrastructure, and seven times as high as that for education. This result is explained by R&D knowledge capital starting from a low base, compared to capital invested in infrastructure and education (Aprahamian and Correa, 2015).

Analysis of STI policy in the SEE economies reveals significant links with other policy areas related to competitiveness treated elsewhere in this publication, in particular:

- **Chapter 1. Investment policy and promotion** aims to bring in foreign direct investment (FDI). FDI can allow new technology to be adopted, especially by small and medium-sized enterprises (SMEs) and particularly if investment promotion is focused on knowledge-intensive sectors. A proactive STI policy can also be a powerful driver of FDI by knowledge-intensive firms wishing to benefit from local knowledge. Indeed, a strong local STI system can provide specific knowledge inputs to knowledge-intensive firms.
- **Chapter 2. Trade policy and facilitation** and STI reinforce each other, since a strong innovation context will give an economy a competitive advantage in its exports. Effective trade policies which open up domestic markets to foreign technology, as well as opening foreign markets to domestic companies, will be strong enablers of the scaling up needed to return investment in R&D.
- **Chapter 3. Access to finance** is a primary issue for innovative companies in the SEE economies which have very weak venture capital and business angel investment systems.
- **Chapter 4. Tax policy** such as tax credits can be used to encourage business R&D spending, while environmental taxes (such as emissions levies) encourage firms to innovate to reduce their tax burden.
- **Chapter 5. Competition policy** strives to increase competition in markets where it is not working well, and thus contributes to improving conditions for innovation. Empirical evidence shows that competitive markets are most conducive to

innovation, even though, in theory, extreme competition may have the opposite effect (Friesenbichler and Peneder, 2016; Aghion et al., 2005).

- **Chapter 7. Education and competencies** are vital for increasing the number and quality of researchers who can carry out STI activities. A strong innovation ecosystem can also encourage talented people to remain in their home country instead of emigrating.
- **Chapter 10. Digital society** is the enabling tool for a major change in scientific practices that can be aggregated under the umbrella of "open science" (OECD, 2015a). Likewise, e-business and e-commerce are major enablers of innovation in the business domain.

Science, technology and innovation assessment framework

The science, technology and innovation dimension in the *2018 Competitiveness Outlook* examines the policy framework for STI. It presents an analytical framework built on the approach developed in the OECD Reviews of Innovation Policy,[4] a comprehensive approach to reviewing national innovation systems which has been used for in-depth reviews of both OECD member and non-member countries. The future joint OECD-EU STI Policy Survey will use a similar framework.

Without seeking to be exhaustive, it considers five broad sub-dimensions which are critical for the development and dissemination of new knowledge to the wider economy:

1. Governance of STI policies: what is the overarching strategic framework for STI? How is policy co-ordinated among concerned government bodies? What is the institutional set-up for implementation?
2. Public research system: how are higher education institutions (HEIs) and public research organisations (PROs) funded? What institutional arrangements ensure research excellence?
3. Innovation in firms: what financial instruments and institutional arrangements are used to support business investment in innovation? How are innovative start-ups nurtured? How is technology diffusion encouraged?
4. Public-private knowledge transfers and linkages: how is science-industry collaboration supported through appropriate instruments and institutional arrangements? How is technology transfer supported?
5. Human resources for innovation: what specific policies are in place to ensure the proper incentives for researchers to contribute to the knowledge economy? Which schemes facilitate mobility of professionals between academia and the private sector?

Figure 9.2 shows how the sub-dimensions and their constituent indicators make up the science, technology and innovation dimension assessment framework. Each sub-dimension is assessed through quantitative and qualitative indicators. The OECD collected the qualitative and quantitative data for this dimension with the support of the SEE governments and their statistical offices.

Quantitative indicators are based on national or international statistics. Qualitative indicators have been collected and scored in ascending order on a scale of 0 to 5, and are summarised in Annex 9.A1.[5] For more details on the methodology underpinning this assessment, please refer to the methodology chapter.

Figure 9.2. **Science, technology and innovation assessment framework**

Science, technology and innovation dimension

Outcome indicators

- gross domestic product (GDP) per person employed
- high-tech manufacturing exports and medium high-tech exports (% of manufacturing exports)
- knowledge intensive services exports (% of total services exports)
- patent applications to the European Patent Office (EPO) and United States Patent Office (USPTO)
- charges for the use of intellectual property, payments (% of GDP)
- charges for the use of intellectual property, receipts (% of GDP)

Sub-dimension 1 Governance of STI policies	**Sub-dimension 2** Public research system	**Sub-dimension 3** Innovation in firms	**Sub-dimension 4** Public-private knowledge transfers and linkages	**Sub-dimension 5** Human resources for innovation
Qualitative indicators 1. National STI plan or strategy 2. Horizontal policy co-ordination 3. Implementation of STI policies 4. International STI policy strategy and framework	**Qualitative indicators** 5. Funding of public research institutions and universities 6. Public research institutional arrangements	**Qualitative indicators** 7. Innovation promotion 8. Financial support: competitive grants for research and innovation in businesses 9. Fiscal incentives for RDI 10. Institutional support: incubators and accelerators 11. Institutional support: technology extension services 12. Public procurement for innovation	**Qualitative indicators** 13. Innovation voucher schemes 14. Competitive co-operative grants 15. Innovative clusters 16. Technology institutes, competence centres, and science and technology parks (STPs)	**Qualitative indicators** 17. Mobility between academia and industry 18. Researcher evaluation in favour of business-academia co-operation 19. Intellectual property rights for business-academia co-operation
Quantitative indicators 1. Gross expenditure on R&D (GERD) (% of GDP) 2. International co-publications (Scimago)	**Quantitative indicators** 3. Citeable documents (per million population) 4. Average number of citations per document 5. Number of researchers per million population (full-time equivalent) 6. Volume of international competitive research grants (Horizon 2020)	**Quantitative indicators** 7. Business expenditure on R&D (% of GDP) 8. Score SMEs introducing innovations (EIS) 9. Motivational index (Global Entrepreneurship Monitor) 10. Non R&D innovation expenditures (EIS) 11. Number of firms introducing a new product/service (EIS) 12. Number of firms introducing a process innovation (EIS)	**Quantitative indicators** 13. Charges for the use of intellectual property, receipts (World Bank World Development Indicators) 14. Joint publications between academia and industry (Web of Science)	**Quantitative indicators** 16. Number of highly educated emigrants 17. Number of science, technology, engineering and mathematics (STEM) graduates

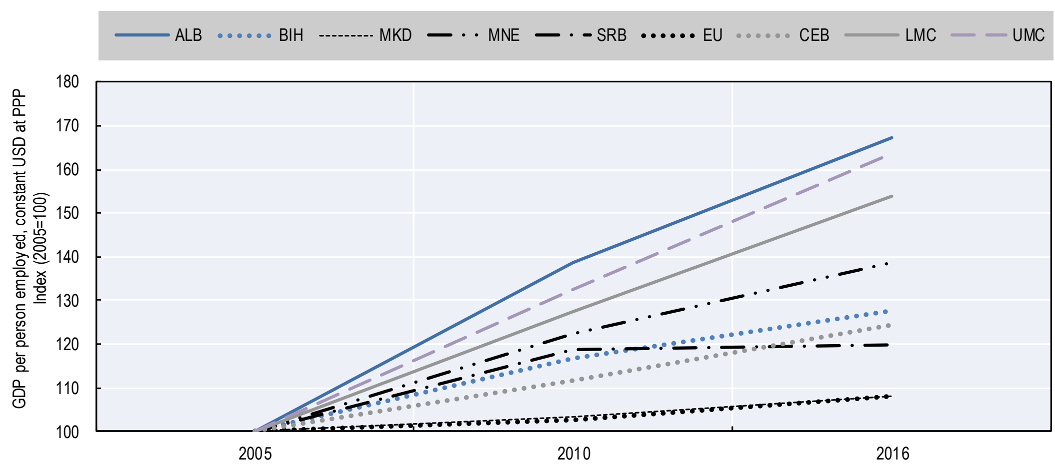
Science, technology and innovation performance in SEE economies

While natural resource endowments and fixed capital investment are major drivers of productivity in the factor-driven and efficiency-driven stages of development, STI plays an important role as a driver of productivity in innovation-driven economies close to the efficiency frontier.

Labour productivity has grown at different rates in the six SEE economies in the past decade (Figure 9.3). Overall it has grown faster than the European Union (EU) average, which is to be expected from economies which are far from the efficiency frontier. In Albania, Bosnia and Herzegovina, and Montenegro, it has also grown faster than in the benchmark group of Central Europe and the Baltics (CEB)[6] economies. However, when compared with economies with a similar degree of development (lower-middle income for Kosovo, and upper-middle income for the others), only Albania outperforms this benchmark.

Figure 9.3. **Labour productivity evolution (2005-16)**

Index of GDP per person employed, constant USD at purchasing power parity (2005=100)



Note: Data for Kosovo are not available. CEB – Central Europe and the Baltics (Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia); LMC – lower middle-income countries; UMC – upper middle-income countries. In SEE, Kosovo is considered to be lower middle income, while the other five economies are upper middle income under the World Bank classification.

Source: World Bank (2017), *World Development Indicators* (database), http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators&preview=on#.

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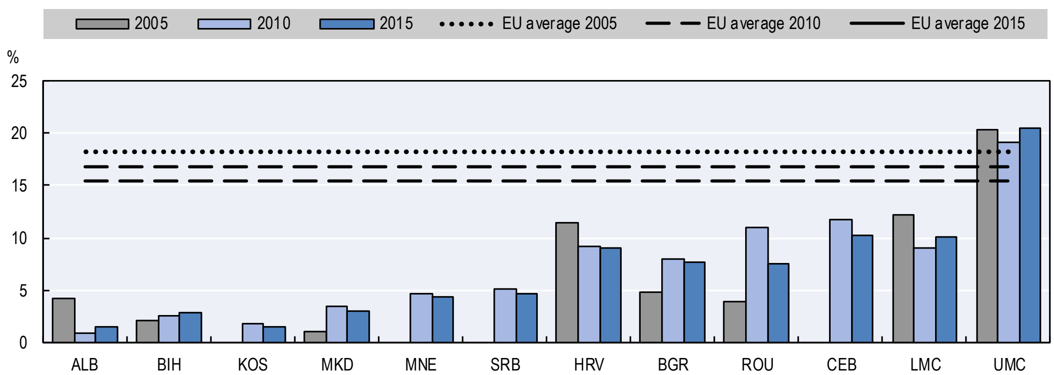
In a well-performing innovation ecosystem, high-tech products make up a significant fraction of total manufacturing exports. High-tech exports are at a very low level in the SEE economies, not only compared to the EU Member States, but also to upper- and lower-middle income countries (Figure 9.4). However, the data should be interpreted with caution, since high-tech exports from middle-income countries often rely on assembly operations, which create relatively little value added in the country itself. In order to improve the analysis, the SEE economies would need to meet the conditions[7] that would enable them to be included in the OECD's trade in value added (TiVA) statistics (OECD, 2016a) to be in a better position to evaluate their integration into global value chains.

When medium-technology products are included, the SEE economies perform significantly better. This is in large part due to the development of the automotive industry value chain, notably in the Former Yugoslav Republic of Macedonia where high- and medium-technology products accounted for 56% of manufactured exports; and in Serbia, where they accounted for 39%, in 2015. This is comparable with, or even higher than the EU average of 54% and the CEB average of 48%. Unfortunately, such favourable statistics do not signify a strong knowledge-intensive input from the local economies, since they largely depend on large foreign investments in the automotive industry and imported technology and design. Indeed, FDI has created very limited spillover effects in the SEE economies (Estrin and Uvalic, 2016; OECD, 2017a).

Figure 9.4. **High-tech exports as a share of manufactured exports (2005-15)**



Note: HRV – Croatia; BGR – Bulgaria; ROU – Romania; CEB – Central Europe and the Baltics (Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia); LMC – lower middle-income countries; UMC – upper middle-income countries. In SEE, Kosovo is considered to be lower middle income, while the other five economies are upper middle income under the World Bank classification.

Source: Government statistical offices (for Kosovo and Montenegro); other data from World Bank (2017), *World Development Indicators* (database), http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators&preview=on#.

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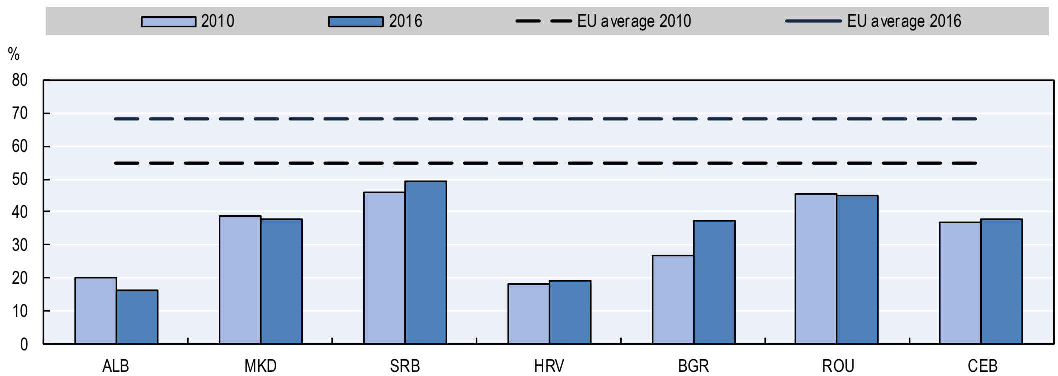
The six SEE economies are essentially service economies, and therefore exports of knowledge-intensive services also need to be considered (Figure 9.5). Serbia's performance here exceeds the CEB average, while the Former Yugoslav Republic of Macedonia's is comparable. One particular area of strength lies in the very dynamic ICT services sector – which represented 37% of Serbia's services exports in 2015 (World Bank, 2017). Naturally, this indicator also depends on the size of the denominator, and thus coastal areas such as Albania have lower values on this indicator due to the dominance of tourism in their services exports.

When it comes to filing patents the SEE economies lag significantly behind, not only the EU average, but also the CEB average. Only a tiny fraction of patents filed in either the European Patent Office (EPO) and the United States Patent and Trademark Office (USPTO) originated in the SEE economies (Figure 9.6).

Figure 9.7 displays two important outcomes for intellectual property (IP) exchanges: receipts from and payments for the use of IP. Figure 9.7.A shows receipts for domestic inventions sold to foreign clients, and Figure 9.7.B shows payments for the use of foreign inventions. Payments for IP use are an indicator of technology diffusion into the SEE economies, as a foreign licence is paid for and used domestically.

Figure 9.5. **Knowledge-intensive services exports as a share of all services exports (2010 and 2016)**



Note: Data for Bosnia and Herzegovina, Kosovo and Montenegro are not available. HRV – Croatia; BGR – Bulgaria; ROU – Romania; CEB – Central Europe and the Baltics (Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia).

Source: National statistical offices (Albania and Serbia); EC (2017a), *European Innovation Scoreboard 2017*, http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_fr.

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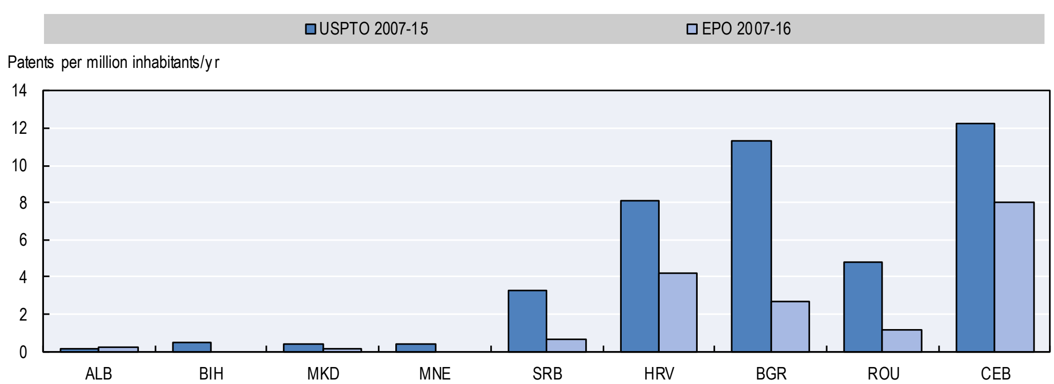
Figure 9.6. **Patenting trends in South East Europe**



Note: Data for Kosovo unavailable. HRV – Croatia; BGR – Bulgaria; ROU – Romania; CEB – Central Europe and the Baltics (Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia)*;* USPTO – United States Patent and Trademark Office; EPO – European Patent Office.

Source: USPTO (2017), *Statistics* (dataset), www.uspto.gov/learning-and-resources/statistics; EPO (2017), *Statistics* (dataset), www.epo.org/about-us/annual-reports-statistics/statistics.html.

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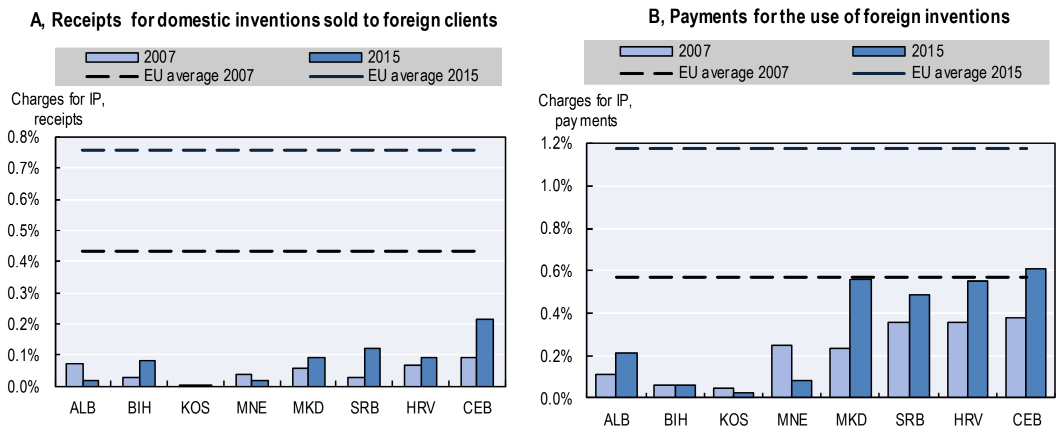
Figure 9.7.A shows that the six SEE economies receive less than one-sixth of the EU average, and less than half the CEB average for their IP. Figure 9.7.B also shows a large gap compared to the EU average for IP payments. However, it is interesting to note that the Former Yugoslav Republic of Macedonia and Serbia attain levels comparable to the

CEB average, indicating comparable levels of technology absorption to Central Europe countries.

Figure 9.7. **Charges for the use of intellectual property, receipts and payments**

% of GDP



Note: HRV – Croatia; CEB – Central Europe and the Baltics (Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia).

Source: World Bank (2017), *World Development Indicators* (database), http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators&preview=on#.

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The following sections examine in further detail the levers which are at the disposal of the six SEE economies to realise the full potential of STI, using the five sub-dimensions of the assessment framework.

Governance of science, technology and innovation policies

The eminently interdisciplinary nature of innovation makes the governance of research and innovation a challenge. Research and research-based policies are usually the domain of ministries of education and science, while business innovation is usually covered by economy ministries. Innovation drives progress throughout society, and touches upon a wide range of issues, including tax policy, competition law and regulations (OECD, 2010a). Line ministries from finance, telecommunications, defence and energy, to transport, health, agriculture and tourism also have a strong interest in innovation.

The governance of STI policies sub-dimension assesses these aspects through four qualitative indicators (Figure 9.8):

The **national STI plan or strategy** indicator assesses the adoption of a national innovation strategy and action plan with responsibilities, timelines, objectives, budgets and monitoring systems.

The **horizontal policy co-ordination** indicator assesses formal and informal mechanisms to ensure synergies and avoid conflicts across the ministries concerned. In the case of a formal body such as an innovation council, the indicator assesses its mandate, as well as its analytical capacity for evidence-based policy decisions.

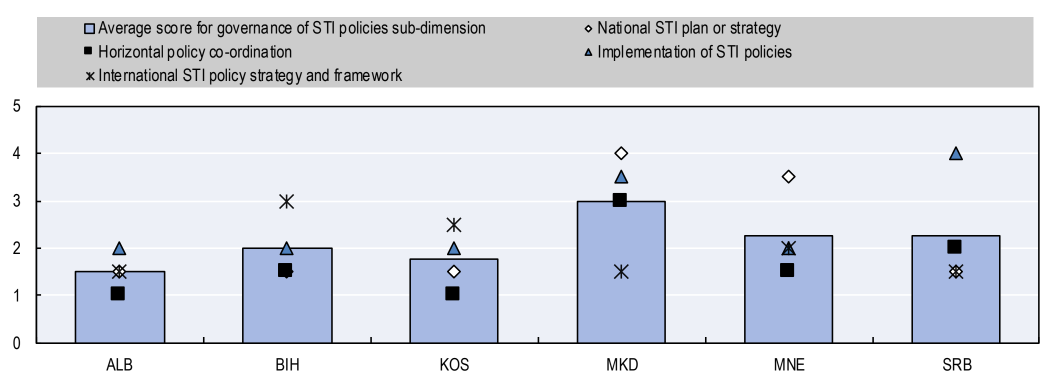
The **implementation of STI policies** indicator assesses the implementation body, be it an agency, a fund or part of a ministry, in particular its professionalism and autonomy from policy makers.

The **international STI policy strategy and framework** indicator assesses policies that support scientific co-operation on a bilateral or multilateral basis, as well as cross-border technology transfer.

Governments need to take an overarching strategic view and co-ordinate policies across the whole of government. Failure to do so can create sets of overlapping and even contradictory measures, while leaving gaps in crucial areas where government support is needed. In particular, they need co-ordinated and consensual policies aiming to bridge the gap between academia and business.

The Former Yugoslav Republic of Macedonia has gone furthest in governance of STI policies, achieving an average score of 3 (Figure 9.8). With OECD support, it adopted an integrated innovation strategy in 2012, covering the whole innovation value chain from basic research to business innovation. It was also the first economy to set up a ministerial-level co-ordination body chaired by the prime minister – although this body has not met between mid-2015 and mid-2017 due to an ongoing governmental crisis – as well as a working-level inter-ministerial working group. It also has a functioning Innovation Fund. Montenegro and Serbia have an average level of 2, with recently adopted innovation strategies. Serbia has an advanced Innovation Fund and also set up a ministerial-level co-ordination body in 2017. The other three economies score below 2, since they lack overall strategies and co-ordination mechanisms, haven't set up any innovation agencies, and mostly focus on international co-operation aspects.

Figure 9.8. **Governance of STI policies: Sub-dimension average score and indicator scores**



Note: See the methodology chapter for information on the *Competitiveness Outlook* assessment and scoring process.

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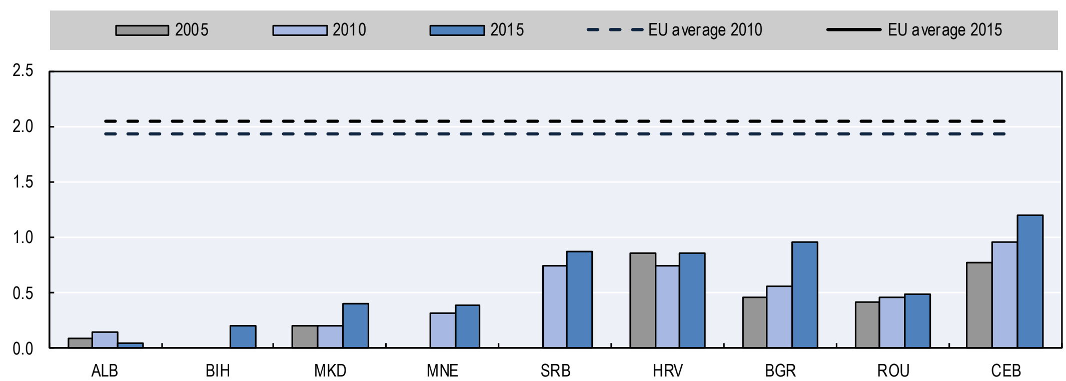
Low research and development expenditure suggests weak commitment to supporting STI

Overall spending on R&D is a key statistical indicator of government commitment to supporting STI policies. Figure 9.9 gives an overview of gross expenditure on R&D (GERD). Overall, GERD remains below 0.5% of GDP in most SEE economies except Serbia, where it reaches 0.9%. This is a small fraction of the EU average level of 2%, and also lags significantly behind the CEB. However, most of the SEE economies have now started to measure GERD, and there has been some increase in spending as the STI agenda has become more prominent.

However, large financial support instruments still mostly depend on donor grants or loans, such as European Instrument for Pre-accession (IPA) grants and World Bank STI policy loans, which are often weighed against other government priorities, and may or may not be renewed. For example, Montenegro implemented grant schemes under the World Bank-financed Higher Education and Research for Innovation and Competitiveness (HERIC) project in 2012-15, but follow-on financing is not foreseen in the short term as priorities have changed. Such fluctuations disrupt attempts to nurture an emerging innovation ecosystem, which is a long-term process best served by long-term and sustainable measures. Indeed, for a grant scheme to have an impact it needs to be sustained so that applicants learn and improve over time. Discontinuing funding discourages them from applying if the process restarts later, introducing further delays in the catch-up process.

Figure 9.9. **Gross domestic expenditure on R&D (GERD)**

% of GDP



Note: Data for Kosovo are not available. HRV – Croatia; BGR – Bulgaria; ROU – Romania; CEB – Central Europe and the Baltics (Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia).

Source: Government statistical offices and ministries as part of the *Competitiveness Outlook* assessment 2016-17; Eurostat (2017), *Gross Domestic Expenditure on R&D (GERD)* (dataset), http://ec.europa.eu/eurostat/web/products-datasets/-/t2020_20&lang=en.

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Approaches to strategies, policy implementation and horizontal co-ordination vary

Policy focus on science, technology and innovation varies from economy to economy. While the Former Yugoslav Republic of Macedonia has developed and implemented an innovation strategy, Serbia and Montenegro implemented policies before any holistic innovation strategies were adopted,[8] although they have since adopted some (Serbia's Action Plan is still pending at the time of writing in October 2017), and the other three economies are yet to adopt them. Serbia also set up a ministerial-level co-ordination body in 2017. Albania, Bosnia and Herzegovina, and Kosovo all have draft strategies. Horizontal policy co-ordination remains an area for improvement in most economies.

Table 9.1 summarises the progress made and remaining challenges in the first three qualitative indicators for this sub-dimension, **national STI plan or strategy**, **horizontal policy co-ordination** and the **implementation of STI policies**.

Table 9.1. **Innovation strategy frameworks in the SEE economies**

Achievements and progress	Remaining challenges
Albania	
– Currently drafting an Innovation Strategy and holding stakeholder consultations. – Triple Helix Action Plan (THAP) adopted by Prime Minister's office with many actions particularly relevant to creating academia-business linkages. – Implementation of policies allocated to professional agencies: National Agency for Scientific Research and Innovation (NASRI) for research and research-based innovation, and the Albanian Investment Development Agency (AIDA) for business innovation.	– Innovation Strategy is yet to be adopted. – Implementation and financing of THAP to be confirmed. – THAP foresees the creation of an Innovation Council, currently pending. – Co-ordination between AIDA and NASRI to be enhanced.
Bosnia and Herzegovina[1]	
– Drafted the state-level Strategy for the Development of Science. – The Republika Srpska has adopted an entity-level Strategy for Scientific and Technological Development. – The Federation of Bosnia and Herzegovina has published a draft strategy from 2012. – Some policy instruments have been implemented at state and entity levels.	– Implementation of instruments is fragmented between the state, entity and cantonal levels, and across the ministries in charge of education and science and those in charge of the economy, industry, entrepreneurship. No dedicated agency exists. – The draft strategies at the state level and of the Republika Srpska are still mostly focused on science, with limited reference to R&D in the business sector; approval is pending. – The Federation of Bosnia and Herzegovina's draft strategy was never adopted due to an over-ambitious objective for GERD (1.5% of GDP).
The Former Yugoslav Republic of Macedonia	
– Adopted its Innovation Strategy (supported by the OECD SEE programme) and Innovation Law in 2012. – The ministerial-level Committee for Entrepreneurship and Innovation met regularly to arbitrate issues during the implementation. – Inter-ministerial working group on innovation meets regularly and co-ordinates implementation. – Established an Innovation Fund financed through a World Bank loan. Evaluation of the Fund is initiated by the European Network of Innovation Agencies (TAFTIE).	– The Committee for Entrepreneurship and Innovation has not met during 2015-17. – The balance between the instruments implemented by the Fund, the Ministry of Education and Science, the Ministry of Economy and the Agency for Promotion of Entrepreneurship (APPRM) could be improved.
Kosovo	
– Drafted its innovation strategy in 2012 (with support from the OECD SEE programme), recent updates have merely covered some data. – Established a working group to draft an Innovation Law which has been sent to the Cabinet of the Minister as of September 2017. – IT strategy adopted with a significant pillar concerning innovation (Pillar 8).	– Innovation strategy is yet to be adopted. – Fragmented policy implementation between Ministry of Education, Science and Technology (for scientific research), Ministry of Economic Development (IT-related innovation policy) and KIESA, the SME agency (SME vouchers and equipment grants).
Montenegro	
– Adopted its Strategy of Innovation Activities (SIA) in 2016, and is actively implementing it. – Established a Scientific Council with members from the Ministry of Science, academia and one member from the private sector, with a mandate mostly related to science. – Implemented specific grant schemes before the existence of its strategy, notably under the World Bank HERIC project since 2012 (USD 16 million).	– The Ministry of Economy is not included in the Scientific Council and has a relatively minor role in the implementation of the SIA. – The successful HERIC project has not secured financing to follow up its financial support instruments.
Serbia	
– Adopted the Research for Innovation strategy in 2016. – Established the ministerial-level Committee for Innovative Entrepreneurship in May 2017, and will have a dedicated Secretariat to provide an evidence base for decision making. – Its Innovation Fund has been operational since 2011 and is a member of TAFTIE. Its grant programmes have been independently evaluated by Applied Economics Ltd. (Israel)	– The strategy's action plan is yet to be adopted and implemented. – The co-ordination of implementation between the Fund, and the economy and education and science ministries could be improved.

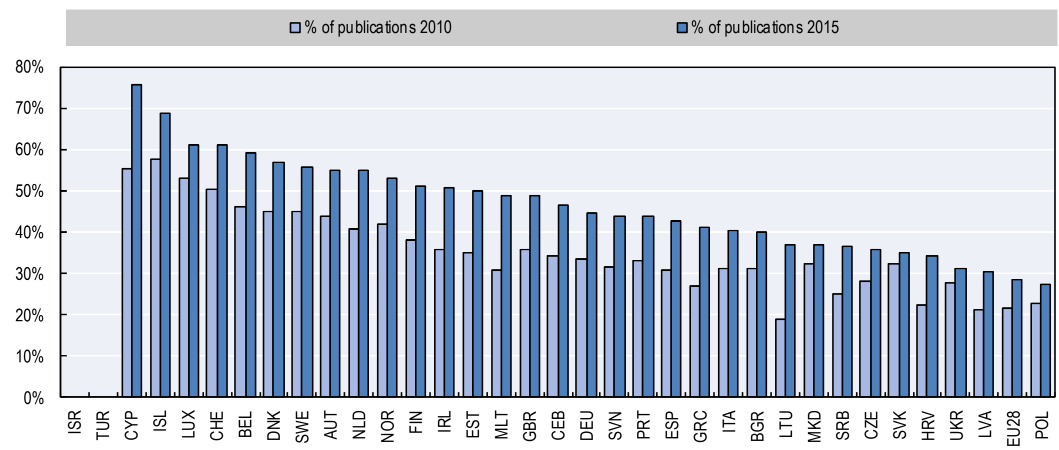
1. There are four main administrative levels in Bosnia and Herzegovina: the State, the Federation of Bosnia and Herzegovina, the Republika Srpska, and the Brčko District. The administrative levels of the State, the Federation of Bosnia and Herzegovina, and the Republika Srpska are taken into account in the *Competitiveness Outlook* 2018 assessment, when relevant. The Brčko District is not assessed separately.

International co-operation is progressing, but could be further enhanced

The governance of science, technology and innovation policy increasingly has an international dimension (OECD, 2010b). In the SEE economies for which data are available, scientific co-publications between domestic and foreign researchers are growing faster than the overall volume of publications.[9] However, with just 37% of publications being co-publications, researchers in Serbia and the Former Yugoslav Republic of Macedonia are still engaging internationally less than average (Figure 9.10).

Figure 9.10. **International co-publications**

% of all publications



Note: Data for Albania, Bosnia and Herzegovina, Kosovo, and Montenegro are unavailable.

1. Note by Turkey: The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the "Cyprus issue".

2. Note by all the European Union Member States of the OECD and the European Union: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

3. The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Source: EC (2017a), *European Innovation Scoreboard 2017*, http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_fr.

StatLink http://dx.doi.org/10.1787/888933704929

All six of the SEE economies are associated with Horizon 2020.[10] Serbia has been the most successful economy, with 158 projects which had attracted EUR 55 million as of September 2017, including 2 European Research Council grants, and a large grant under the Spreading Excellence and Widening Participation scheme.[11] These results exceed Serbia's budget contribution to Horizon 2020 of EUR 34 million as of January 2017. The other five economies combined have attracted only 95 projects, worth EUR 11 million, which is considerably less than their contribution to the scheme.

Participation in Maria Skłodowska-Curie actions (grants for scholarly exchanges under Horizon 2020) has again been most extensive in Serbia, with 41 exchanges, followed by 9 for Bosnia and Herzegovina, and 1-3 exchanges each for the remaining 4 economies. Bosnia and Herzegovina, Kosovo and Montenegro actively support scientists by subsidising consulting to help them write Horizon 2020 proposals. Serbia and Montenegro are in the process of restructuring their network of national contact points to make them more efficient at transmitting key information from Brussels to the research institutions.

Bosnia and Herzegovina has one of the most advanced frameworks for international co-operation in the region. This is because it is the main area of focus of its state-level Ministry of Civil Affairs within its STI policy, the other areas being mostly devolved to the entities and cantons. Its previous Strategy for the Development of Science outlined a structured approach, as does the draft new one. It has given consistent support for participation in international calls (Horizon 2020, EUREKA and others), and runs a recurrent grant scheme[12] which finances participation in international conferences, fairs and collaborative R&D projects with foreign partners. Kosovo also has a relatively developed internationalisation policy, with instruments supporting participation in conferences, academic exchange and small collaborative projects. Kosovo’s IT strategy also foresees international cluster linkages.

All of the economies have bilateral co-operation agreements and scholarships to facilitate international mobility. However, since Horizon 2020 mobilises significant contributions from national budgets, there is very little space to finance other types of international co-operation. Therefore, this co-operation mostly relies on initiatives by partner countries, such as recent joint calls by Serbia and the People’s Republic of China, and Albania and Austria.

A regional co-operation initiative in science and technology is being established under the name of the Western Balkans Research and Innovation Centre (WISE), an international organisation with a mission to strengthen regional research innovation and technology systems and improve the research and innovation climate in South East Europe.[13] Initially, it envisages having seven members: the six economies covered in this report, and Croatia. The initiative was initiated at a ministerial conference in Split in September 2015, and has now been ratified by four economies: Albania, Bosnia and Herzegovina, Croatia and Montenegro. Ratification by four members makes it possible to establish the organisation, which will have its headquarters in Split, Croatia.

In addition, the Multi-Annual Action Plan for a Regional Economic Area in the Western Balkans (MAP) foresees important regional initiatives, such as the development of a regional centre of excellence to promote collaboration among science, technology and industry, as well as engagement of those communities with Europe-wide smart growth approaches (MAP, 2017).

It is interesting to note that none of the six economies has a structured programme for co-operation with their diasporas. As will be discussed below, brain drain is a significant issue, and several attempts were made in the past to attract emigrants back to their home economies through “brain gain” programmes, with limited success. However, there are other ways to engage with the diaspora to facilitate the circulation of knowledge. Croatia’s Unity through Knowledge fund offers an interesting example, linking diaspora members with domestic institutions (Box 9.1).

Box 9.1. Good practice: Unity through Knowledge Fund in Croatia

The Unity through Knowledge Fund (UKF) was established in Croatia in 2007 as an instrument to connect Croatian scientists and professionals to centres of excellence abroad, using the diaspora connection as an effective tool to enhance the partnerships. Co operation between a Croatian institution and a foreign one provides the opportunity to transfer knowledge and enhance the competitiveness of domestic knowledge production.

The programme includes a cross-border grant which supports medium-scale collaborative research projects in Croatia with the involvement of the Croatian scientific and research diaspora, as well as a grant designed to increase the mobility of young researchers and professionals between academia and Croatian industry. In order to help establish partnerships, the Ministry of Science, Education and Sports has created a database of contacts within the Croatian scientific diaspora. The programme provides incentives to domestic researchers and members of the diaspora to connect and collaborate with each other. This collaboration enables the domestic institution to gain knowledge from the international partner.

A total of 91 projects received support during the first cycle (2007-12), including 560 scientists (380 from Croatia and 180 from the diaspora, who were at institutions including Yale University, ETH Zürich, and the Royal Institute of Technology in Sweden). It also allowed projects to attract additional funding from the European Seventh Framework Programme (FP7) (34% of funding for Croatian projects from FP7 in the period 2007-10 originated from UKF-related projects).

UKF was selected as "best practice" by the European Regional Economic Forum in the area of developing human capital and managing migration for more competitive European regions. It was also selected as "good practice" by the International Labour Organization for promoting linkages between migration and development.

Source: Adapted from Hornstein Tomić and Pleše (2014), "Skilled mobility as a challenge for Croatian diaspora and migration policies".

The way forward for the governance of STI policies

The positive trends observed in the governance of STI systems should be continued and reinforced.

Among the more advanced economies which have adopted holistic strategies – the Former Yugoslav Republic of Macedonia, Montenegro and Serbia – **the focus should be on enhanced implementation and sustainable financing of instruments, as well as independent assessment of the impact of those instruments**, and of the strategy as a whole.

The other economies (Albania, Bosnia and Herzegovina, and Kosovo), **should prioritise the adoption of draft strategic frameworks after a substantial stakeholder consultation process** to ensure widespread buy-in and mobilisation in their implementation. In the meantime, Kosovo could implement Pillar 8 of its IT strategy which would boost innovation in the IT sector, while Albania could implement its officially adopted Triple Helix Action Plan, to help prepare the ground for its future innovation strategy. In Bosnia and Herzegovina, the state-level strategy uses a bottom-up approach of consolidating entity-level strategies and policies.

Overall, most economies need to improve their inter-ministerial co-ordination. The Former Yugoslav Republic of Macedonia could resume meetings of its Committee for Entrepreneurship and Innovation, while Serbia needs to ensure the successful functioning of its newly established Council for Innovative Entrepreneurship. Bosnia and Herzegovina, and Montenegro could consider expanding the membership of their scientific councils to include members from economic ministries. They could also broaden their mandate to include the full scope of business innovation (including non-technological innovation). Albania and Kosovo could consider establishing the innovation councils foreseen in their draft strategies. Box 9.2 offers a good-practice example from Norway of horizontal co-ordination of STI governance.

All six SEE economies could improve the implementation of their innovation policies, particularly co-ordination at the working level. They need closer co-operation between bodies in charge of supporting science, for example between ministries of education and science and their agencies, and between the economic ministries and their SME agencies. They also need to conduct independent evaluation of the performance of these agencies. Bosnia and Herzegovina's situation continues to be the most complicated, with responsibilities split not only between sectors, but also across the state, entity and cantonal levels of government. It might be useful to establish a state-wide working group with participants from both government sectors at different levels in order to share experiences and policy concepts, while respecting the constitutional mandate of each actor.

International co-operation could be organised more strategically, in order to prioritise the many different modes of co-operation, including bilateral agreements and participation in European instruments. The different economies have had different levels of success with participation in Horizon 2020, and some economies are planning to improve the efficiency of their National Contact Point networks, as well as supporting scientists in proposal writing. Regional sharing of good practices could prove useful in this domain, and this could take place in the framework of WISE, as soon as it is established.

The SEE economies could make greater use of their very widespread diasporas through programmes of collaborative grants, such as the Croatian UKF scheme (Box 9.1). Internationalisation policies should also consider opportunities for SMEs and cross-border technology transfer, in collaboration with international networks such as Fraunhofer, which is transferring Industry 4.0 practices to companies and academic institutions in Transylvania (Fraunhofer, 2014).

Governments need to create an overarching strategic view and co-ordinate policies across the whole of government. Failure to do so can create sets of overlapping and even contradictory measures, while leaving gaps in crucial areas where government support is needed. In particular, they need co-ordinated and consensual policies aiming to bridge the gap between academia and business need to be co-ordinated and consensual. See Box 9.2 for an example from Norway.

Public research system

A strong research base provides for knowledge creation in the transition to knowledge-based economies. Research occurs in both the public and private sectors: innovation in the business sector is covered in the next sub-dimension, while this section focuses on research in higher education institutions (HEIs) and public research organisations (PROs). HEIs and PROs represent an overwhelming majority of the R&D capacity of economies in the SEE region, which is why their management, modes of financing, and opportunities for human capital development are key for creating research excellence in the region.

Box 9.2. Good practice: Horizontal science, technology and innovation co-ordination in Norway

Norway's Long-Term Plan for Research and Higher Education 2015-2024 (LTP) is built around three overarching government objectives for STI policy: 1) developing research communities of outstanding quality; 2) enhancing competitiveness and innovation; and 3) tackling major social challenges.

The LTP aims to adopt a long-term perspective, to serve as a plan and not only a strategy, and to cover a broad policy spectrum, not confined to the policy fields in the remit of the Ministry of Education and Research. It has enhanced horizontal strategic orientation and co-ordination, setting a whole-of-government framework for high-level meetings chaired by the prime minister and cabinet discussions on STI issues, and helped improve the consistency of the various activities of the Norwegian research agency. Regular revisions of the LTP every four years provide an opportunity for stakeholders to meet and add more concrete structural and programme-style policy activities to the LTP from 2018 onwards, without changing the plan's general orientation.

Source: OECD (2017b), *Public Procurement for Innovation: Good Practices and Strategies*, http://dx.doi.org/10.1787/9789264265820-en.

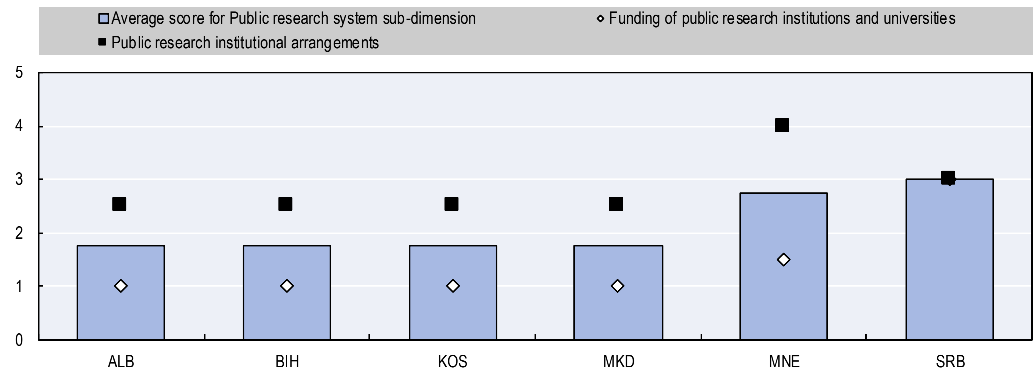
The public research system sub-dimension assesses these aspects through two qualitative indicators (Figure 9.11):

The **funding of public research institutions and universities** indicator assesses the financing framework, which usually consists of a combination of institutional funds (block funds) and project funds. Some economies have introduced performance-based research funding, based on the rationale of rewarding output, rather than input (Box 9.3).

The **public research institutional arrangements** indicator measures the legal and institutional frameworks for governing public research institutes and universities. A major aspect of governance is the balance between the principle of academic autonomy (which ensures long-term stability of research priorities), and the influence which a ministry can exert to ensure coherence with overall government social priorities.

Serbia and Montenegro are in the lead on this sub-dimension, with an average score close to 3, signifying that they have adopted and largely implemented the relevant frameworks. The situation in these two economies differs, however. Serbia has established and run an entirely project-based funding system for its PROs for several years now with nominally[14] competitive research grants, and has a well-developed institutional framework. At the same time, Montenegro has gone ahead with an advanced evaluation of its national university and has implemented restructuring on the basis of this assessment, while on the funding side is still relies mainly on legacy block grants without any performance requirement and has only a few competitive research grants. In the remaining economies, basic governance frameworks are in place but funding is still largely based on legacy systems, and performance contracting is still seen as only a remote possibility for the future (Figure 9.11).

Figure 9.11. **Public research system: Sub-dimension average scores and indicator scores**



Note: See the methodology chapter for information on the *Competitiveness Outlook* assessment and scoring process.

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Research outcomes are improving

The volume and quality of scientific production offers a measure of basic research outcomes. The number of scientific articles per million population is used as a measure of volume; quality measures use citations per article, normalised relative to the average for the 28 EU Member States (EU-28). The performance of the SEE economies is very low, both in volume and quality, but the trend between 2010 and 2015 is clearly positive for the Former Yugoslav Republic of Macedonia, Montenegro and Serbia (Figure 9.12).

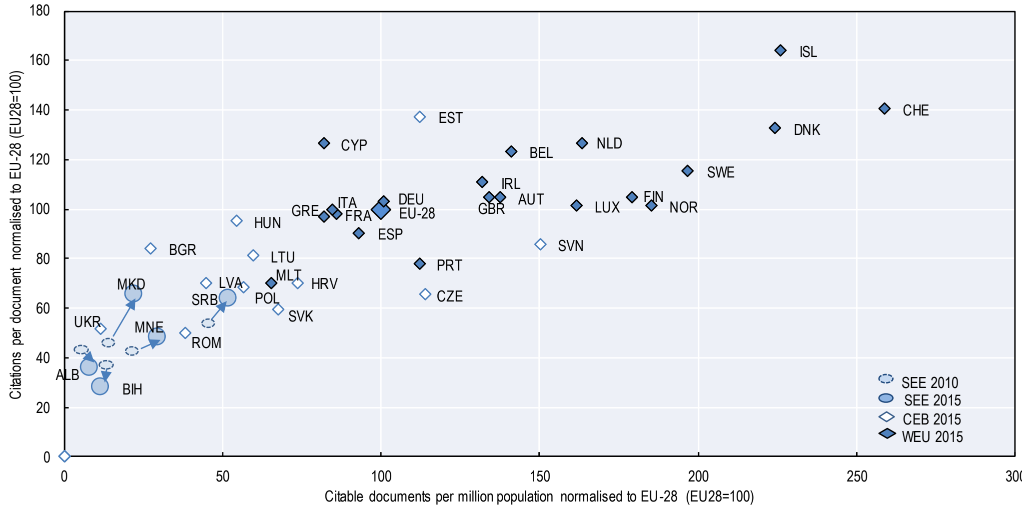
Another measure of quality is the share of scientific publications which are among the top 10% most cited. According to the European Innovation Scoreboard, 4.1% of publications in the Former Yugoslav Republic of Macedonia reached this benchmark in 2016 (up from 3.6% in 2010), while 5.3% of Serbian publications achieved this, up from 4.6% (EC, 2016). This performance is nearly in line with the average for Central Europe (5.7%), but still significantly behind the EU-28 average (10.6%).

The SEE economies' modest performance overall in the scientific area can be linked to the shortage of funding discussed under the previous sub-dimension, which translates into a modest number of researchers overall. However, the productivity of those researchers – measured as the number of publications per researcher – is higher than in most developed European countries (Figure 9.13).

Legacy block funding dominates, but performance-based schemes are envisaged for the future

Of the six economies, Serbia has adopted the most radical approach to funding public research, allocating 100% of funds on a competitive basis, based on domestic and international peer reviews of projects (Box 9.3). However, in practice, the success rate of applications is over 80%, so the process cannot be considered very competitive. Serbia plans to reform this approach in 2019 under its new strategy. This reform will combine project and institutional funding, and introduce performance criteria. The other SEE economies mostly rely on legacy block institutional funding calculated through formulas based on the number of researchers and students (for HEI). The Former Yugoslav Republic of Macedonia and Montenegro are carrying out feasibility studies to identify potential future models for performance-based financing. The studies are focused on identifying relevant models of performance contracting as well as key performance indicators which could be used for such contracting.

Figure 9.12. **Scientific production in SEE and comparator countries**



Note: WEU – Western Europe; EU-28 – the 28 EU Member States.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Source: Scimago (2017), *Country Rankings* (dataset), www.scimagojr.com/countryrank.php; World Bank (2017), *World Development Indicators* (database), http://databank.worldbank.org/data/reports.aspx?source=wo rld-development-indicators&preview=on#.

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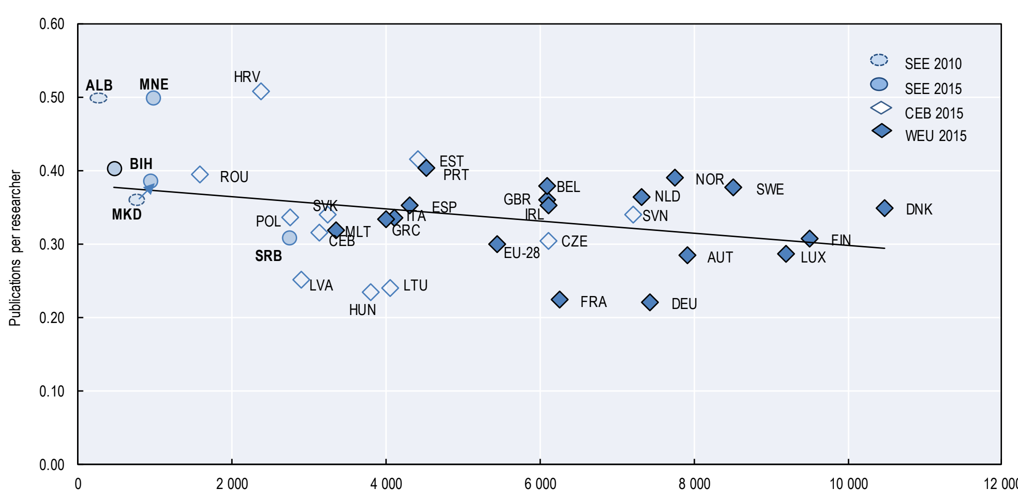
Figure 9.13. **Productivity of scientists in SEE and comparator countries**



Note: WEU – Western Europe; CEB – Central Europe and the Baltics (Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia); EU-28 – the 28 EU Member States.

Source: Scimago (2017), *Country Rankings* (dataset), www.scimagojr.com/countryrank.php; World Bank (2017), *World Development Indicators* (database), http://databank.worldbank.org/data/reports.aspx?source=wo rld-development-indicators&preview=on#.

StatLink http://dx.doi.org/10.1787/888933704986

Box 9.3. Performance-based funding

Funding of research in HEIs and PROs usually relies on a combination of institutional "block" funding, and competitive research grants. Institutional funding provides long-term stability which enables institutions to engage in long-term research cycles, while competitive grants enable excellent researchers to get extra funding for high-impact projects which are often mission oriented. Governments can use them to steer research towards priority fields or issues.

While competitive grants are clearly focused on outcomes, and ensure that funds are allocated to the research teams with the best chance of achieving excellent outcomes, block funding is traditionally based on simple formulas often related to faculty size and infrastructure costs, with specific investment plans for new equipment. In recent years, countries have started including performance-based indicators to encourage excellence in this institutional component.

The OECD STI Outlook has found two broad groups of practices in performance-based research funding systems:

1. **Indicator-based** performance-based research funding at university level relies on quantitative formulas using bibliometric measures, citations and a broad range of indicators including external research funding, completion rates, employment of graduates, faculty size, student population, prizes and awards, university league tables, and summary indexes. Systems like this are used in Austria, Denmark, Finland, Germany, Greece, Norway, the Russian Federation and Turkey.
2. **Peer reviews** at the level of the university, fields within universities or departments may be informed by metrics, or summary indices. Such systems are in force in Australia, Denmark, Italy, Poland, the Slovak Republic and the United Kingdom.

Source: OECD (2016b), "Financing public research", http://dx.doi.org/10.1787/sti_in_outlook-2016-36-en.

Additional funding is also available for projects through competitive grants, but this financing is not always predictable. For example, the Law on the Scientific and Research Activities in the Former Yugoslav Republic of Macedonia foresees an annual call for research projects but in practice, after a large call in 2012 for laboratory equipment (which equipped 83 laboratories), it issued no further calls until 2017. Montenegro issued significant calls for funding between 2014 and 2016 for research grants and the establishment of the science and technology park. This received finance under HERIC (through a World Bank loan), but has not since secured follow-up financing. In Kosovo, the Ministry of Education and Science regularly issues calls for small projects of up to EUR 10 000 each, awarding five grants in the first nine months of 2017, while larger research grants were provided in a single call financed from an EU Instrument for Pre-Accession Assistance (IPA) project. In Albania, the National Agency for Scientific Research and Innovation (NASRI) has the responsibility for issuing calls, but has not done so since 2013 due to a restructuring process.

The governance of academic institutions is regulated, although approaches to academic autonomy vary

All of the SEE economies have functional governance systems for HEIs and PROs in place. HEIs and PROs have governing boards with clear rules and mandates. Most of the governing boards have elected members representing the faculty, the government and students. Most universities have mission statements, but they do not include the so-called "third mission" of co-operation with the private sector. There is no formal requirement for private-sector participation in governing boards.

A variety of approaches is used to balance academic autonomy and the influence of the ministry. In Kosovo, Montenegro and Serbia, the government has minority representation on university boards, while the canton government has majority representation in Sarajevo University.[15] Albania has a hybrid solution, whereby the government is represented on the administrative boards of universities, which are complementary to their senates. Albania's 2015 Law on Higher Education also stipulates that the Ministry of Education will have a majority of seats (four out of seven) on administrative boards unless the university can justify covering at least 50% of its budget from tuition fees, in which case the faculty is entitled to four seats (Government of Albania, 2015). The Former Yugoslav Republic of Macedonia does not prescribe the composition of university by law – instead it is determined by the statute of each university. It does not foresee any formal representation of the government, and exerts influence informally.

While most of the SEE economies have some form of monitoring of their HEIs, Montenegro has had the European University Association carry out a comprehensive evaluation of its HEIs. It implemented the recommendations from this evaluation to restructure the University of Montenegro into a single legal entity.

The way forward for public research systems

Beyond the overall issue of low levels of public expenditure on R&D, **the six SEE economies could enhance the conditions for excellence through more sophisticated funding and governance mechanisms**.

The SEE economies should continue to develop feasibility studies for performance contracting for financing research, while taking local constraints into account.

The SEE economies could commission external evaluations of PROs and HEIs, using Montenegro as an example, to recommend measures for enhancing the performance of basic research in their institutions.

In order to facilitate co-operation with the private sector, HEI mission statements could introduce a "third mission" of co-operation with business. The economies could also consider private-sector participation in the governing boards of universities.

Innovation in firms

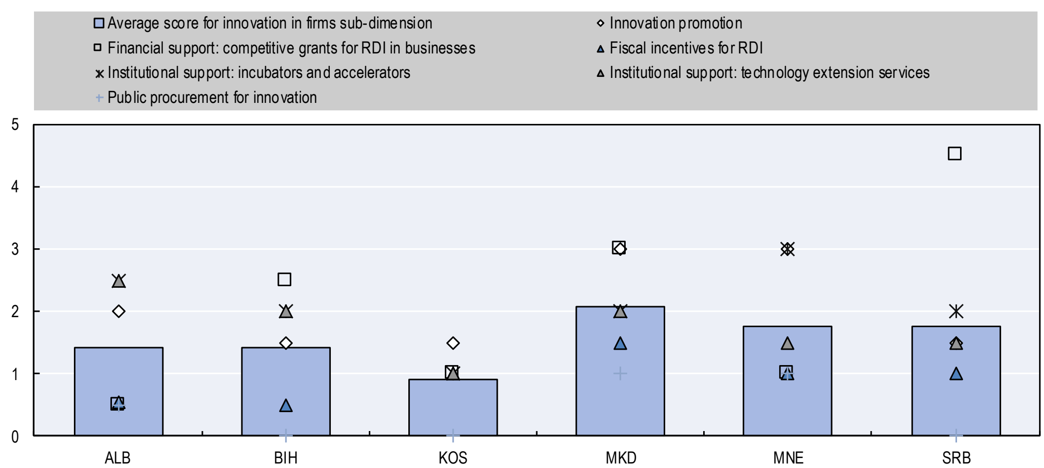
Market mechanisms alone cannot ensure optimal levels of business investment in innovation. This is because innovation suffers from three market failures: 1) uncertainty (both technological and commercial), which is much higher than the risk taken in usual business situations; 2) indivisible upfront fixed costs (such as the cost of developing a prescription drug); and 3) the public good nature of innovation outputs which makes it difficult for a firm to accrue the full benefit for itself.

Such market failures are exacerbated in the SEE economies due to the small size of firms as well as small markets which are insufficiently integrated into global value chains. These features make it less attractive for foreign capital to invest in innovative projects in the region. Skills gaps combined with brain drain also limit the creative forces which could drive innovation. In such an environment it is crucial to achieve the right policy mix to raise awareness and create incentives for businesses to invest more in research, development and innovation.

The innovation in firms sub-dimension assesses these aspects through six qualitative indicators: 1) innovation promotion; 2) financial support (competitive grants for research and innovation in businesses); 3) fiscal incentives for RDI (tax credits and VAT exemptions); 4) institutional support (incubators and accelerators); 5) institutional support (technology extension services); and 6) public procurement for innovation (Figure 9.14).

Frameworks to support innovation in firms are still at an emerging stage in the six SEE economies, as can be seen from their average scores which range between 1 and 2 (Figure 9.14). Innovation promotion is quite widespread; innovation funds in the Former Yugoslav Republic of Macedonia and Serbia have implemented competitive grants for R&D in firms; and incubator infrastructure is emerging all over the region. However, technology extension services, procurement for innovation and fiscal incentives for RDI are largely absent from government policies.

Figure 9.14. **Innovation in firms: Sub-dimension average scores and indicator scores**



Note: See the methodology chapter for information on the *Competitiveness Outlook* assessment and scoring process.

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Businesses need government support for R&D

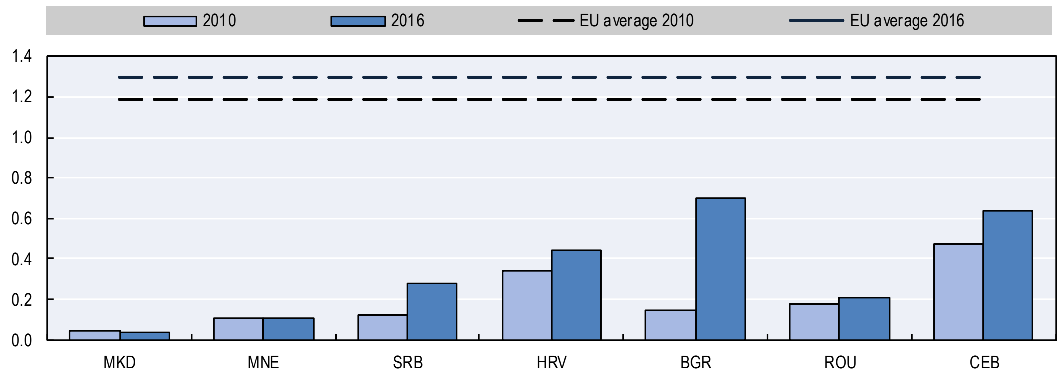
Business expenditure on R&D is a fraction of that in Central European countries, and lower still in comparison with the EU Member States (Figure 9.15). As mentioned in the introduction, Croatia experienced social rates of return on R&D of 73% in 2011, much more than the returns on infrastructure or education, notably due to a low stock of knowledge capital in the country (Aprahamian and Correa, 2015). As Croatia is a good comparator for the SEE economies, given their shared history, this suggests that business expenditure on R&D is clearly below socially desirable levels in the six economies, and thus government action is needed to remedy this situation.

Entrepreneurship itself is still largely necessity driven, rather than opportunity driven, as shown in the motivational index measured by the Global Entrepreneurship Monitor (Figure 9.16).

Venture capital is in its infancy in the SEE economies. The pioneering South Central Ventures/Enterprise Innovation Fund (ENIF) is a EUR 40 million fund sponsored by the European Investment Fund and the European Commission. The fund has invested in five ventures in Serbia and the Former Yugoslav Republic of Macedonia, as well as ventures in Croatia (South Central Ventures, n.d.).

Figure 9.15. **Business expenditure on research and development in SEE**

% of GDP



Note: Data for Albania and Kosovo are unavailable. HRV – Croatia; BGR – Bulgaria; ROU – Romania; CEB – Central Europe and the Baltics (Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia).

Source: Government statistical offices and ministries as part of the *Competitiveness Outlook* assessment 2016-17; EC (2017a), *European Innovation Scoreboard 2017*, http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_fr.

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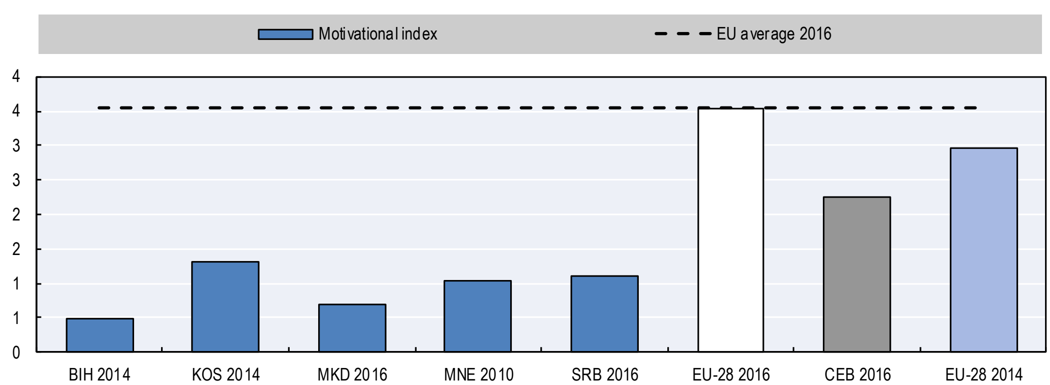
Figure 9.16. **Motivational index in SEE**



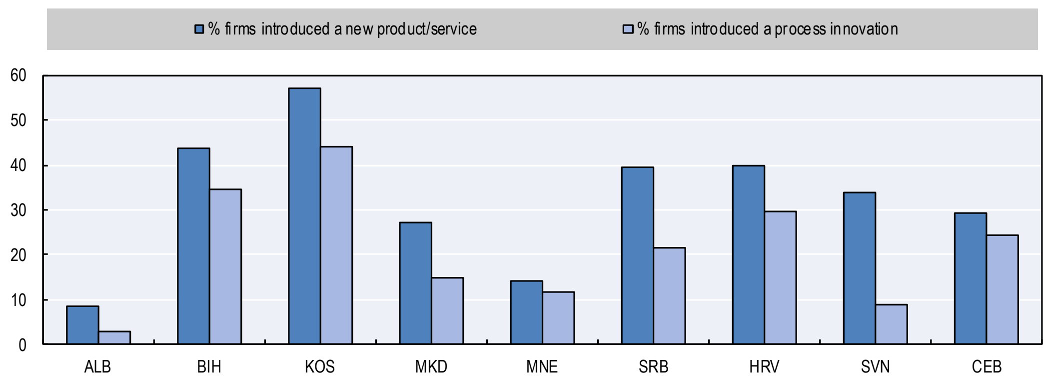
Note: The motivational index is the ratio of opportunity-driven total entrepreneurial activity to necessity-driven entrepreneurial activity. Data for Albania unavailable. CEB – Central Europe and the Baltics (Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia).

Source: GEM (2011), *2010 Global Report,* www.gemconsortium.org/report; GEM (2015), *2014 Global Report,* www.gemconsortium.org/report; GEM (2016), *2015/16 Global Report,* www.gemconsortium.org/report; GEM (2017), *2016/17 Global Report,* www.gemconsortium.org/report; EC (2017a), *European Innovation Scoreboard 2017*, http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_fr.

StatLink http://dx.doi.org/10.1787/888933705043

In contrast, self-reported innovation in firms is higher in Bosnia and Herzegovina, Kosovo, and Serbia than the CEB average (Figure 9.17). Firms in the Former Yugoslav Republic of Macedonia report that 12% of their sales originate from innovative products and services, and firms in Serbia report 10%; slightly more than the CEB average of 9.6% and close to the EU-28 average of 13% (EC, 2017a). As existing firms invest very little in R&D, we can infer that these innovations are mostly non-technological innovations, often “me too” imitations of foreign products and services. This hypothesis is also supported by the high levels of investment in non-R&D innovation expenditure, with companies in the Former Yugoslav Republic of Macedonia and Serbia reporting greater expenditure than the EU average (EC, 2017a).

Figure 9.17. **Firms introducing innovations in SEE (2016)**



Note: HRV Croatia; SVN Slovenia; CEB – Central Europe and the Baltics (Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia).

Source: EC (2017a), *European Innovation Scoreboard 2017*, http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_fr.

StatLink http://dx.doi.org/10.1787/888933705062

Innovation promotion activities are being developed

The Former Yugoslav Republic of Macedonia and Montenegro have developed a strategic approach to innovation promotion, which is included in their strategies and action plans. They have run promotional activities including events such as start-up fairs, hackathons, Open Science days and competitions. The other economies have also organised various events, but not as part of a strategic approach. For example, both Serbia and the Republika Srpska run very successful competitions for the best technological innovation. Over the period 2005-15, 2 359 teams participated in these competitions, attended 366 training sessions, and created 80 start-up companies. Non-government organisations (NGOs) and other private initiatives organise additional events such as start-up weekends, hackathons and training, often sponsored by donors. Examples of these include events run by Innovation Centre Kosovo, and hackathons in Mostar (Bosnia and Herzegovina) and Tirana (Albania). The OECD organised pioneering “triple helix” competitions in Bosnia and Herzegovina in 2012, and in Kosovo and Albania in 2015, which demonstrated the potential of bringing together academia, business and government to innovate.

Another key component of innovation promotion is the establishment of effective communication through websites and social media. Initiatives in this area remain relatively fragmented, with no one-stop-shop for innovators to provide holistic information in a single portal. Instead, information is fragmented across the websites of different ministries, agencies and innovation funds, and websites dedicated to certain events (e.g. the Best Technological Innovation competition in Serbia).

Financial support for research and development is emerging, but below potential

The average score for the **financial support for research and innovation in businesses** indicator is 2.1, but varies from 0.5 in Albania to 4.5 in Serbia (Figure 9.14). The Serbian Innovation Fund is the leading initiative offering competitive grants for R&D in business, and is seen as a good practice example in the region. The fund has been implementing "mini" grants of up to EUR 80 000 and "matching" grants of up to EUR 300 000, according to international best practice, including international peer reviews of project proposals. It has also used impact assessments to revise its programme manuals. It must be noted, however, that only 48 firms benefitted from the fund's support over 2011-15 – it would need to be scaled up to make a real impact on the Serbian economy. Its total disbursement of EUR 6 million has created 276 jobs in the companies it has funded – about EUR 22 000 per job.

The Former Yugoslav Republic of Macedonia has also established a Fund for Innovation and Technology Development (FITD), which provides four forms of financing to SMEs: 1) co-financed grants for start-ups and spin-offs; 2) co-financed grants and conditional loans for the commercialisation of innovations; 3) co-financed grants for technology transfer; and 4) technical assistance through business technology accelerators. In its first two years of operation (2015-16), the FITD distributed 30 grants to start-ups, and 7 grants for the commercialisation of innovations. It issued a technology transfer funding call, but this was unsuccessful notably because of a collateral requirement, which it will remove in the future. It has issued no calls under the fourth instrument for business accelerators.

The Federation of Bosnia and Herzegovina provides small-scale grants to support individual innovators, as well as larger grants for equipment, as part of an SME package. This grant has been implemented for several years, and has been evaluated. The Republika Srpska has no operational instruments to support R&D in firms. There is a state-level grant to support a technical culture and innovations, offering individual innovators up to EUR 3 000.

Albania, Kosovo and Montenegro have no dedicated instruments for R&D in firms, but firms are able to apply for R&D grants offered by their science ministries. In practice, most SMEs are not aware of these grants, and there have been only one or two exceptional cases of an SME applying. In addition, applications are hampered by additional administrative steps – for example in Montenegro, an SME would need to register as a scientific institution to be eligible.

The SEE economies have not implemented any **fiscal incentives for R&D** in firms in the form of tax breaks or credits, and the average score is thus below 1 (Figure 9.14). Some strategic documents mention the possibility of conducting feasibility studies for such incentives. Some economies have VAT exemptions for certain categories of scientific equipment.

Institutional support for R&D exists, but home-grown technology extension services are needed

Incubators and accelerators are designed to support the emergence of start-up companies, and accelerate their development through appropriate mentoring and connections to sources of finance. The average score on this indicator is 2.1 (Figure 9.14). All six of the economies have established incubators, initially with the support of foreign donors. Norway supported the Innovation Centre in Banja Luka (Bosnia and Herzegovina), INTERA in Mostar and the Innovation Centre Kosovo in Pristina, while Italy supported the Innovation Hub in Tirana. These incubators offer co-working space, training and events such as hackathons and start-up weekends. Governments are also starting to support the incubators. In the Former Yugoslav Republic of Macedonia, the FITD was planning to issue a call for tenders to support incubators in 2017. In Bosnia and Herzegovina, the Ministry of Science of the Republika Srpska gives financial support to the Banja Luka Innovation Centre, while INTERA in Mostar only partly relies on grants from the Federal Ministry of Development, Entrepreneurship and Crafts. Montenegro's incubator in Podgorica has closed, though two others remain in Bar and Berane, and government support is focusing on the science and technology park, which will be discussed under the next sub-dimension. Albania is establishing a third incubator in Tirana under its Triple Helix Action Plan. In Serbia, incubators are mostly supported by municipalities and NGOs.

While incubators serve start-ups, mostly in technology-driven sectors (predominantly ICT firms in the SEE economies), **technology extension services** (Box 9.4) are an important policy tool to support the diffusion of relevant technologies to a wider group of SMEs, including mature ones in traditional industries. They can help firms to upgrade their operations and realise incremental innovation which does not require extensive R&D investment. These services place audit and consulting at the disposal of SMEs.

None of the six SEE governments applies a systematic approach to technology extension services – this is reflected in the average score of 1.7 (Figure 9.14). Albania comes closest in the agricultural sector, where its five Centres of Agricultural Technology Transfer across the country provide agricultural technologies to farmers, offering technical expertise and demonstrations of new technology in agriculture. Albania also offers manufacturing firms a programme of innovation audits which identify gaps, but there is no follow-up to help remedy the deficiencies identified.

The Former Yugoslav Republic of Macedonia's Innovation Strategy includes offering technical assistance to SMEs, and its Competitiveness Strategy includes strengthening capacities for SMEs to help them understand IP rights and implement in-house R&D. Kosovo's SME agency provides a scheme for consultancy and training for SMEs, but with no focus on technology. Kosovo and the Federation of Bosnia and Herzegovina also provide matching grants for firms to buy equipment for modernisation. While this can be an effective tool to support modernisation, it requires relatively large individual grants, which implies that only a very small number of companies can benefit.

In the absence of government support, the EBRD's Advice for Small Businesses programme is active across the six economies. In 2014-16, the programme assisted over 1 200 SMEs in the region, with 70% of beneficiaries reporting an increase in turnover within 12 months of completing the project. Their median growth was 25%. At the same time, 58% of companies increased their number of employees, by a median of 25%, and 21% of SMEs reported accessing finance within one year of project completion (EBRD, 2015). With costs amounting to about EUR 5 000 per job created, these figures show the breadth of impact which relatively moderate investment in technology extension services can have.

Box 9.4. Technology extension services

Technology extension services concentrate on offering direct support to local firms, bringing about pragmatic improvements in their operations and practices, usually with commercially proven technologies. Technology extension services fall between basic business development services such as business planning and basic marketing, and high-end R&D (such as technology transfer offices and centres of scientific excellence).

Their role starts with public mission background work, which includes providing information, awareness raising, and training. These activities eventually identify specific examples of companies needing help to upgrade their skills, and product or service delivery processes. This preparatory stage should be funded by governments as a public mission.

Once they have identified a project, extension services perform an audit to assess the state of operation of the company's production processes and their results. Based on the results of the audit, they prepare an improvement plan, and offer assistance to implement it. Such projects are usually co financed between the firm and government. Firms are often unable to support the full cost of such services, but should participate in and finance at least part of it.

Examples of technology extension services include the Manufacturing Extension Partnership in the United States, which has support centres in every state; the Canadian Industrial Research Assistance Program, which makes field engineers available in every province; and the French *Réseaux de développement technologique* (structuring industries, strengthening SME performance and attracting foreign investors), which operates in every region.

An example from a medium-income country is the Turkish Small and Medium Industry Development Organization (KOSGEB), an agency of the Ministry of Industry and Technology. KOSGEB runs several instruments aimed at developing capacity among SMEs. It provides subsidies for firms to buy consulting services and also subsidises laboratory services. The programme was originally intended to help manufacturing firms, but has gradually expanded to include service firms as well.

Source: Innovation Policy Platform (n.d.), "Technology extension services", www.innovationpolicyplatform.org/content/technology-extension-services.

Public procurement is not used to promote innovation in the six SEE economies

Public procurement can be used to fulfil the demand for a new product or service, or to improve existing products or services. Public procurement accounted for about 14% of GDP in the European Union in 2016 (EC, 2018), a considerable budget, part of which could be leveraged as an incentive to innovation. Examples from neighbouring countries include the introduction of hybrid (solar and wind-powered LED) lighting in the Jaroslaw commune in Poland and smart personal protection systems for fire fighters in Hungary (OECD, 2017b). The Croatian government tendered out de-mining following the 1990-95 war. This gave a start-up firm, Dok-Ing, the opportunity to start producing de-mining robots, which are now successfully exported to over 25 markets worldwide. Other, more proactive procurement for innovation policies have the specific objective of stimulating innovation (Box 9.5).

Box 9.5. **Procurement for innovation in OECD countries**

A recent OECD study (OECD, 2017b) found that 80% of responding countries supported procurement for innovation, and 50% have an action plan specifically for procurement for innovation. Examples include the Austrian Action Plan on Public Procurement Promoting Innovation (2012), whose implementation is progressing well thanks to co-ordinated governance and the empowerment and mobilisation of procurers, and the Danish Strategy for Intelligent Public Procurement.

Implementing procurement for innovation can be challenging, and governments need to overcome a range of hurdles in the process, including risk aversion, lack of skills among procurement officials, management issues and political support. An earlier study showed that more than 60% of governments used performance-based tender specifications, 50% provided guidance to procurement personnel to avoid focusing on lowest price, 47% involved suppliers early in the process to foster innovation through dialogue, 46% allowed tenderers to propose new products and services for small lots, 42% practised pre-commercial procurement, and 39% communicated the government's long-term needs to allow companies enough lead time to respond (OECD, 2013a). However, only 10% had a specific budget for public procurement of innovation.

Source: OECD (2017b), *Public Procurement for Innovation: Good Practices and Strategies*, http://dx.doi.org/10.1787/9789264265820-en; OECD (2013a*), Implementing the OECD Principles for Integrity in Public Procurement: Progress since 2008*, http://dx.doi.org/10.1787/9789264201385-en.

There are virtually no policy initiatives in the six SEE economies to exploit the potential of government procurement for encouraging innovation, and the average score for this indicator is 0.4 (Figure 9.14). Only the Former Yugoslav Republic of Macedonia's Innovation Strategy mentions procurement for innovation, and it has only one pilot scheme run jointly by the Skopje bus company and the FITD. This involves a call for ideas for smart bus stops and a hackathon to develop an innovative software solution for optimising bus routes. In the other SEE economies, the only recent evolution in public procurement has been a gradual shift towards favouring the economically more advantageous solution rather than the lowest price.

Risk aversion, particularly concerning corruption, is a strong barrier to the development of procurement for innovation. It should be noted that specifying functional requirements in calls for tenders, rather than technical specifications, has the effect of broadening the number of potential suppliers, and is encouraged under the Recommendation of the OECD Council on Fighting Bid Rigging in Public Procurement (OECD, 2012b). For example, a tender for public schools in Finland asked for a "solution for locking schools", whereas a more traditional approach would have been to request "mechanical locks for schools". Such a broad functional requirement meant they got more creative solutions, including both hardware and software to enhance school security (OECD, 2017c).

The way forward for innovation in firms

The SEE economies have made a number of positive developments in government support to innovation in firms. Innovation funds are being used in two of the economies, and incubators/accelerators are operating in all six. Innovation events help to raise overall awareness about the benefits of business innovation. However, these policies largely focus on a small subset of firms, namely high-tech start-ups. The beneficiaries represent a few dozen firms in each economy, and the cost of job creation is relatively high (for example EUR 22 000 per job in the case of the Serbian Innovation Fund).

The SEE economies could consider implementing policies to **spread new technology to a broader range of SMEs** through systematic support for technology extension services. They could build on the experience of the EBRD's scheme, which has helped several hundred beneficiaries in each economy, and created jobs at the cost of only about EUR 5 000 per job.

Procurement for innovation represents another untapped resource for supporting innovation. While governments' need for radically innovative products and services may be limited, the SEE economies could consider **adapting their existing procurement processes to use functional requirements rather than technical specifications** to allow innovative solutions to emerge.

Information promoting innovation is dispersed across the websites of ministries, agencies, NGOs and innovation centres and so on. Therefore the SEE economies could consider creating **integrated innovation websites to provide a single location** to spread information to firms more efficiently.

Public-private knowledge transfers and linkages

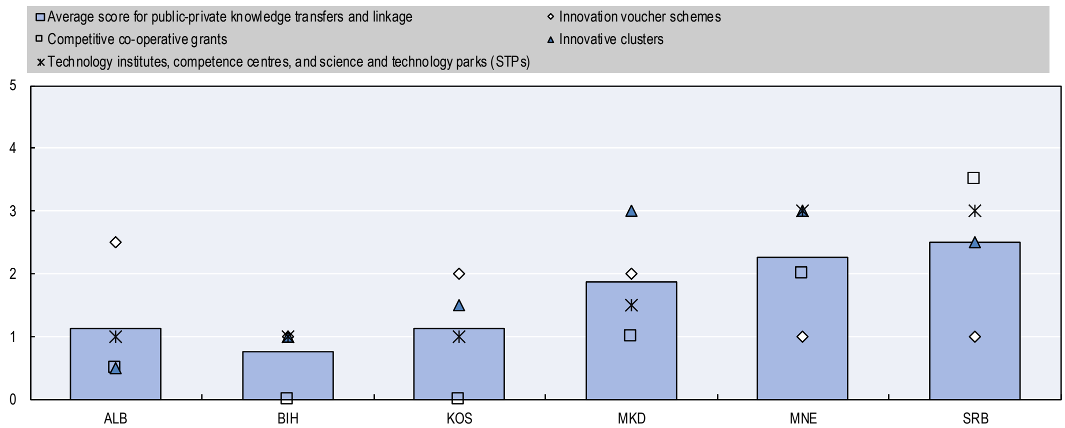
Partnerships for innovation among industry, academia and government can accelerate value creation in innovation when the actions of these three stakeholders are co-ordinated. This acceleration of value creation comes from synergies arising between the three stakeholders: businesses have first-hand access to new technologies; scientists receive feedback from entrepreneurs about the commercial viability of their research; and governments obtain insights into the types of policy interventions that spur industry-research co-operation. The main challenge in implementing such partnerships is to ensure effective communication among the three stakeholders, in light of their different priorities, environment and mindsets. Other practical barriers include differences in values, time horizons, working practices and communication methods, which are all very different between academia and business. Therefore, research-industry partnerships have to be carefully structured and implemented to overcome these barriers, initiating a virtuous cycle of communication and co-operation, combining the market knowledge of entrepreneurs with technology from academia and policy frameworks from government.

An indication of barriers to collaboration is a low number of public-private co-publications. In 2017, for example, only 4.4 of these were published per million population in Serbia and less than 1 in the Former Yugoslav Republic of Macedonia, compared to an average of 9 in comparable Central European economies, and 28 in the EU (EC, 2017b).

Policy intervention can help to support these processes. The public-private knowledge transfers and linkages sub-dimension assesses the degree of government support to these partnership initiatives. It comprises four qualitative indicators: 1) innovation voucher schemes; 2) competitive co-operative grants; 3) innovative clusters; and 4) technology institutes, competence centres, and science and technology parks.

The six SEE economies have made unequal progress in this sub-dimension, with scores ranging from 0.75 to 2.5 (Figure 9.18). Cluster policies are the most developed, with some economies creating their first science and technology parks. However, only Serbia and Montenegro have implemented competitive co-operative grants, and innovation voucher schemes have had mixed outcomes.

Figure 9.18. **Public-private knowledge transfers and linkages: Sub-dimension average scores and indicator scores**



Note: See the methodology chapter for information on the *Competitiveness Outlook* assessment and scoring process.

StatLink http://dx.doi.org/10.1787/888933705081

Cluster policies have had mixed results, but remain present in the region

Clusters are defined as geographical concentrations of interconnected companies: specialised providers, service providers, firms in related industries and associated institutions in particular fields that compete but also co-operate (Porter, 1998). Innovative clusters are clusters where the activities focus on co-innovation.

Clusters can be initiated by businesses which understand the potential of co-operation. Where market failures lead to a sub-optimal level of clustering, governments can intervene to foster interactions and co-operation instead. In situations where governments are not sufficiently proactive, international donors often step in to initiate cluster initiatives; however it is difficult to ensure the long-term efficiency and sustainability of such donor-initiated clusters (Ketels, Lindqvist and Sölvell, 2006).

Policy instruments used to develop clusters include 1) engaging actors (events and networking), to create trust; 2) capacity building among cluster managers, as well as offering individual companies collective services (counselling, training or joint marketing); and 3) facilitating large scale-collaborative R&D. However, cluster policies are prone to problems such as “institutional capture”, or the allocation of public resources to sectors that are not likely to become competitive (Potter, 2009).

In the SEE economies, general initiatives such as joint and collaborative R&D which could become innovative clusters have been implemented by donors. In some cases governments have also extended support, but often activity has declined when the donor funding expired. A recent analysis failed to find any impact of clusters on company competitiveness in Bulgaria, the Former Yugoslav Republic of Macedonia or Serbia (Karaev, 2014). Since companies do not perceive that they have received any benefit, they also do not wish to contribute significant membership fees towards cluster operations. Government support persists, but at too low a level for higher value-added activities such as joint R&D that could bring them closer to innovative clusters.

In Serbia, the Ministry of Economy supports clusters, albeit with declining financial support. Only a few of its 22 existing clusters are considered successful, for example the automotive, ICT and apparel clusters (SECEP, 2010), and even those have not developed an "innovative" aspect. Their main weaknesses stem from mistrust among enterprises; unskilled cluster management; and a lack of common infrastructure for R&D, design and training.

The Former Yugoslav Republic of Macedonia also has a cluster support programme, but these clusters "lack potential for innovation […] and they have achieved very little in sharing and creating economies of scale" (Karaev, 2014). Montenegro's cluster policy has been evaluated by the United Nations Development Programme (UNDP), but this evaluation was not made available. In Bosnia and Herzegovina, clusters have previously been exclusively donor-funded initiatives, and many have disappeared. However, a feasibility study is in progress for a new IT cluster for Herzegovina, which should also include a competence centre within INTERA. Kosovo's IT strategy foresees establishing a cluster of excellence for IT, with an international board, and a joint competence centre. Albania has included a cluster feasibility study in its Triple Helix Action Plan.

Overall, the SEE economies would need to reassess their cluster policies in light of their potential impact, and either reform them based on businesses' true needs (e.g. around competence centres, such as envisaged in Herzegovina and Kosovo), or discontinue them if the benefits do not justify the costs.

Voucher schemes and grants for technology transfer and linkages are rare in the SEE economies

As pointed out above, co-operation between academia and business needs to overcome substantial barriers. Two types of instruments can be used to offer the right incentives for collaboration: innovation vouchers and co-operative grants. Innovation vouchers have a low unit value (usually EUR 2-8 000), and support SMEs to do initial exploratory projects with a research institution in order to test the ground for co-operation, with limited risk. Innovation vouchers need to be simple to implement, with fast turnaround (less than 3 weeks from application to award in most cases), and usually do not have a selection process. They mostly operate on a "first come, first served" basis, or deal with excess demand through a lottery. In Flanders, the application form is one page, and a response is received the very same day (OECD, 2013b). Box 9.6 gives an example of an innovation voucher scheme in Poland.

Collaborative grants are more substantial, and need a rigorous selection process based not only on technological merit, but also on market opportunity. The Flemish collaborative grant requires applicants to prove that each EUR 1 of subsidy will translate into a EUR 25 increase in turnover.[16] In sum, innovation vouchers provided by governments offer limited purchasing power to SMEs to purchase knowledge, whereas collaborative grants incentivise multi-institutional R&D activities.

The Former Yugoslav Republic of Macedonia has an **innovation voucher scheme**, but it is underfunded, offering only 26 vouchers worth EUR 500 each per year. Across the six assessed economies, the average score for this indicator is 1.6 (Figure 9.18). Albania and Kosovo did launch innovation vouchers, but both programmes failed due to insufficient take-up by companies. The ministries in charge have not yet investigated the cause of this failure, but promotion of the schemes was not sufficient. Montenegro plans to run an innovation voucher scheme under its industrial policy, but has not yet implemented it. Serbia's Innovation Fund envisages introducing an innovation voucher as part of the technology transfer facility, while Bosnia and Herzegovina has no plans for any voucher schemes.

Box 9.6. **Good practice: An innovation voucher scheme in Poland**

The Polish Agency for Enterprise Development (PARP) started implementing a voucher scheme in 2008, with the objective of initiating collaboration between entrepreneurs and academia. The voucher targets micro, small and medium-sized enterprises, and can only be used for product or process development by a research institution (Jasinski, 2014).

The face value of the voucher is EUR 4 000, covering up to 80% of the project cost. In the first six years of implementation (2008-14) vouchers were distributed to 2 053 entrepreneurs. An evaluation prepared by Uniconsult showed that 41% of companies continued to co operate with academia after the voucher project was over (PARP, 2010).

The voucher is still available as of 2017; the subject of the development now needs to be linked to a Smart Specialisation topic.

Serbia has allocated funding for **competitive co-operative grants** to its Collaborative Grant Scheme which it is planning to run during 2017, and this indicator has an average score of 1.2 (Figure 9.18). The grants are expected to cover up to 70% of the total eligible cost, with a maximum of EUR 300 000 per project. The lead applicant must be an SME operating in Serbia, and the consortium must include at least one public scientific research organisation. Montenegro also had a Collaborative R&D Subprojects (CRDS) grant under the HERIC project in 2015. This instrument is expected to be moved to the Ministry of Science. However, funding for a future collaborative grant has not yet been secured. The Former Yugoslav Republic of Macedonia has no operational instrument at the moment, but plans to design one in 2017 and pilot it in 2018. Other economies have no competitive co-operative grant schemes.

Technology institutes, competence centres, and science and technology parks are just emerging

Institutions to support knowledge transfers from academia include competence centres, technology institutes and science and technology parks (STPs). Competence centres bring together academia and businesses for joint work on research projects. These centres run multi-year research programmes in a specific field. Typically, they are co-funded by the public and private sector. They often provide doctoral-level education, and organise events such as seminars or workshops. Competence centres are often virtual rather than physical.

Technology institutes facilitate knowledge transfers between academia and businesses, provide knowledge through research services with a consultancy-like approach and provide access to equipment. Technology institutes are physical centres. They target technologically competent SMEs – who need to have a minimum level of capability – and help them take their innovation capacity a step further.

STPs are business support schemes offering infrastructure and a range of support services to high-tech SMEs. They tend to have formal and operational links with centres of research excellence, such as research universities or PROs, which enable technology transfer, and are viewed as a means of creating dynamic regional clusters of innovation. Technology parks offer technical training, financial services, advanced equipment and networking activities.

Among the six SEE economies, the average score for the indicator on technology institutes is 1.8 (Figure 9.18). Serbia has the most significant applied technology institutes, including the Mihajlo Pupin Institute, which focuses on IT; the Nikola Tesla

Institute, which covers electrical engineering; and the Institute for Biological Research Siniša Stanković. Serbia also has five science and technology parks but even the most significant of these, Belgrade STP, currently operates more as an incubator than as a genuine STP. Even though the University of Belgrade is one of its founders, its links to academia are not well established, and collaboration between companies and academia occurs on an ad hoc rather than a systematic basis. In 2012 Serbia drafted a feasibility study for two competence centres, for agro-food and biomedicine, with the support of the OECD (2012a) – but no such centres have yet been established.

Montenegro is in the process of establishing a national STP, headquartered in Podgorica, with operational units called "impulse centres" in Nikšić, Bar and Pljevlja, at an estimated cost of EUR 16 million. The centre in Nikšić is up and running with 14 tenant companies, and has organised a variety of training and events, but the laboratory is not yet operational.

In Bosnia and Herzegovina, INTERA – a private foundation initiated with donor support – is currently operating mostly as an incubator or accelerator, providing workspaces, training and events such as hackathons. Future plans include the establishment of an excellence centre to serve the future IT cluster. Kosovo also envisages a competence centre in its IT Strategy, while Albania's Triple Helix Action Plan mentions a feasibility study for the establishment of competence centres.

The way forward for public-private knowledge transfer and linkages

The six SEE economies have made some efforts to bridge the gap between academia and business, including some notable high-profile investments in STPs in Bosnia and Herzegovina, Montenegro, and Serbia. However, they will need to make additional effort before these actions bear fruit. There are also less costly policy actions that could bring about change.

The economies need to change the structure of the incentives on offer to encourage academia and business to seek co-operation with each other. As discussed in the public research system sub-dimension, introducing a "third mission" for universities and PROs – to co-operate with industry – could be helpful, as could including co-operation with businesses in academics' evaluation criteria (see next section).

The SEE economies need to organise more events to bring the different communities together and encourage them to co-operate to resolve problems. The OECD has organised triple helix competitions bringing together academia, business and local government in Albania, Bosnia and Herzegovina, and Kosovo. Competitions like these have shown concrete results in the form of partnerships, consulting agreements and launches of new products based on business-academia collaboration (OECD, 2013c). Such events are not costly, since they can offer modest in-kind prizes of consulting for the best projects. Newly established STPs would be natural venues for such events.

The economies could make better use of innovation vouchers, which are currently underused in the region. A relatively low-value voucher can provide an incentive for businesses and academic institutions to start co-operating. However, in order for schemes to have an impact, they need to issue a large number of vouchers, and these vouchers need to be used. In order to ensure uptake, the instrument should be widely promoted.

The SEE economies could consider introducing collaborative grants as a follow-on to vouchers, with progressively higher unit values, the amounts correlating to the market potential of the innovation. For example, the Flemish innovation agency requires consortia to provide market studies which demonstrate the market potential of the proposed innovation, offering evidence that the future increase in turnover will be at least 25 times the subsidy amount.

Support for clusters should become more selective, supporting clusters with excellent management practices, and encouraging them to integrate in innovation as a key collaborative activity.

To rationalise investment in brick and mortar, the SEE economies should estimate the costs and benefits of large STP projects carefully. If such projects are to go ahead, they need to create relevant links between science and academia, rather than simply operate as incubators or training centres. Smaller-scale competence centres with a sectoral focus might prove more likely to achieve the goal of knowledge transfer. In this respect the Multi-Annual Action Plan for a Regional Economic Area in the Western Balkans (MAP) provides important initiatives, such as the development of a regional centre of excellence to promote collaboration between science, technology and industry, as well as engaging those communities with Europe-wide smart growth approaches (MAP, 2017).

Human resources for innovation

People and their skills are the main drivers of innovation. While Chapter 7 (Education and competencies) covers skills more generally, the sub-dimension on human resources for innovation focuses on specific measures aimed at steering scientific careers towards research excellence and co-operation with industry. It has three qualitative indicators (Figure 9.19):

The **mobility between academia and industry** indicator considers the use of policy measures to improve the mobility of professionals between public research institutions and the private sector, which can help to circulate knowledge and enhance conditions for co-operation.

The **researcher evaluation in favour of business-academia co-operation** indicator considers how far such mobility is encouraged by explicitly including it in scientists' evaluations, and as part of the criteria for advancement into higher positions such as professorships.

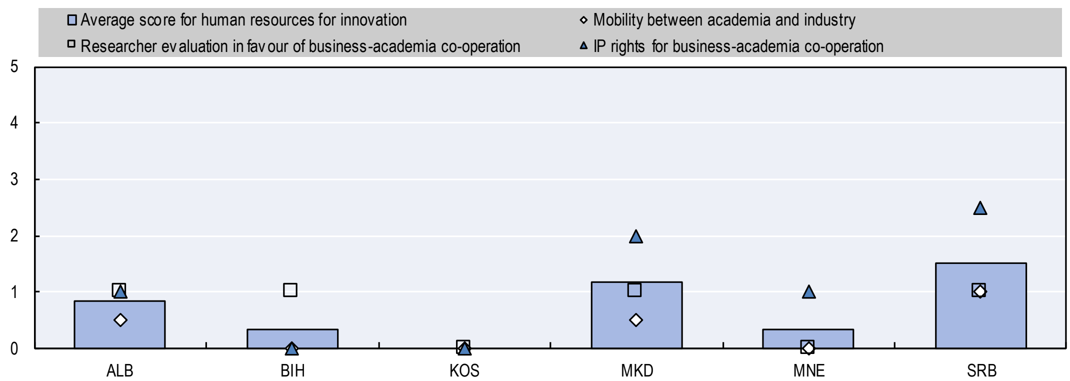
The **intellectual property rights for business-academia co-operation** indicator assesses whether there is an equitable distribution of rights between institution and researchers, something which can create an incentive for the researcher to produce patents, which will enable licensing and commercialisation.

The SEE economies have implemented very few of these measures, and this is reflected in their average scores of between 0 and 1.5 (Figure 9.19). Some economies have made dispositions concerning the split of IP between researchers and institutions, but there are virtually no measures to encourage mobility between the public and private sectors, nor evaluation rules to encourage scientists to collaborate with the private sector.

Scientific careers are not steered towards research excellence or business co-operation

The analysis of policies for **mobility between academia and industry**[17] considers whether the economies offer some of the practices present in OECD countries, such as 1) industrial PhD schemes, providing fellowships for candidates to work on a project jointly defined by a company and a university; 2) provisions for entrepreneurial leave of absence, which allow researchers in PROs to take unpaid leave and have a guaranteed return to employment, should their ventures fail; and 3) subsidies for scientists who wish to switch to working in the private sector.

Figure 9.19. **Human resources for innovation: Sub-dimension average scores and indicator scores**



Note: See the methodology chapter for information on the *Competitiveness Outlook* assessment and scoring process.

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None of the SEE economies have any such policies in place, and the average score for this indicator is 0.3 (Figure 9.19). In Albania, the Triple Helix Action Plan does mention mobility, but provides no funding for the tasks envisioned, which consist mainly of communication and stakeholder consultations on potential future action. In the Former Yugoslav Republic of Macedonia, the Innovation Strategy foresees the introduction of an entrepreneurial leave of absence, but this has never been acted upon.

In order to foster knowledge transfer to the private sector, many countries use metrics on patents and co-operation with industry when evaluating academic researchers. Among the SEE economies, however, there is no evidence of any formal policies to evaluate **researchers for business-academia co-operation** and the indicator has an average score of 0.7 (Figure 9.19). In the Former Yugoslav Republic of Macedonia, the Cyril and Methodius University of Skopje has introduced items such as patenting and consulting for the private sector among the criteria for promotion to professorship. However, such activities provide few points overall, and offer only a symbolic incentive to collaborate with industry.

When assessing **intellectual property rights for business-academia co-operation,** this chapter does not consider the general IP regime, which is covered in Chapter 1 (Investment policy and promotion). Rather, it considers how IP rights are split between institutions and individual researchers. In order to achieve the correct incentives for all stakeholders to engage in the development of commercially viable IP, a delicate balance must be struck. The 1980 Bayh-Dole Act in the United States clearly defined a split of IP rights between the university, the researcher and the federal government, achieving the appropriate incentives for each stakeholder. The researcher has an incentive to draft the patent, while the part reserved to the university justifies the support it provides to patenting and commercialisation of inventions through its technology transfer office. Since the act was passed, patenting at US universities has increased sharply and they have generated large amounts of licensing revenue (OECD, 2003). Consequently, many other countries have adopted similar legislation to encourage technology transfer (OECD, 2003). However, countries should ensure their legislation is adapted to their own specific issues such as the organisation of the higher education and research sector, R&D financing mechanisms, and the existence of support services for technology transfer.

In the assessed SEE economies, the average score for this indicator is 1.1 (Figure 9.19). The split is well defined in Serbia, where the Innovation Law clearly states that researchers are entitled to at least half of the profits from any IP which they authored. In Montenegro, the issue was been addressed through the HERIC project, but there are no specific rules on the split of IP. None of the other SEE economies have defined precise criteria for splitting IP rights.

Human capital is high, but affected by brain drain

As discussed in Chapter 7, although tertiary educational attainment is below the EU average in the six SEE economies, overall it is comparable with the CEB average. Tertiary attainment is significantly higher in the Former Yugoslav Republic of Macedonia, Montenegro and Serbia. Assessment of one of the quantitative indicators for this sub-dimension reveals a similar pattern for the proportion of STEM graduates among the tertiary-educated population.

Local companies, including the most successful high-growth companies, do not see a lack of human capital as a significant barrier to innovation. Only 5% of high-growth SMEs[18] in the SEE economies considered human capital as a major impediment to innovation – far behind corruption, informality, access to finance, regulation, competition policy, public procurement, labour market policies and SME support services (OECD, 2013c).

As discussed in sub-dimension 2, limited investment in R&D means there are a low number of researchers in the SEE economies. However, they are more productive than in most EU countries, and are as likely to publish in the best quality journals as the CEB average. Another positive point is the relatively widespread provision of ICT training in enterprises. In Serbia, 22% of enterprises offer ICT training, similar to the EU average on that indicator, while the figure is 12% in the Former Yugoslav Republic of Macedonia (EC, 2017a).

Brain drain remains a very acute issue in the SEE economies. The emigration rates of highly educated individuals continue to rise, and exceeded 30% of tertiary graduates in the six SEE economies in 2010. This compared to about 10% of tertiary graduates in the 15 countries that were EU members prior to 2004 (EU-15), and 19% in the CEB. Emigration rates range from 15% of tertiary graduates in Serbia and Montenegro to 43% in Bosnia and Herzegovina (Landesmann and Mara, 2016). Data on immigration by highly skilled workers (brain gain) are not available, but remain anecdotal.

In conclusion, there is a significant gap between the relatively good performance of scientists from the region in scientific publications, and the very poor performance on patenting and commercialisation of knowledge.

The way forward for human resources for innovation

Serbia’s introduction of the IP split in the Serbian Innovation Law in 2010 is a positive achievement. **Serbia’s next step should be to make academics aware of the law in order to encourage them to patent their discoveries**. The other economies could also consider a similar reform.

All six SEE economies should consider measures to encourage greater mobility of researchers between the public and private sectors. One such measure is the entrepreneurial leave of absence. The guarantee of a return to a safe job could lower the perceived risk of entrepreneurship and encourage researchers to try to start up their own companies. Such a measure does not require additional spending, even though the institution has to invest some effort in replacing the person during their absence. Industrial master's and PhD degrees could be implemented with relatively limited subsidies.

Finally, **introducing collaboration with industry into academics' evaluation criteria** could send a strong message to the academic community that knowledge transfer is desirable and helps create a positive dynamic of co-operation. This message is absent today.

Conclusions

The six SEE economies have demonstrated that they have taken initial steps towards an STI policy framework that is conducive to scientific excellence and a thriving innovation ecosystem. Governments are adopting holistic innovation strategies which span the whole spectrum of science, technology and business innovation. They have put in place governance frameworks for HEIs and PROs, and are increasing their efforts to create an environment favourable to the emergence of start-up companies, centred on incubators and accelerators.

A number of challenges remain. These include the efficient implementation of adopted strategies, notably through better horizontal co-ordination between ministries and agencies, both at the decision-making and implementation levels. The economies could consider new modes of financing for public research, based on performance contracts. They could further improve the governance of HEIs and PROs, notably by introducing private-sector representation on governing bodies. In order to encourage business investment in R&D, governments could develop technology extension services to help diffuse new technology and consider leveraging public procurement to stimulate innovation.

A number of measures would encourage knowledge transfer and linkages between the public and private sectors, starting with events to bring together the business and academic communities, innovation vouchers to initiate collaboration, and cluster policies focusing on common R&D activities, including the establishment of dedicated competence centres to create the conditions for joint activities.

To help develop human resources for innovation, the economies could provide clearer incentives through rules on the division of intellectual property rights, ensure that collaboration activities are taken into account when evaluating academics, and specific measures to support the inter-sectoral mobility of professionals.

Addressing those challenges would enable the region to build an innovation ecosystem which would facilitate the transition towards a knowledge-based economy.

Notes

1. A public-sector fund, established by the European Investment Fund, and the European Commission, managed by South Central Ventures.
2. There are four main administrative levels in Bosnia and Herzegovina: the State, the Federation of Bosnia and Herzegovina, the Republika Srpska and the Brčko District. The administrative levels of the state, the Federation of Bosnia and Herzegovina and the Republika Srpska are taken into account in the *Competitiveness Outlook 2018* assessment, when relevant. The Brčko District is not assessed separately.
3. "Triple helix" is a term which designates business-academia-government partnerships for innovation.
4. See the OECD Reviews of Innovation Policy webpage for more information and a list of published reviews, www.oecd.org/sti/inno/oecdreviewsofinnovationpolicy.htm.
5. A score of 0 denotes absence or minimal policy development while a 5 indicates alignment with what is considered best practices. Each level of scoring is updated for the individual indicator under consideration, but they all follow the same score scale: a score of 1 denotes a weak pilot framework, 2 means the framework has been adopted as is standard, 3 that is operational and effective, 4 that some monitoring and adjustment has been carried out, and 5 that monitoring and improvement practices are systematic.
6. Central Europe and the Baltics consist of 11 transition countries: Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia.
7. In particular, input-output tables are a pre-condition for this.
8. These economies did have science and technology strategies, but they did not cover business innovation.
9. The overall volume of publications is also very low, as will be discussed later in this chapter (Figure 9.12).
10. The biggest EU research and innovation programme ever, with nearly EUR 80 billion of funding available over 2014-20.
11. Personal communication from B. Fabianek, July 2017.
12. Support to Innovation and Technical Culture in Bosnia and Herzegovina.
13. Personal communication from Danica Ramljak, interim director of WISE, 12 October 2017
14. Very high success rates – in excess of 80% – show that the grants are in reality not very competitive.
15. In Bosnia and Herzegovina, the rules vary according to entity and canton.
16. Private communication from IWT, the Flemish innovation agency.
17. The international mobility of researchers, such as Maria Skłodowska Curie actions, is discussed under international co-operation in the first sub-dimension.
18. "High growth" is defined as a growth in turnover of over 20% per annum over three consecutive years.

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Annex 9.A1.
Science, technology and innovation: Indicator scores

Table 9.A1.1. **Science, technology and innovation: Indicator scores**

	ALB	BIH	KOS	MKD	MNE	SRB
Governance of STI policies						
National STI plan or strategy	1.5	1.5	1.5	4.0	3.5	1.5
Horizontal policy co-ordination	1.0	1.5	1.0	3.0	1.5	2.0
Implementation of STI policies	2.0	2.0	2.0	3.5	2.0	4.0
International STI policy strategy and framework	1.5	3.0	2.5	1.5	2.0	1.5
Public research system						
Funding of public research institutions and universities	1.0	1.0	1.0	1.0	1.5	3.0
Public research institutional arrangements	2.5	2.5	2.5	2.5	4.0	3.0
Innovation in firms						
Innovation promotion	2.0	1.5	1.5	3.0	3.0	1.5
Financial support: competitive grants for RDI in business	0.5	2.5	1.0	3.0	1.0	4.5
Fiscal incentives for RDI	0.5	0.5	1.0	1.5	1.0	1.0
Institutional support: incubators and accelerators	2.5	2.0	1.0	2.0	3.0	2.0
Institutional support: technology extension services	2.5	2.0	1.0	2.0	1.5	1.5
Public procurement for innovation	0.5	0.0	0.0	1.0	1.0	0.0
Public-private knowledge transfers and linkages						
Innovation voucher schemes	2.5	1.0	2.0	2.0	1.0	1.0
Competitive co-operative grants	0.5	0.0	0.0	1.0	2.0	3.5
Innovative clusters	0.5	1.0	1.5	3.0	3.0	2.5
Technology institutes, competence centres, and science and technology parks	1.0	1.0	1.0	1.5	3.0	3.0
Human resources for innovation						
Mobility between academia and industry	0.5	0.0	0.0	0.5	0.0	1.0
Researcher evaluation in favour of business-academia co-operation	1.0	1.0	0.0	1.0	0.0	1.0
IP rights for business-academia co-operation	1.0	0.0	0.0	2.0	1.0	2.5

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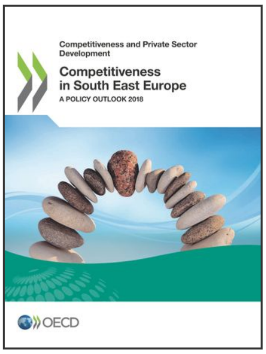

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