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ACRONYMS

ADA	Austrian Development Agency
AI	Activity Index
APERM	Agency for Promotion of Entrepreneurship of the Republic of Macedonia
ARWU	Academic Ranking of World Universities
BAS	Business Advisory Services
BERD	Business Expenditure on R&D
BSCB	Business Start-up Center Bitola
CERN	European Organization for Nuclear Research
CIP	Competitiveness and Innovation Program
CIS	Community Innovation Survey
COST	European Cooperation in Science and Technology
EC	European Commission
EEN	European Enterprise Network
ELSR	Equipping Laboratories for Scientific Research and Applicative Activities
ERA	European Research Area
ESA	Enterprise Support Agency
EU	European Union
FDI	Foreign Direct Investment
FP6	Framework Program 6
FP7	Framework Program 7
FTE	Full-time Equivalents
FYRM	Former Yugoslav Republic of Macedonia
GBAORD	Government Budget Appropriation or Outlays on Research and Development
GDP	Gross Domestic Product
GEM	Global Entrepreneurship Monitor
GOVERD	Government Expenditure on R&D
GTZ	Gesellschaft Technische Zusammenarbeit – German Society Technical Corporation
HERD	Higher Education R&D
ICT	Information and Communication Technology
IIP	International Intellectual Property
IP	Intellectual Property
IPA	Instrument for Pre-Accession Assistance
IPARD	IPA Rural Development Program
IPR	Intellectual Property Rights
IRC	Innovation Relay Center
ISO	International Organization for Standardization
IUS	Innovation Union Scoreboard
IVCS	Innovation Voucher Counseling Scheme
MANU	Macedonian Agency for Science and Art
MIS	Management Information Systems

MoE	Ministry of Economy
MoES	Ministry of Education and Science
NCDIEL	National Centre for Development of Innovation and Entrepreneurial Learning
NCIE	National Committee for Innovation and Entrepreneurships
NPHESRDA	National Program for Higher Education, Scientific Research and Developmental Activity
OECD	Organisation for Economic Co-operation and Development
PCMPS	Program for Competitiveness of the Macedonian Products and Services
PREDA	Prilep Region Enterprise Development Agency
PRO	Public Research Organization
PTD	Program for Technological Development
R&D	Research and Development
RDI	Research and Development for Innovation
RESC	Regional Enterprise Support Center
SME	Small and Medium Enterprises
SOIP	State Office of Industrial Property
TAM/BAS	Management and Business Advisory Services Program
TIDZ	Technological Industrial Development Zones
TTO	Technology Transfer Office
UKF	Unity through Knowledge Fund
UKIM-BSC	University of Cyril and Methodius-Faculty of Mechanical Engineering
USAID	United States Assistance for International Development
WBC	Western Balkans Countries
YES	Youth Entrepreneurial Service

FOREWORD

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

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

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DISCLAIMER

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

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EXECUTIVE SUMMARY

1. This Note presents an overview of the current features of research and innovation systems in the Former Yugoslav Republic of Macedonia (FYRM). During the last decade, Macedonia has taken steps to make research and innovation more competitive, with the objective of increasing the impact on the national economy.

2. Yet profound challenges remain. Key challenges in Macedonia's research and innovation policy are:

- In terms of R&D capabilities in research institutions and universities, the country needs to improve institutional infrastructure for R&D, improve the number of young researchers, develop mechanisms for transferring knowledge and research in the business sector, and strive a better distribution of advanced human capital across sectors (public and private). Not only the amount of R&D needs to be leveraged but the nature and orientation needs to change (more applied research). A better balance between applied and basic research is needed.

- To foster research excellence governance of research and education systems need to more merit-driven in line with international standards for science and education. This will require to increase competitive grant funding and enhanced career incentives (including salaries and complementary economic compensations for outstanding research quality achievements), as measured by contributions in research, education, and technology transfer.

- Strengthen firm investment in R&D and enhance firm innovation competences through industry-science technology collaboration. Improve industry-science linkages for innovation will require to develop formal and systematic industry-science collaboration mechanisms for research and innovation through increased incentives provided by a clear legal and policy framework for technology transfer activities and public support for institutional capabilities (TTOs). Such a framework should enable universities and PROs with appropriate legal rights to engage in commercialization activities, private sponsorships, personnel mobility, and other forms of industry-science collaboration.

- With respect to brain drain and the scientific diaspora, improve policy frameworks through immigration laws and connectivity programs (e.g., UKF), which should cover the wide range of research collaboration forms, including research fellowships; joint research programs and doctorates; mobility exchanges; training programs; and financial support for business creation and joint-ventures.

3. Many of these issues are addressed in the recently adopted National Innovation Strategy 2012-2020 and its Action Plan 2013-2015 (November 2012). An increased budget for the implementation of the action plan is fundamental. In May 2013, a new Law on Innovation Activity was adopted. This law defines innovation activity, regulates the principles, objectives, and subjects of the innovation activity; and establishes the governance of innovation policy, including funding rules, management and administration as well as supervision of main operating agencies in the area of innovation and research and technology development.

4. The law targets innovation and defines principles for commercialization of innovation

and funding of scientific research and firm innovation activities. The law foresees the creation of new implementing body entitled "Innovation Fund" to finance innovation and technological development in order to improve competitiveness of Macedonian companies through development of new knowledge and innovation. The Fund will also provide technical assistance and consulting services for start-up and SMEs in order to increase firm innovation investment and competences.

5. In advancing the policy agenda and responding to these challenges, it is important to enhance regional collaboration in R&D and innovation and its different components: R&D infrastructure, human capital and training, financial resources, and institutional capabilities. Regional collaboration is key for the Western Balkan countries to accelerate the formation of research capabilities and better integrate into international networks of research and innovation, facilitate policy learning and leverage international (and national) resources for R&D infrastructure and innovation, and finally, accelerate regional research specialization to the benefit of the region, economic development and growth.

INTRODUCTION

6. There is growing awareness worldwide about the critical role that innovation plays in economic development. In April, 2009 the Western Balkan countries (WBCs) signed the Ministerial Joint Statement of Sarajevo, which called for enhanced regional cooperation to promote innovation. The European Union (EU) has been at the forefront of this approach, urging member countries to spend more and better on research and innovation. To support the effort in the Western Balkans, the EU contracted with the World Bank in June, 2011, to assist the region in developing a Regional R&D Strategy for Innovation.

7. For the Western Balkans to catch up, effectively integrate into the European Research Area (ERA), become part of international knowledge networks, and compete in global markets, it is essential that research and innovation capacity building at the national level be strengthened. A two-pronged strategy is emerging, following extensive and multiple consultations with public and private sector representatives. It combines: i) the advocacy of national-level policy reforms to improve the impact of research and innovation on economic growth and job creation for the long term; and, ii) joint investments in selected regional initiatives that will help alleviate bottlenecks in the short-to-medium term.

8. At the national level, countries will need to enhance investment in research and development (R&D) substantially and on a sustained basis, while at the same time transforming national innovation systems – the research base, public institutions, private sector, market actors, and linkages among them – into more effective, coherent, and competitive systems. In this process, enabling policy frameworks and incentives to actors is crucial to stimulate new ideas, their transfer to industry, and private sector investment in risky and long-term projects related to innovation. Political commitment by the governments is crucial in achieving these transformations.

9. In the context of the recent economic downturn, many developed countries have increased investment in R&D and have used innovation policy as a counter-cyclical instrument to secure new sources of growth. If WBCs do not emulate such efforts and increase investment in knowledge, the technological and economic gap between the Western Balkans and its future EU partners may grow. To avoid this, governments will, in short, need to spend more and better in research and innovation.

10. Since independence in 1991, the Former Yugoslav Republic of Macedonia (FYRM) has faced a number of economic and political challenges that have strongly influenced the country's R&D activities. Budgetary constraints and weak institutional capacity remain major impediments to the development of research and science. Financing for science and research has been very low, and international donor participation in the R&D sector continues to be limited.

11. During the last decade, however, the country has taken steps to make research and innovation more competitive, with the objective of increasing the impact on the national economy. Yet profound challenges remain. A fundamental challenge is to generate new sources of competitiveness from the local research base, along with the need to capitalize on knowledge from the skilled diaspora through enhanced linkages. The economic crisis has brought an even more drastic reduction in the opportunities to apply science in the development of the country's economy. This situation has diminished scientific and research cooperation among universities, scientific institutions, and economic entities.

12. Key challenges in FYRM's R&D policy include: insufficient infrastructural facilities and institutional infrastructure; underdeveloped mechanisms for transferring knowledge and research in the business sector; unbalanced distribution of researchers by sector; low investments in applied research and innovation and a low level of private investment in R&D; a disproportionately low number of young researchers; and unaccounted brain drain. Many of these issues are addressed in the recently adopted National Innovation Strategy 2012-2020 and its Action Plan 2013-2015 (November 2012).

13. This note describes FYRM's profile in terms of R&D capacity and discusses the main features of the national research system, its strengths and weaknesses, recent policy trends, and challenges. The first section details the importance of R&D for innovation and economic development and growth. The second section briefly describes national trends in economic performance and R&D and innovation. The third section outlines the governance system for research and the process of policy making, identifies the main agencies and actors, and briefly discusses recent national strategies for research and innovation. Section four reports the current policy programs and instruments, along with other important policy developments. Section five describes research and innovation infrastructure, while section six deals with the integration to ERA and international collaboration. The note concludes with a discussion of remaining R&D challenges, and identifies potential policy areas suitable to policy collaboration among the WBCs.

WHY R&D AND INNOVATION

14. With the growing worldwide awareness of the importance of research and innovation for economic development, the capacities to undertake scientific and applied industrial research, and to transfer, adapt, and assimilate new technologies into economic structures and diffuse them into society have become especially critical to national competitiveness and growth.

15. There is ample and compelling evidence confirming the correlation between R&D and economic performance. Several international studies demonstrate that R&D spending increases result in a corresponding increase in productivity, leading to per capita income growth. These increases mutually reinforce each other and lead countries to long-term sustained growth rates.[2] At the country level, R&D accounts for up to 75 percent of the differences in total factor productivity growth rates, once externalities are taken into consideration.[3] At the firm level, the R&D expenditures of enterprises are often correlated to higher sales and productivity growth, as well as a propensity to export. Further, product innovation, which results from R&D efforts, leads to employment growth and more qualified and better paid jobs by expanding demand and new business opportunities.[4]

16. The potential impact that investments in research and innovation have on productivity growth is even higher for developing countries, given the opportunity for catching up that is associated with larger investments in innovation.[5] Results from a study using firm level data for the Western Balkans show that innovative firms grow 15 percent faster in sales and 8 percent faster in labor productivity than do non-innovative firms.[6] Business R&D expenditures significantly contribute to sales, by 14 percent, and labor

[2] Hall and Jones (1999).
[3] Griliches (1979).
[4] Harrison *et.al*. (2008).
[5] Lederman and Maloney, (2003) for estimates of social rates of return for R&D.
[6] Seker (2012).

productivity growth, by 7 percent. Furthermore, when firm R&D, training and infrastructure services are compared, R&D is shown to have the highest correlation to sales growth. For neighboring countries, similar evidence is reported.[7] Reaching the Europe 2020 Agenda and, in particular, the 3 percent of Gross Domestic Product (GDP) target, could generate a permanent increase of between 8 and 13 percent in Bulgaria's and Romania's export levels, for example.

17. Investing in R&D is necessary not only to enhance firms' innovation capacity but also to absorb external technology properly; screen and identify technology options; adopt and adapt foreign technology and know-how; and, benefit from spillover effects from foreign direct investments and other sources of knowledge transfer. Informal knowledge activities and day-to-day learning are also sources of ideas. Formal R&D is important, however, in that it represents a systematic and more effective approach to technological innovation – both radical and incremental innovation – in both the manufacturing and the non-manufacturing and services sectors.

18. Public support for research and innovation is critical, particularly in the context of stagnant economies. Consistently, public investments in research and innovation have been a priority in the economic stimulus packages of Organisation for Economic Co-operation and Development (OECD) economies. In this sense, a growing consensus on the importance of counter-cyclical innovation policies – increasing R&D investment and improving framework conditions – is emerging.[8] Finland and South Korea, for example, are at the forefront of this approach, increasing public spending on innovation even in the context of tighter fiscal policies.[9]

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

1. WHERE THE COUNTRY STANDS

Economic Performance and Structure

20. The Former Yugoslav Republic of Macedonia (FYRM) has experienced economic growth in the last decade. From 2001 to 2010, the annual GDP growth rate averaged 7.63 percent. Affected by the

[7] World Bank (2011).
[8] See for instance OECD (2010).
[9] World Bank (2009).

worldwide economic crisis, the country reported a decline in 2009 (-0.9 percent) in growth rates, but recovered in 2010 with a growth rate of 2.9 percent.[10]

21. According to the value added data for 2005, the country's industrial production is dominated by a number of divisions. These include the electricity, gas, steam, and air-conditioning supply (12.43 percent), and the following manufacturing categories: food products (11.47 percent), basic metals (11.47 percent), apparel (11.32 percent), other non-metallic products (7.46 percent), tobacco products (5.81 percent), beverages (4.91 percent), and coke and refined petroleum products (4.53 percent). Industrial sectors have a big influence on the structure of the GDP. According to previous data on GDP for 2010, mining and quarrying had a share of 1.5 percent, manufacturing accounted for 12.6 percent, and electricity, gas, steam, and air-conditioning supply was at 3.7 percent.

22. The main export products are from the mining and metal industries. Exports of metal industries (supported catalysts), ferronickel, and petroleum oils and preparations represented 27 percent of the total national value in 2011.[11] In 2012, the export value of goods came to USD 4,001,857,000, while imports ranked were valued at USD 6,510,922,000.

23. According to the 2008 data from the State Statistical Office, 17.1 percent of all active enterprises[12] were new enterprises; in 2009, that number was 19.2 percent, and in 2010 it was 16.8 percent. Data show that in 2008, the total number of enterprise terminations came to 11.7 percent of the total number of active enterprises in the given sectors. Analyzed by activity sector, the data show that the sector with the highest share of enterprise openings and closures was "Wholesale and retail sale trade; repair of motor vehicles and motorcycles."

24. The external current account deficit remains moderate. In 2011, with increased economic activity, solid exports and strong transfers resulted in a current account deficit of 2.7 percent of GDP. A sluggish economy in 2012 led to a widening of the current account deficit.[13]

25. According to data from the State Statistical Office, the number of active business entities in the Republic of Macedonia in 2011 was 73,118. The sectors with the highest share were: wholesale and retail trade, and repair of motor vehicles and motorcycles with 27, 468 entities accounting for 37.6 percent of the total, and manufacturing with 8,155 entities or 11.2 percent. The least represented sectors were electricity, gas, steam and air-conditioning supply, with 98 entities or 0.1 percent of the total, and mining and quarrying, with 176 entities or 0.2 percent. The data on the number of persons employed indicates that most firms are micro-firms: 82.9 percent of the companies employed one to nine persons.

26. FYR Macedonia has made great strides in reforming its economy over the last decade. The country is working on improving its competitiveness by deepening regulatory reforms and strengthening the rule of law to encourage private investment. Progress has been made on business environment reform, including an overhaul of the business registration system. Efforts have also moved ahead in streamlining legislation governing the regulatory regime, simplifying licensing procedures, and increasing efficiency in filing taxes. This is reflected in FYR Macedonia's place in the Doing Business ranking, the best in Eastern Europe. However, a number of challenges remain, such as developing a more competitive and

[10] State Statistical Office of the Republic of Macedonia (2012).
[11] Foreign Trade Statistics (2012).
[12] These statistics refer to enterprises whose main activity according to the National Classification of Activities-NKD Rev.2 is in the sectors of activity B to S (without sectors A, O, T, U and class 64.20).
[13] World Bank (2012).

export-oriented enterprise sector, improving the transport and energy infrastructure, and increasing the skills level of the workforce.[14]

R&D and Innovation Trends

R&D Trends

27. Since the beginning of the new millennium, science and research in FYR Macedonia has been insufficiently funded, especially by the private sector. The percentage of GDP devoted to R&D in 2010 was 0.22 percent of GDP, though this was up from 0.17 percent in 2007. This share is lower than the EU average of around 2 percent. Total R&D expenditures have been decreasing from 0.23 percent of GDP in 2003, of which private sector funding accounted for only 1.3 percent. Business Expenditure on R&D (BERD) was 0.003 percent.

28. The vast majority of R&D activities in the country are carried out by the public sector, mainly through the state universities and other public research institutions. Funding allocated to higher education institutes represented 7 percent of total general government R&D funding in 2009, whereas the private sector accounted for 4 percent. Government budget outlays on R&D as a share of total general government expenditures were 9 percent.[15]

29. The leading scientific institution in Macedonia is the Macedonian Academy of Science and Arts (MANU), which consists of five departments and five research centers. Two of them – Research Centre for Genetic Engineering and Biotechnology, and the Research Centre for Energy, Informatics and Materials – are internationally recognized. Macedonia has also five state universities with 60 departments, 18 private universities with 79 departments, and 7 public research institutions.[16] As resources, in particular those from the government have decreased over time, research expenditures have been used primarily to pay researcher salaries. Almost no investment is provided to maintain, let alone modernize, the research infrastructure.

S&T Human Capital and researchers

30. The research community of the Republic of Macedonia consists of 2,394 researchers, of which 79 are in the business sector, 668 in the government sector, and 1,647 at universities.

31. The share of researchers in the FYR Macedonia has been on a downward trend over the last few years. The number of full-time equivalents (FTE) working in R&D decreased by 6 percent, from 1,435 in 2005 to 1,350 in 2007. Furthermore, the share of researchers in the country is lower than in most neighboring economies. In 2007, there were 1.6 FTE researchers per 1,000 employees in the country, which is significantly below the 2009 ratios for Bulgaria (3.4), Croatia (3.6), Romania (1.9), and the EU-27 average (6.6).

32. Statistics for the FYR Macedonia show a decrease of more than 70 percent in the number of researchers and scientists, mainly due to the emigration of highly skilled professionals between 1995 and

[14] World Bank (2012).
[15] Budget of the Ministry of Education and Science (2009: most recent available data).
[16] Polenakovik (2011).

2000.[17] Driving forces for this migration, which included scientists, engineers, and other professionals, are found in the deteriorated economic living conditions, political instability, the lack of infrastructure, and the low levels of funding for research.

Business R&D and Innovation

33. As the private sector in FYR Macedonia is still rather weak, the share of national R&D funding by companies remains very limited, thus rendering research in the country under-funded and dependent on funds from the EU and other international sources. In 2010, the business expenditure on R&D (BERD) amounted to 0.04 percent of GDP, Government Expenditure on R&D (GOVERD) was at 0.09 percent of GDP, and Higher Education R&D (HERD) was also 0.09 percent of GDP. Business accounted for only 23 percent of GERD in 2007, compared to 55 percent in the EU.[18]

34. Results from the Community Innovation Survey (CIS) and from a GfK survey shows that about one third of firms introduced at least one type of innovation between 2008 and 2010, which is similar to the EU-27 average.[19] However, almost half of micro companies did not introduce any type of innovation; patenting activities were also limited. The GfK survey showed that 20 percent of companies consider themselves to be very or extremely innovative, while 23 percent stated that they do not innovate at all. In addition, 23 percent of firms report having introduced product or service innovation in the previous 3 years (the CIS survey reports 17 percent).

35. Evidence from the GfK survey shows that companies' investment in R&D is very low. Less than 40 percent of the companies reported some type of expenditures related to innovation activities, but those were mainly for the acquisition of machinery, equipment, and software. Macedonian companies very rarely use external R&D services – only 7 percent of the companies surveyed by GfK answered positively on this, while reported expenditures on purchasing external R&D, or acquisition of external knowledge, is minor (only about 20,000,000 Denars in total for all companies). Furthermore, half of the companies do not offer any form of training to their employees. More than half of the Macedonian enterprises perceive the following factors as the most important obstacles for innovation: high cost of innovation (60 percent), lack of funds within the company or within the group (57 percent), and lack of access to external financial resources (52 percent).

36. Another important dimension of the absorptive capacity of the companies is their willingness to acquire new knowledge. As noted, about half of the GfK surveyed companies never offered their employees any type of training. The training that was offered included in-house training (50 percent), with focus on technical training (37 percent) and management related training (17 percent). Only 20 percent of companies consider that "brain drain" may cause major (9 percent) or significant (11 percent) disruption to the activities of the company. More than 25 percent of companies reported that at least one technical/scientific person left the company in the last 3 years.

[17] Presentation by Mr. Goran Torbakov, Adviser to the Prime Minister of the Republic of Macedonia for Foreign Investments and Diaspora, at the Forum Migration for Development in the Western Balkans (2012).
[18] Eurostat (2011).
[19] OECD (2011c).

Industry-Science Collaboration

37. According to the GfK survey,[20] less than 9 percent of companies have links with Macedonian universities, and only 5 percent have connections with research institutions. In the area of collaboration, Macedonian companies included in the GfK survey are primarily cooperating with suppliers (59 percent) and customers (55 percent), while the level of joint activities with other enterprises is rather low among companies in the same sector (31 percent), and almost nonexistent with other business (3 percent). The most common source of knowledge and support used by the surveyed companies are consultants (16 percent) from the Macedonian private sector. Even cooperation with the universities is largely based on consultancy (43 percent) and training (26 percent).

38. The companies' lack of cooperation among themselves and with the universities and research centers is partly a result of the companies' low level of networking. More than two out of three companies (68 percent) stated that they are not part of any network, only one out of four companies (24 percent) belong to a domestic network or association, and participation in international networks/associations is almost unknown among Macedonian companies (2 percent).

Scientific and Innovation Performance

39. According to a background study commissioned for this project based on bibliometric (SCOPUS) data over the period 2003-2010, Macedonia ranks fourth among the WBCs in terms of total publications, although it is in the bottom among the group of Eastern Europe and European countries. Total publications increased from 146 to 465 during this period. Publications per thousand inhabitants have, however, decreased from 14 to 4.[21]

40. In terms of quality, the normalized citation impact[22] indicates that Macedonia is third among the WBCs, with an average impact of 0.70 in the period considered. This puts Macedonia above the WBC average (0.62), but the country is far below the EU-27 average (1.30) for the same period. In fact, none of the WBC countries exceeds the world impact average (1). Serbia holds the highest normalized impact average of the WBCs for the period (0.74), while Croatia is only slightly above the WBC average. Further details about the scientific performance are reported in Box 1, below.

41. In terms of specialization, the activity index (also called "Relative Specialization Index"[23]) per area for the WBC shows that FYR of Macedonia has relatively strong specializations in Chemistry (with

[20] OECD (2011c).
[21] SCIMAGO Research Group (2012).
[22] Normalized Impact scores indicate the scientific impact that institutions/countries/regions have over the scientific community. Normalized Impact values show the ratio between the average scientific impact of an institution/country/region and the world average impact of publications of the same time frame, document type, and subject area. The values are expressed in decimal numbers and show the relationship of the institution's average impact to the world average, which is 1. For Example a score of 0.8 means the institution is cited as 20 percent below the world average, and 1.3 means the institution is cited 30 percent above the world average. Normalized Impact is computed using the methodology established by the Karolinska Institutet in Sweden, where it is called the "Item oriented field normalized citation score average."
[23] The activity index highlights the relative research efforts of a country to a given field. The concept was suggested by Frame (1977) to compare any country's performance with the world's performance. The activity index (also called "Relative Scientific Specialization" or RSS) is a measure of the degree of specialization of a country in a particular field. It is calculated by dividing the percent of all papers in a field from Country X by the same proportion calculated at the world level. Thus a RSS between 0 and 1 indicates that a country is relatively unspecialized in that field, while any RSS above 1 represents a relative specialization

an index of 2.2), Mathematics (1.4), and Physics and Astronomy (1.3) (see Table 1). These three areas have the highest specialization index, followed by Chemical engineering (1.11) and Medicine (1.06).

42. Macedonia shows no specialization in Agricultural and Biological Sciences, Computer Sciences or Engineering (the activity index is about one in each of these three fields), and is relative disadvantaged in the fields of Energy (0.58), Health Professions (0.14), and Immunology and Microbiology (0.45), among other fields.

43. According to the latest available information from the Innovation Union Scoreboard 2011, Macedonia was last in terms of R&D expenditures in the public sector, at 0.14 percent of GDP for 2011, while the R&D expenditure rate in the business sector was only 0.04 percent.[24] The country is also in the latest group of Modest Innovators, with growth in innovation performance of the country above the EU-27 average (1.20 percent), it is 2.3 percent.[25]

44. During the period 2006-2010, 1,796 patent applications were received by the State Office of Industrial Property (SOIP). Roughly 90 percent of the applications SOIP receives each year are from international entities, primarily within the EU. The number of granted patents in the same time period reached 1,459. SOIP saw an exceptionally high number of applications in 2007, with 466 patent applications filed, of which 28 percent were from national applicants. Since then, the number of filed applications has been decreasing, with 232 patent applications filed and 97 granted in 2010. In the course of 2011, a total of 405 patent applications were filed at the SOIP, 37 of which were national, and 368 of which were foreign applications. The number of filed patent applications in 2011, compared to 2010, increased by 11.3 percent. During 2011, Macedonia achieved an increase in the number of national patent applications, which grew from 27 in 2010 to 37 in 2011, for an increase of 37.0 percent. At the same time, Macedonian nationals submitted a greater number of patent applications, increasing the rate from 7.4 to 9.1 percent.

Table 1: Research Specialization Areas in the WBCs: Activity Index of the total volume of publications over the period 2003-2010.

		Albania	Bosnia & Herzegovina	Croatia	FYR of Macedonia	Montenegro	Serbia
Most Specialized	1	Earth and Planetary Sciences 3,3	Medicine 2,8	Social Sciences 2,5	Chemistry 2,2	Computer Science 0,6	Mathematics 3,6
	2	Environmental Science 2,9	Social Sciences 2,7	Veterinary 1,8	Mathematics 1,4	Physics and Astronomy 0,5	Chemistry 3,2
	3	Immunology and Microbiology 2,3	Agricultural and Biological Sciences 1,1	Agricultural and Biological Sciences 1,7	Physics and Astronomy 1,3	Agricultural and Biological Sciences 0,3	Decision Sciences 3,1

in that field; the higher the RSS above 1, the greater the degree of specialization in that field. (SCIMAGO Research Group, 2012).

[24] European Commission (2011).

[25] The Summary Innovation Index is composite indicator obtained by an appropriate aggregation of the 24 IUS indicators European Commission (2011). Malta and Portugal are the growth leaders of the moderate innovators and Bulgaria is the growth leader of the modest innovators. The performance of modest innovators it is below 50 percent that of the EU27.

Least Specialized	24	Engineering 0,4	Arts and Humanities 0,3	Neuroscience 0,4	Arts and Humanities 0,2	Pharmacology, Toxicology and Pharmaceutics 0,03	Economics, Econometrics and Finance 0,6
	25	Health Professions 0,2	Neuroscience 0,3	Decision Sciences 0,3	Nursing 0,2	Veterinary 0,03	Arts and Humanities 0,3
	26	Chemical Engineering 0,2	Nursing 0,04	Nursing 0,1	Health Professions 0,1	Nursing 0,03	Nursing 0,2

Source: (SCIMAGO Research Group, 2012).

Box 1: Scientific Performance Indicators

- The research areas in which the country specializes are chemistry, mathematics, and physics and astronomy. In Macedonia, medicine is the discipline with the highest output, and neuroscience, with 13 documents, is the most highly cited (11.46). The least specialized areas are arts and humanities, nursing, and health professions.
- Over 70 percent of Macedonia's publication output is from higher education institutions, which also has the most citations, at almost 70 percent. The health sector produces less than 10 percent of publications, with the same percentage of citations. Public institutions produce 10 percent of publications and have more than 15 percent of citations. Compared to the WBCs and EU-27, this pattern is skewed towards higher education institutions.
- Leading research institutions in the country are St. Cyril and Methodius University of Skopje with 1,650 documents during the survey period; the Macedonian Academy of Sciences and Arts (184 documents), and the State University Hospital of Skopje (105 publications). The highest international collaboration rate is for the Macedonian Academy of Sciences and Arts, with 64.13 percent of its publications co-authored in collaboration with institutions in other countries. None of the three institutions mentioned above exceed the normalized impact average.
- On average, 50 percent of the publications with Macedonian participation were written with international collaboration, putting the country fourth among the WBCs. The percentage of collaboration fluctuates between 39 percent and 54 percent for the period studied.

Source: (SCIMAGO Research Group, 2012).

2. NATIONAL RESEARCH AND INNOVATION SYSTEMS –FEATURES AND CHALLENGES

45. The following section explores the nature of FYRM's R&D and innovation system—encompassing stakeholders, governance, stated strategy, funding, and the state of policy development—with the aim of identifying possible weaknesses and resultant reform possibilities. It posits, in line with Macedonia's national strategy plus the emerging Western Balkans R&D Strategy for Innovation, that Macedonia can accelerate its path towards research excellence and innovation through selected R&D governance reforms combined with prioritized initiatives that strengthen the research base, enhance effective research commercialization from publicly-funded research institutions, and encourage large expenditures in research and innovation by the business sector.

Need for a Systemic View

46. Given the cross-sector nature of knowledge and innovation, governance for research and innovation policy incorporates a broad set of mechanisms and actors, instruments, and institutions in the field of R&D, education, technology and specialized services, and entrepreneurship. This calls for policy coordination across different ministries and agencies.

47. The innovation system in the FYRM, as in other countries, involves many stakeholders within the public and private sectors (universities, research institutes, the Macedonian Academy of Sciences and Arts, ministries, and private entrepreneurs) spending on R&D and interacting as parts of a value chain that should move ideas to market.

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

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

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

Need for Good Governance

51. In the path toward research excellence, it is essential to have research systems that are competitive and transparent, with quality-driven recruitment practices and efficient administrative procedures serving the purposes of institutional missions. Better governance of universities and public laboratories can be achieved through new mechanisms, such as greater use of project funding, awarding contracts and grants through competition, and selective increases in funding for research fields that are linked to social and economic need.[26] Reform of the management and funding of higher education and science institutions, through incentives that focus on excellence and relevance, can help strengthen the contribution of public investment to scientific progress and innovation.

[26] OECD (2011a) and OECD (2011b).

- Merit-driven research funding means competitive granting, subject to a peer-review system and international criteria in which projects are selected on the basis of the quality of proposals and expected results.
- Good governance in research funding implies meritocracy and transparency in grant funding; accountability, evaluation, and monitoring practices; transparency; and, performance evaluation to measure contributions to knowledge, local economic and social needs, and growth. Evaluation criteria must recognize that excellence in research and training has become, at least in some disciplines, more tied to industry applications and contributions than to addressing social problems. [27]

52. In research institutions, appropriate governance mechanisms mean performance-driven career development, clear and transparent recruitment policies, and clear rules regarding ownership and commercialization of intellectual outcomes – revenue participation by researchers – resulting from research. This also implies that results of publicly funded research are protected and published in a way that encourages their use.[28] In order to improve governance for research excellence, and consistent with the goal of a better integration with ERA, examples of governance principles to make research careers more attractive can be found in the European Charter for Researchers and the Code of Conduct for the Recruitment of researchers.

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

54. Some of these policy areas are covered by the Bologna Declaration within the framework of the European Higher Education Area, which was signed in 2007 by 46 governments. Countries agreed on 10 action lines aimed at making higher education in Europe more compatible and comparable, and more competitive and attractive for students and researchers in Europe and worldwide.[29]

55. Governance is crucial to the success of any public policy. Good governance for research and innovation policy means having an integrated and coherent policy-making process in place with stable institutions, and deploying policy agencies that perform according to policy objectives and well-defined implementation procedures. Elements of good governance include policy formulation mechanisms (consultation and priority identification), target setting and programming (medium and long run), monitoring and accountability, and information dissemination mechanisms.[30]

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[27] OECD (2011b).

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

[29] This entails comparability in degrees. Countries are setting up national qualifications frameworks that are compatible with the overarching framework, and adopting quality assurance mechanisms in accordance with the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG). Another element is fair recognition of foreign degrees and other higher education qualifications in accordance with the Council of Europe/UNESCO Recognition Convention.

[30] The European Commission's White Paper on Governance (European Commission, 2001) sets out five principles that underpin good governance. They are: openness, participation, accountability, effectiveness, and coherence. These are required for the sound management of public resources and essential in creating environment conducive to business, as well as a productive partnership between public and private sectors.

56. A fundamental component of good governance is the legal framework for research and innovation activities in which stakeholder responsibilities are clearly defined, especially for funding and performing agencies. Government obligations in the provision of resources to deploy such missions and objectives must also be delineated.

57. Policy priorities and targets, action lines, and corresponding resource planning are made possible through national strategies for science, technology, and innovation. [31] National strategies articulate countries' vision regarding the contribution of research and innovation to national economic development, and are therefore helpful to organize efforts and policy reforms in a specific direction. In some cases, national strategies outline the specific policy instruments to be used to meet a set of goals or objectives.

Actors in Policy Formulation

58. The FYRM relies on a rich and complex policy-making system that involves several advising and consulting bodies, as well as a number of committees and implementing agencies spread among different ministries, such as those for science and education, economy, and agriculture. While steps have been taken to improve policy dialogue across institutions, coordination for research and innovation policy design could be further enhanced. As stated in the OECD (2012) country assessment, a continuous inter-institutional dialogue needs to be established, and public-private consultation mechanisms need to be strengthened.

59. The Ministry of Education and Science and the Ministry of Economy are the two main institutions in policy design for research and innovation. The Ministry of Education and Science is in charge of issues such as education, science, technology, and R&D, while the Ministry of Economy is responsible for the national strategies for small and medium enterprises SME development, foreign direct investment, and industrial policy. The Deputy Ministry for Economic Affairs has an increasingly important role in both the design and implementation of policy programs. The Parliament of the Republic of Macedonia is the highest policy-making body; the preparation and adoption of legislative acts go through its Education, Science, and Sports Committee.

60. *The National Committee for Innovation and Entrepreneurships (NCIE),* created in 2011, is chaired by the Prime Minister. Its members are nominated by the government from key ministries, academia, and the business sector. Its main focus is commercialization of innovation, along with increasing the level of innovation activities in the business community and in society as a whole. The main responsibilities of the Committee for Entrepreneurship and Innovation involve:

- Coordination of governmental policies and measures for boosting innovation and competitiveness;
- Coordination of budget allocation in accordance with government priorities;
- Monitoring the work of the Fund for Innovation and Technological Development;
- Review and approval of programs to support development projects and programs of the Fund, before resulting in government procedure;

[31] OECD (2012b).

- Provision of recommendations to the government in terms of programs and projects by international organizations to support and develop innovation activities;
- Regular monitoring of policies and measures of the European Union and the countries with best practices in the field of innovation, and assessment of their impact;
- Making recommendations and proposals to the ministries for their innovation-related activities; and,
- Making recommendations and suggestions to the government related to the business environment, intellectual property rights, and support for innovation activities.

61. *The Deputy Prime Minister for Economic Affairs and Coordination of Economic Recourses* has an overall responsibility for economic policies, structural reforms, and investment. Currently, the Cabinet is also coordinating the innovation policy agenda. For this purpose, an Advisory Body for Innovation was created, consisting of high-level representatives of all relevant institutions and appointed by the Committee for Entrepreneurship and Innovation. The Advisory Body is responsible for guiding, monitoring, and coordinating the implementation of the Action Plan of the Innovation Strategy.

62. *The Ministry of Education and Science (MoES),*[32] through its Department for Science, Technical, and Technological Development is the main ministry involved in science and R&D on the operational level. The Ministry is also responsible for R&D funding. It provides funds necessary for the development of science and scientific education, national research and technology development projects, and development of research and technology infrastructure. The main body through which it operates is the Department for Science, Technical, and Technological Development, which is the main sub-body of MoES responsible for science and R&D. The Department is responsible for science and R&D; development of programs; co-ordination of proposals and selection; and, fund allocations for Technological and Development (up to 15-20,000 euros).

63. *The Ministry of Economy (MoE)* has overall responsibility for the national strategies for SME development, foreign direct investment (FDI), and industrial policy, particularly through its *Department for Entrepreneurship and Competitiveness of SMEs,* which develops legislative acts for SMEs, provides funds for start-up centers and business incubators, supports women entrepreneurship, etc. The *Department for Industrial Policy* is in charge of developing industrial policy, selecting key areas for development, providing measures for increasing competitiveness of industry, clustering, etc. MoE has been the main driver for development of the National Innovation Strategy 2012-2020, with the support of OECD.[33]

[32] The ministry of Education and Science has very good collaboration with other Ministries, especially with the Ministry of Economy.

[33] Other ministries involved in R&D comprise the Ministry of Health, the Ministry of Information Society and Administration the Ministry of Agriculture, Forestry and Water Economy (which stimulates cooperation between farmers, the Faculty of Agriculture and Food, the Faculty of Veterinary, and use of IPARD funds), the Ministry of Environment and Urban Planning, and the Ministry of Defense. Other institutions involved in the research and innovation system are the State Office of Industrial Property; state universities; the Agency for Promotion of Entrepreneurship in the Republic of Macedonia (operating agency for entrepreneurship promotion; issuing innovation vouchers, etc.), and the State Statistical Office, among others.

Implementing Bodies

64. Key implementing institutions for R&D policy are:

- *National Council for Higher Education, Science, Technology and Innovation.* The most recently adopted Law for Higher Education and the most recently adopted Law of Scientific and Research Activities require that a National Council for Higher Education, Science, Technology and Innovation be established. The Council is a body that will undertake the responsibilities of the Council for Scientific and Research Activity, National Committee for Scientific and Research Activity, and the Committee for Technological Development and Board of Ethics. It will be formed with the aim of expanding the dialogue among educational institutions, the industrial sector, and government institutions.
- *Agency for Promotion of Entrepreneurship of the Republic Macedonia* (APERM) is a state-owned institution established to conduct the program on measures, activities for promotion of entrepreneurship and creation of small businesses, and other programs adopted by the government concerning entrepreneurship and small businesses. APERM is the major national player for implementation and coordination of national and international support for the SME sector.
- *Fund for Innovation and Technology Development* is one of the main outcomes of the National Innovation Strategy 2012-2020. The Fund should be established by the end of 2013 and has an initial budget of 7.7M euros for a 3-year period. The Fund will execute the following activities:
  - Provide financing for start-ups and early-stage SMEs focused on innovation, through grants and matching grants;
  - Provide technical assistance (consulting services) for start-ups and early-stage SMEs in order to stimulate innovative thinking among companies, new product management know-how, etc.;
  - Support establishment of "accelerators" and innovation facilitators;
  - Support commercialization of R&D projects from industry;
  - Support technology transfer projects; and,
  - Support establishment of equity and mezzanine funds focused on innovation.
- *The Department for Industrial Policy* is within the MoE. This Department developed the Strategy for Industrial Policy 2009-2012 as an integrated and proactive approach in competitiveness enhancement, and is responsible for support and development of clusters in the Republic of Macedonia.[34] Support of R&D and Innovation, along with cluster development, is identified as one of the areas of intervention. In addition, this department prepares annual programs for implementation of industrial policy, offering measures for competitiveness enhancement of industry as well program for support of clustering. Several MoE programs were merged into the Program for Competitiveness, Innovation, and Entrepreneurship in 2013. MoE is expecting to

[34] The Industrial Policy has five main pillars: (a) International collaboration and stimulation of FDI, (b) Applied R&D and innovations, (c) Eco-products and sustainable development, (d) SMEs development and entrepreneurship, and (e) Collaboration through networking and clustering.

start in late 2013 with implementation of the significant part of the strategy with Instrument for Pre-Accession Assistance (IPA) project for strengthening the capacities for implementation of industrial policy.

- *Department for Entrepreneurship and Competitiveness* is within the *Ministry for Economy*. This Department is responsible for development of annual programs for SMEs; support of business incubators and regional business support organizations; support to SMEs in implementation of ISO and HASSP standards; etc.
- *Department for Innovation, Competitiveness and Entrepreneurship* is planned to be developed within the *Ministry of Education and Science*. This department will:
  - Participate in the preparation of the Innovation Strategy;
  - Participate in the preparation of Action Plans arising from the Innovation Strategy;
  - Submit proposals to the government on policy in the area of innovation activity, and programs;
  - Monitor and analyze the European and global trends and standards in innovation activity and proposal of measures for implementation in the Republic of Macedonia;
  - Monitor the implementation of existing operations in terms of innovation activity and propose measures in accordance with the development potential of the Republic of Macedonia;
  - Offer opinions, suggestions, and guidelines for international cooperation, realize international cooperation, and ensure inclusion of those involved in innovation activity in the European and international innovation space, while also analyzing international practice in this area;
  - Prepare expert analyses in the area of innovation activity;
  - Conduct research, surveys, and economic and technological inquiries in order to assist the shaping of government policy in support of innovation activity; and,
  - Initiate amendments to laws and other regulations in this area in order to encourage innovation activity.

Monitoring, Policy Evaluation and Statistics

65. The reporting and policy evaluation system is not yet well developed in Macedonia. Although several funding programs have recently implemented monitoring mechanisms for awarded projects, a systematic policy that monitors across agencies is still missing. Recent progress has been made in terms of statistical development.[35]

66. Detailed mapping of all R&D and innovation stakeholders is needed, especially development of management information systems (MIS) that will link all stakeholders and will be centralized in MoES or another government body, with milestones, type of information needed, etc. Currently, MoES is requesting information from different stakeholders, but this is not being done systematically. The main

[35] The latest innovation-related survey was conducted for the OECD background study for development of the National Innovation Strategy during April-May 2011.

R&D and innovation indicators are monitored by the government and the State Statistical Office. However, with adoption of the National Innovation Strategy 2012-2020, the Cabinet of the Deputy Prime Minister for Economic Affairs became a central point that will monitor implementation of the strategy. This institution will also be responsible for establishment and management of the innovation and technology development fund. The Ministry of Economy, under the auspices of the World Bank-funded Business Environment Reform and Institutional Reform Project developed in 2010, is evaluating the innovation performance of the country and comparing it to the EU member states.

67. There are ongoing efforts to monitor RDI policies and programs, mostly at the institutional level rather than at the program level. There is, however, a tendency to use international indicators rather than developing an internal statistical methodology. At the institutional level, for instance, the National Centre for Development of Innovation and Entrepreneurial Learning (NCDIEL) introduced two important methodologies for Macedonia: 1) the use of the Global Entrepreneurship Monitor (GEM) with surveys in 2008, 2010, 2012, and another planned for 2013, and 2) the launching of the European Innovation Survey (now Innovation Union Scoreboard – IUS) for 2010. Both were conducted with donor support. The government should allocate funds for continuous implementation of GEM and IUS. There are plans in the State Statistical Office for implementation of the Innovation Policy in 2013, and as part of those plans, the Office intends to allocate funds for an on-site survey of 2,000 companies to help form the basis for the indicators of the Innovation Union Scoreboard for 2013.

68. In 2011 and 2012, the Macedonian government started to follow the Global Innovation Index[36] as a measurement tool to track innovation developments in the country.

Research and Innovation Actors

69. The main research actor is the Macedonian Academy of Sciences and Arts through its five departments and units of the state universities.

70. *Macedonian Academy of Sciences and Arts*: MANU participates in the establishment of Macedonian research policy, acts as an advisor to the government on scientific issues, and promotes and performs research. MANU implements its activities through five departments (Linguistic and Literary Sciences; Social Sciences; Mathematical and Technical Sciences; Biological and Medical Sciences; and, Arts) as well as five research centers (Research Center for Genetic Engineering and Biotechnology; Research Center for Energy, Informatics, and Materials; Center for Strategic Research; Center for Linguistics; and, the Lexicographical Center).

71. *Academic institutions*: The Macedonian research community comprises the following universities:

- *The University Ss. Cyril and Methodius*[37] in Skopje is the largest public university and comprises 23 faculties (schools), 5 institutes, and 5 affiliate public scientific institutions. The Institutes are: Institute of Agriculture; Institute for Sociological, Juridical, and Political Research; Institute for Earthquake Engineering and Seismology[38] (42 research employees); Institute for Livestock Breeding; and, the Economic Institute.

[36] http://www.globalinnovationindex.org/gii/main/fullreport.
[37] See http://www.ukim.edu.mk.
[38] See http://www.iziis.edu.mk.

- Affiliate public scientific institutions to the University Ss. Cyril and Methodius are: Institute for Macedonian Literature, Institute for Macedonian Language, Institute for National History, and Institute for Folklore.
- *The University St. Kliment Ohridski in Bitola*[39] consists of 11 faculties (schools) located in Bitola, Ohrid, Veles, Kicevo, and Prilep, as well as one research institute (for Tobacco Growing) in Prilep.
- *The University Goce Delcev*[40] in Stip comprises 13 Faculties, 9 centers, and 4 institutes (Institute of Nutrition, Gastronomy, and Dietary Science; Institute of History and Archeology; Institute of Information Science; and, Institute of Languages).
- *The State University in Tetovo*[41] comprises 10 faculties (schools).
- *The University of Information Science and Technology in Ohrid*, established in 2009, comprises five faculties (Faculty of Information Systems, Visualization, Multimedia, and Animation; Faculty of Machine Intelligence and Robotics; Faculty of Computer Science and Engineering; Faculty of Computer Networks and Security; and, Faculty of Information Theory and Analysis).

72. The schools of the state universities are the main contributors to R&D expenditures in higher education. Private universities are minor research performers in Macedonia, with marginal participation in R&D activities. In 2010, representatives from Macedonian universities were appointed to the main three European research bodies: the European Research Area Committee, the European Strategy Forum on Research Infrastructures, and the Steering Group on Human Resources and Mobility.

3. POLICY DEVELOPMENT

National Strategy

73. The main challenges in promoting RDI policies include:

- Insufficient infrastructural facilities, equipment, and materials, as well as institutional infrastructure;
- Unbalanced distribution of researchers by sector;
- Low public investments in applied research and innovation;
- Low level of private investments in the R&D sector;
- Low number of young researchers in proportion to the total number of researchers;
- Unaccounted brain-drain and brain-gain;
- Underdeveloped mechanisms for transferring knowledge and research results in the business sector;

[39] http://www.uklo.edu.mk.
[40] http://www.ugd.edu.mk.
[41] http://www.unite.edu.mk.

- Significant unaccounted supply and demand of R&D and innovation services: private, off-the-record engagement of institutional researchers on private and public sector projects; and,
- Very low level of scientific collaboration with the diaspora.

74. The recently adopted National Innovation Strategy 2012-2020 and Action Plan for Innovation 2013-2015 both address most of these problems. In parallel, a periodic (4-year) policy program for research and technology has been developed through the National Program for Higher Education, Scientific Research and Developmental Activity in the Republic of Macedonia (NPHESRDA).

75. According to the World Bank Policy Questionnaire, Macedonia is strengthening governance for research and innovation policy-making and implementation. Through the design of recent national programs and the national strategy, discussed below, the government is improving the links between strategy targets and public budget decisions. These links are regulated within annual programs. A more programmatic policy model is currently being developed. Depending on the annual budget, some of the targets are reached, but not all reached.

76. Further improvements are needed at the level of implementation and operation of action lines and monitoring mechanisms of policy programs. In order to continuously guide, monitor, and coordinate measures derived from the Innovation Strategy, an Advisory Body for Innovation was formed. The members of the Advisory Body for Innovation were appointed by the Committee for Innovation and Entrepreneurship. The Advisory Body for Innovation holds meetings on a weekly basis and coordinates the technical working groups responsible for the coordination of activities within different institutions. Furthermore, the development of the Department for Innovation, Competitiveness, and Entrepreneurship within the Ministry of Education and Science is an essential step for continuous coordination and evaluation of the Innovation Strategy.

77. In addition to resource constraints, the most binding constraints preventing full implementation of the national strategy include the following: i) lack of good coordination among stakeholders; ii) low interest in the business sector for research and innovation initiatives; iii) extremely low level of commercialization of the research outputs (universities, innovators, and business R&D centers); and, iv) limited number of Technology Transfer Offices and insufficient innovation funds.

78. The recently adopted National Innovation Strategy 2012-2020 is addressing almost all of these problems. The MoE, in cooperation with other relevant institutions supported by the OECD, developed the National Innovation Strategy 2012-2020 in November 2012.[42] This is the first time a national innovation strategy has been established in Macedonia. The strategy aims to transform the country into a knowledge-based economy able to compete in international markets through its skilled labor and innovative companies.[43] Because this is the country's first national strategy, the Innovation Strategy has been developed in a transparent way, with public consultation and the involvement of almost all key stakeholders.

[42] There was an attempt to joint both documents, but MoES decided first to develop a 4-year national program, and then to continue with development of the innovation strategy. The MoE and OECD team included priorities of the national program developed by MoES in the Innovation Strategy.

[43] Four strategic objectives are defined: enhance the business sector propensity to innovate, strengthen human resources for innovation, and create a regulatory framework to support innovation, and increase knowledge flows and interactions between research institutions and business.

79. For the National Innovation Policy, the total budget for the action plan of 3 years (2013-3015) will be around 19 million euros. Figure 1a displays the current Innovation Strategy. The main objectives of the Strategy are:

1. Strengthening the business sector's propensity to support innovation;
2. Strengthening human resources for innovation;
3. Creating a regulatory environment that will support innovation; and,
4. Increasing the flow of knowledge between actors in innovation.

80. Implementation of the Action Plan measures is expected to strengthen the competitiveness of the national economy and encourage knowledge and innovation-driven economic development, which is one of the three main objectives of the Strategy "Europe 2020." At the same time, it is expected that the Innovation Strategy will contribute to strengthening the cooperation between the actors of the "Triple Helix Model": the business community, the academic sector, and government bodies. It is also expected to create an effective innovation system for all stakeholders of innovation activity, thus creating jobs, which will in turn affect the rate of unemployment in Macedonia. Some of the major activities arising from the Innovation Strategy are development of the Law on Innovation Activity and establishment of a Fund for Innovation and Technological Development.

81. The Law for Innovation activity regulates the principles, objectives, and subjects of the innovation activity; the scientific-research activity; the transfer of technological knowledge; and the statute, the competencies, the management and administration, the financing, the work supervision, and other issues related to the work of the Fund for Innovations and Technological Development. The Law was adopted by the Parliament in May, 2013.

82. In accordance with the 2008 Law on Scientific-Research Activity, the MoES recently developed the National Program of Higher Education, Scientific Research, and Developmental Activity in the Republic of Macedonia (2013–2017). MoES puts out a new NPHESRDA every 4 years. The 2013-2017 Program was prepared at the end of 2012. The NPHESRDA determines the objectives, content, and scope of tasks in the science and research area, the research infrastructure, financing of scientific and research activities, human resources, the international dimension, and impact on the economy. MoES develops the program based on an existing implementation system and procedures, which are also transparent to the public.

83. The most important strategic goal of the Program is increasing the investment in R&D up to 1.8 percent of the GDP by 2020, as well as increasing the investments of the private sector by 50 percent of the total investment in R&D.

84. Other fundamental directions of the current research policy are given by the Program of the Government (2006–2010), which was further extended in the Government Program for the period 2011-2015. The following reform measures, policies, and activities are anticipated:

- Increase investments in scientific-research infrastructure;
- Provide funds for scientific-research work targeting the private sector;
- Encourage and support science through fiscal policy;
- Promote cooperation with scientific-research institutions from abroad;
- Establish strict and fair selection criteria regarding staff employment in scientific research institutions;

- Support cooperation between scientific-research institutions and economic institutions;
- Develop and commercialize new products, services, and processes;
- Stimulate the introduction of new technologies;
- Transfer knowledge;
- Offer professional training on how to use new technologies and technological processes;
- Promote partnerships between the science and business sectors;
- Improve the technological cooperation developing and managing clusters;
- Introduce innovations and patents in the business operation of the companies; and,
- Expand capacity building for stimulation of research and innovations.

85. Other policy developments framing research and innovation policy documents are reported in the Annex (Box A1). Expanded European and regional cooperation is among the country's main strategies, including the National Strategy for Development of Education in the Republic of Macedonia 2005-2015.

4. FUNDING PROGRAMS AND POLICY INSTRUMENTS

Research Funding

86. Macedonia provides state universities with institutional funding for all of their basic activities, based on the number of students and study programs. However, the universities are also encouraged to acquire additional funds from international R&D programs and the business community. The funding for research institutions is primarily through block grants (institutional funding).[44] On the competitive side, there are open calls for R&D projects such as developmental and innovation projects, in which the state covers up to 30 percent of total costs. The application procedure involves the participation of teams of experts from universities and private companies. However, funds through competitive programs are very limited (only about 2,000 euro), and really only cover the fees of the experts. Investments in equipment or possible prototyping are left to company budgets.[45]

87. Through 2012, the Ministry of Education and Science provided annual support and co-financed research activities such as developmental and innovation projects (up to 30 percent of total cost); access to scientific journals; publication of scientific books; participation in domestic and international conferences, seminars, etc.; international study visits for approximately 100 young scientists; and equipment for universities and laboratories. In 2014, the total budget allocated to these activities will be 60 million euros.

88. Although not completely established, the Macedonian research system is moving toward better governance, with research quality and the relevance of research becoming standards in research funding. The Department for Science, Technical, and Technological Development in MoES developed the criteria for awarding R&D funds. These criteria are: i) Relevance of the outcomes of the project to the national

[44] The state budget for higher education in 2008 amounted to roughly 29 million euros, and the budget expenditures for scientific and research activities for 2008 were approximately 5.8 million euros.
[45] Funding is provided by the budget in accordance with the goals and priorities defined in the National Program for Scientific and Research Activities, the Program for Technological Development, the Program for the Implementation of the Industrial Policy Strategy, and development programs of public interest for Macedonia.

priorities; ii) Project relevance to call priorities; iii) Possibilities for commercialization of the outcomes of the project; iv) Researcher experience; and, v) Budget allocation.

89. In addition, the MoE Department for Industrial Policy recently developed new criteria for evaluating the cluster's level of innovation, based on the innovation of private sector cluster members. This is in addition to already established criteria for awarding funds through annual open calls.

90. According to the World Bank Policy Questionnaire, to enhance the quality of R&D and strengthen incentives for research excellence, the Macedonian government has undertaken several reforms. First among these is adoption of performance measurement systems or stronger evaluation of scientific performance (e.g., publication and citation criteria, participation in international conferences, etc.). The government is also reforming funding structures. For instance, in 2010, a new procedure for career promotion among academic and research staff was adopted, requiring increased publication, citation criteria, and participation in international conferences. Furthermore, through the project "scientific subvention," the government rewards authors for publishing papers in the major journals. Establishment of an Innovation and Technological Development Fund planned for 2013 will contribute to increased R&D quality.

91. According to the World Bank Policy Questionnaire, however, improving research synergies by pooling expertise and resources (such as creation of centers of excellence, multi-disciplinary research centers, etc.) is not currently part of the agenda.

92. There are ongoing efforts to strengthen the infrastructure for research at public research institutions. Within the framework of the project "equipping laboratories for scientific research and applied activity" (2011 – 2014, equipping 160 labs), 60 million euros have gone to 80 laboratories in the fields of information sciences, technological sciences, medicine, natural sciences, mathematics, biotechnical sciences, social sciences and humanities, and safety.

93. The government has provided public universities with full autonomy to recruit staff and has implemented simpler procedures for collaborating with industry. However, the government must provide approval and funds for new employment positions. In addition, universities' ability to define governing bodies and structure is still limited by the ministries, as is their ability to allocate resources internally and access private sources of funding.

94. In January 2013, Parliament adopted several amendments to the Law for Higher Education. Among the most important are the following recommendations, which apply to each university:

- Establish career center and alumni association that will have regular meetings with the stakeholders;
- Establish an "Advisory council for collaboration with the university environment" with representatives from the business sector and local government. The Council will help direct university study programs and model them according to labor market needs;
- Introduce courses of entrepreneurship and innovation where possible;
- Spend 40 percent of the university budget as follows:
    - Scientific and research related projects;

- Obligatory study visits of 1-3 months to the top 500 Universities from the list of Center for World-Class Universities of Shanghai Jiao Tong University. There should be at least one study visit in a 3-year time frame; and,
- Criteria for academic promotion, with focus on increasing the number of papers in the international journals.

95. Within the new Law for Higher Education, in Article 120, is an announcement obligating the Macedonian government to establish a National Council for Higher Education, Science, Innovation, and Technology. The Council will have 17 members: the MoES Minister, President of Macedonian Academy for Science and Arts, President of the inter-university conference, 6 members to be nominated by the government, 2 members from the business sector, and 6 members from different scientific areas. The criteria for membership in this council are very high.

Human Capital, Mobility and Diaspora

96. According to the World Bank Policy Questionnaire, recent programs implemented to improve human resources in science and technology include: raising interest in and awareness of science among youth via promotional campaigns on TV; revising academic curricula to make science and technology more attractive to students, such as by expanding interdisciplinary training in science education; improving teaching in mathematics and science, including through the use of ICT in teaching content and delivery; and, improving the quality of university research laboratories/infrastructure.

97. The government is providing full scholarships for all Macedonian students that will be enrolled in the programs of the 100 Best Foreign Universities (according to the Shanghai list). Many bilateral scholarships are available in China, the UK, Slovenia, Poland, and elsewhere. For students from technical disciplines, the government is providing a number of scholarships for undergraduate studies. There are also continuous changes in university curriculums. Intensive teacher training has been provided in the last 3 years in the areas of natural sciences in primary and secondary schools.

98. The World Bank Policy Questionnaire found that demand-side policies to increase the attractiveness of employment in public research organizations remain under-developed, as do reforms promoting more flexibility in public sector employment and efforts to improve provision of information to students regarding job opportunities in the public and private sectors.

99. Currently, there are no policy programs targeting the financing of PhD and post-doctorate training, such as through fellowships, funded research opportunities, etc. Nor are there formal efforts to improve industry-science links through, for example, PhD training and PhD joint programs.

100. Efforts to strengthen the mobility of researchers within the WBCs are few. Those that do exist focus primarily on the funding of scholarships and grants. Recent efforts to globally enhance the mobility of scientific and high-skilled personnel include policy initiatives that focus exclusively on the funding of scholarships and grants for international mobility of Macedonian researchers.

101. There are currently no plans to reform immigration legislation for the highly-skilled or provide support to create special positions at universities and public research organizations. To date, there are no fiscal incentives to attract foreign researchers, and there are no programs to promote collaboration between local scientists and scientists in the diaspora.

102. To encourage mobility and the return of highly-educated individuals to the country, several initiatives and programs have been established. The government has accelerated the procedure for the validation of diplomas and scientific qualifications of foreign higher education institutions, significantly reducing both costs and the number of required documents, while also easing the deadline for action. Preferential treatment is given to diplomas and qualifications acquired in the first 500 universities in the Academic Ranking of World Universities (ARWU)[46] To improve diaspora tracking, a database for scientists and business persons abroad has been created, along with a forum. A body that directly stimulates collaboration with the diaspora is the Foundation Macedonia 2025.[47] The Ministry of Education and Science is working on a Strategy for Networking, Cooperation, and Reducing of the Immigration of Highly Educated Individuals.

103. The strategy aims to accomplish the following:

1. The creation of conditions to monitor and coordinate the movement of highly educated individuals who choose to migrate out of the country, as well as to engage the potential of intellectual immigration;
2. Reduction of the emigration of highly educated individuals by increasing the appeal of the labor market in the Republic of Macedonia. Further, the strategy aims to engage highly educated youth, as well as to improve the quality of educational opportunities provided by the government of Macedonia;
3. A transition from outflow to inflow of highly educated individuals through an increase in public awareness of the Republic of Macedonia's need for human capital development; and,
4. An increase in intellectual exchanges with foreign countries, to be accomplished by encouraging cooperation between educated individuals originally from Macedonia who live and work abroad with Macedonian research institutions and development companies.

Private Sector R&D and Innovation

104. A very small part of the state R&D budget is spent by private organizations; due to the transition from planned to market economy. During 2004, only 2 small, 21 medium, and 31 large enterprises invested in R&D activities. Investments amounted to 1.24 million euros, based on data from the Central Registry.

105. One of the main financial instruments is co-financing projects of the business community through the *Law and Program for Encouraging and Supporting Technological Development*. The organizations of technological development, which are registered in a special database of the Ministry of Education and Science, compete in public calls. The grants are up to 30 percent of the value of positively evaluated projects, but only if the remaining 70 percent is secured by the organizations. The allocation of the funds is made by the Ministry of Education and Science.

106. The *Management and Business Advisory Services (TAM/BAS) Program* co-finances consulting and innovation projects of companies, using local and international consultants, researchers, and

[46] The Academic Ranking of World Universities is released by the Center for World-Class Universities at Shanghai Jiao Tong University.
[47] The initiative group "Macedonia 2025," composed of successful executives and managers from North America who are of Macedonian origin, seeks to promote investment opportunities and incentives in Macedonia, and encourage the Macedonian diaspora to invest in the country.

technology specialists. The BAS Program has been financed by the European Agency for Reconstruction (phased out), the European Commission, and bilateral donors. While BAS is assisting micro enterprises and SMEs, TAM is providing large companies in the textile, food processing, automotive, metals, construction, and pharmaceutical industries with international industrial expertise and technological know-how.

107. The *Program for the Development of Entrepreneurship, Competitiveness, and Innovation of Small and Medium Enterprises* (2007–2010) was developed by the Ministry of Economy and envisions the promotion of business R&D. A new program for the period 2011-2013 was also adopted and is in the process of implementation for 2013. Each year, the Ministry's Sector for SME Development and Competitiveness reports to the government on the implementation of the annual program.

108. The Ministry of Economy has launched projects to help domestic businesses adopt and implement ISO standards (e.g., 9001 and 14000) by co-financing the process of certification. The Ministry co-finances up to 30 percent of the research projects and public scientific institutions' work with the business sector on the development of new products, processes, materials, etc. The Ministry of Economy, through the annual Program for *Implementation of the Industrial Policy Strategy for 2011*, co-finances projects in business sector for:

- Technology transfer, technology infrastructure, and staff training projects up to MKD 180,000 (about 3,000 euros). The total fund of the Ministry for 2011 was MKD 2.5 million (about 40,600 euros);
- Employment of researchers with Master's and Ph.D. degrees who are not older than 35 for at least 2 years of full-time employment, and with co-financing of up to MKD 100,000 (about 1,620 euros);
- Support for development of competitive products (commercialization of new products, increase of productivity and efficiency) by co-financing up to 180,000 MKD (about 3,000 euros). Total funding for this measure in 2011 was 3,000,000 MKD;
- Support in market development (market research, development of marketing strategy, brand development) by co-financing up to 180,000 MKD (about 3,000 euros).Total funding for this measure in 2011 was 2,500,000 MKD; and
- Commercialization of patented innovations by co-financing of costs up to 120,000 MKD. Total funding for this measure in 2011 was 600,000 MKD.

109. A business angel network was established in 2012, with the support of the United States Assistance for International Development (USAID). The Competitiveness Project is part of the Macedonian Innovation Centre[48]. Several investment readiness dinners have been held, and a few projects are in the pipeline and waiting for investors. Through January 2013, no single investment was completed. In matters of nurturing services for new firms, several initiatives have been launched. The APPRM has a support program that allows firms to use innovation vouchers.

110. For the period 2006-2010, the government introduced lower taxes, compared to the rest of Europe. One fiscal policy instrument that indirectly supports R&D investments is zero corporate tax on all profits that are re-invested into the development of a company. This policy does not differentiate between

[48] See: http://www.i2b.org.mk/.

R&D and other investments, but encourages all profit-oriented companies, including private universities, to re-invest profits into their development, where R&D is potentially included. There are no specific tax incentives for R&D investment or deductions for long-term investment, nor are there fiscal deductions or subsidies for importing of R&D equipment, for companies or research organizations.[49]

111. For SMEs, there are some programs to encourage entrepreneurship through training, information services, and other means. Public policy for firm innovation also considers the promotion of collaboration and networking among firms. These strategies are pursued through support to joint R&D programs; consortia (private-public; private-private); and, regional innovation clusters.

112. The fostering of firm innovation through international co-operation, for example, attracting research labs of foreign firms or supporting access of domestic firms to foreign programs, is not currently included in the policy agenda. Likewise, public-private research collaboration in key areas ("strategic technology agreements") is currently not an explicit part of the agenda, nor is the encouragement of industry-science links through personnel mobility or consortia.[50]

113. There are some measures to link domestic firms, in particular SMEs, to foreign sources of research and innovation, including cooperation in R&D with the countries of the Western Balkans. Among these measures are: i) additional/preferential funding for projects with international partners; ii) co-funding for project partners not located in the country; and, iii) support to find international partners.

114. The European Enterprise Network (EEN) is moving towards the above-mentioned objectives. However, the EEN's work must be extended to all areas and regions, and its services must be strengthened to increase the number of staff, level of services, and promotional activities towards the business sector.

Technology Transfer and Science and Industry Cooperation

115. There are no technical obstacles for collaboration with industry. However, research and innovation collaboration between firms and research institutions remains under-developed. The main issues hindering industry-science collaboration are the willingness of the companies to develop joint research, as well as the capability of the university staff to sell their knowledge to the companies.

116. Several initiatives have been launched. The Department for Science, Technical, and Technological Development just developed new and important projects that started in 2012. Among these are the project website patent.mk, for support of patent applications, and the project website nauka.mon.gov.mk-register, for researchers in the Republic of Macedonia. Projects scheduled to start in 2013 include a website/register for laboratories, and Internet-based platform that will link domestic researchers and the scientific diaspora.

117. The Memorandum for Cooperation between the biggest research and educational university, Ss. Cyril and Methodius in Skopje, and the Macedonian Chamber of Commerce is expected to strengthen cooperation on R&D projects. Technological industrial development zones (TIDZ) have been developed,

[49] However, within the new National Innovation Strategy, there are actions planned for tax reduction for investment in R&D equipment by companies.

[50] More specifically, MoES provides financial support to joint projects: developmental and innovation projects (up to 30 percent of total cost), and development/support of clustering. In addition, the government has regular meeting every 2 months with the business sector (i.e., chambers of commerce) on different topics regarding the business environment. These policy programs were conceived in the Law on Promotion and Stimulation of the Technological Development (April 2011).

offering favorable tax and infrastructure conditions for the operators, including 0 percent corporate and personal income tax for the first 10 years (taxes will be 10 percent afterwards).[51] One zone near the airport in Skopje (Bunardzik) is operational with the two flagship greenfield investors Johnson Controls and Johnson Matthey, followed by VanHool, TeknoHose, Kemet, ProtekGroup, Mothersongroup, etc.[52] Several other technological zones are in the development phase (Shtip, Bitola, Prilep, Kavadarci, Kicevo, Gevgelija, etc.) and several factories are already opened, including the Draxlmaier Group facility in Kavadarci, which should employ more than 4,000 persons in the next 3 to 4 years.[53] The management of the TIDZs is carried out through the public Directorate for TIDZ.

118. In respect to technology transfer policy frameworks for publicly-funded research institutions, there are several holes. Until December 2012, there was no legal framework regarding the creation and commercialization of intellectual property rights resulting from state funded research, limiting the ability of universities and PROs to engage in such activities. Likewise, policy or institutional laws do not yet exist regarding spinoff creation and incentives to researchers to participate in technology transfer activities (e.g., recognition in curricula; researchers' rights to participate in licensing revenues and equity participation in new firms). Public support for the creation of technology transfer units is still embryonic.

119. There are, however, some initiatives that go in these directions. The new Innovation Strategy considers support for Technology Transfer Offices (TTOs). The next step in 2013 is to prepare legislation for TTOs. The government recently launched the following initiatives to accelerate innovation and entrepreneurship: a promotional campaign with the slogan "OSMELI SE! NAPRAVI GO PRVIOT CEKOR!" (Be brave! Make the first step!); the new website www.osmelise.mk; promotion of university start-up creation; and, legislation for a university spin-off companies project. The investment in the latter is to exceed 10,000 euros for researchers who apply R&D outcomes to establish a spin-off company. There are also plans for establishing a scientific technological unit at the engineering campus of the Ss. Cyril and Methodius University, Southeast European University in Tetovo, at the company Seavus, in the Bitola region, etc.

5. RESEARCH AND INNOVATION INFRASTRUCTURE

Innovation and Technology Transfer Infrastructure

120. There are five Regional Enterprise Support Centers (RESCs) in FYR Macedonia, three Enterprise Support Agencies (ESAs), and the entrepreneurship support agency Prilep Region Enterprise Development Agency (PREDA). There were seven business incubators established by the World Bank in 1997 to support business start-ups: the Incubator Delcevo, the Incubator "Turtel" Shtip, the Incubator "Biljana" Prilep, the Incubator Sasa, the Deni Incubator Veles, the Gica Incubator Ohrid, and the Inkubator Strumica. In 2013, only the incubator in Strumica was still operating. Two other business start-up centers were developed, again with support from the donor community. The first is within the

[51] TIDZ-favorable conditions include: no VAT and customs duties for export; subsidy of up to 500,000 euros for building costs; land lease for up to 99 years at favorable concessionary rates; free access to utilities; and a green customs corridor expediting exports to the EU.
[52] http://www.fez.gov.mk/johnson-controls.html.
[53] http://www.draexlmaier.com/presse/pressemitteilung/article/neues-draexlmaier-produktionswerk-in-mazedonien-mit-erstem-platz-ausgezeichnet.html.

University Ss. Cyril and Methodius in Skopje, at the Faculty of Mechanical Engineering (UKIM-BSC), supported by the Austrian Development Agency (ADA) in 2013.[54] The other incubator, the Business Start-up Center Bitola (BSCB), is financed by the Ministry of Foreign Affairs of the Netherlands. It is a project initiated by the local university, chambers of commerce, and business support centers.

121. The most active incubator in Macedonia is the Youth Entrepreneurial Service (YES) Foundation, an IT incubator located in Skopje. The YES Foundation incubator's main component is a business incubator for supporting micro, small, and medium enterprises in the ICT field through the process of business incubation. The incubator offers access to services for accelerating their growth and development. Initial support was received from the Foundation Open Society Institute Macedonia and SINTEF (Norwegian Government).

122. An Innovation Relay Center (IRC) was established by SINTEF[55] Norway in 2006, seeking to increase business competitiveness by strengthening the technological and innovation base of SMEs. USAID, through the Competitiveness Project (2008-2012), established an Innovation Center that aims at supporting and commercializing innovation projects by finding strategic partners, business angels, or investors. In parallel, USAID is assisting in establishing a Fund for Innovations that is in the process of capitalization with USAID and private funding.

123. Initiated and funded by the Ministry of Education and Science in 2002, four technological nuclei were established in Skopje at the Schools of Natural Sciences and Mathematics, Mechanical Engineering, Electrical Engineering, and Medicine. In addition to these, with the support of the Deutsche Gesellschaft Technische Zusammenarbeit (GTZ), five other centers for technological transfer were established. Through the USAID project "Macedonian Competitiveness Activity (2002-2007)," organizational and financial support was given to the following clusters: lamb meat and cheese; tourism; IT; wine; and, apparel. The activity of some clusters ceased or significantly decreased after the completion of the USAID project.

Supporting Institutions: the IPR systems and Certification Institutes

124. The State Office of Industrial Property is responsible for the protection of IPRs in the country and for drafting proposals to adopt legal and other acts in the field of intellectual property. SOIP maintains registers of filled and granted IPRs. Every 2 months, SOIP issues an official gazette comprising data of the legal status of filed and granted IPRs.

125. The SOIP represents the interests of the Republic of Macedonia at the international, European, and regional levels for intellectual property. In this respect, the SOIP launches initiatives concerning the ratification of international and regional agreements, and manages delivery of obligations in the field of intellectual property arising from the ratification of international agreements signed by the Republic of Macedonia. SOIP cooperate with other entities involved in the system of protection and enforcement of IPRs in the country and abroad. SOIP conducts qualification examinations for registration of legal representatives in the field of intellectual property for representation of parties during the administrative

[54] The business start-up center had founded 50 new companies, all of them led by students or recent graduates and all meeting basic criteria of being innovative, profitable, and knowledge-based businesses. Supported with ADA funds, UKIM-BSC organized six cycles of business plan competition among students and recent graduates and provided almost 100,000 euros in grants.

[55] The SINTEF Group is the largest independent research organization in Scandinavia.

protection of the IPRs before the Office. The qualification examination is carried out according to the Regulation of Representatives. The SOIP is responsible for dissemination of information to the public, raising the awareness among general public about IPRs, and preparation and publication of guidelines and manuals in the field of intellectual property. SOIP is promoting creativity and innovation through initiatives such as the International Intellectual Property (IIP) day, the Patent of the Year, local exhibition of inventions, participation in international exhibition of ideas/inventions/new products, etc.

126. The Strategy for Intellectual Property of the Republic of Macedonia 2009-2012 was developed with assistance from the USAID. The Ministry of Economy supervised the activities, monitored the achievement of the Strategy goals, and reported to the government on progress. The SOIP collected information from the participating institutions to facilitate report preparation. The goal of the Strategy was "to elevate the level of efficiency and effectiveness in the protection and enforcement of the intellectual property rights in 'FYR Macedonia', in compliance with the standards and rules of the European Union." Tasks included: i) strengthening the legal framework in the area of intellectual property law; ii) strengthening the enforcement of intellectual property rights; iii) developing the capacity of individual right holders and business community for protection and enforcement of intellectual property rights; and, iv) strengthening public awareness and benefits from intellectual property.

6. INTEGRATION TO ERA AND INTERNATIONAL COLLABORATION

Integration to ERA and Framework Programs

127. FYR Macedonia presented 23 calls for competitive funding under FP7 in 2010. For the FP7 period 2007-2010, the total number of proposals came to 271. The success rate, or the share of proposals that received funding, was 17 percent on average for the period and 26 percent for 2010, on par with the average ratio for the SEE economies. Meanwhile, the funding for the supported FP7 grants received by FYR Macedonia amounted to 5.4 million euros in the period 2007-2009, which was 72 percent of the requested amount of 7.5 million euros. This share is significantly higher than in many neighboring economies (see tables below).

128. The database of the Ministry of Education and Science shows that in a period of more than 6 years (2007 through April 2013), the country submitted 580 proposals, of which 476 were eligible and 83 were funded. This corresponds to an average success rate of 15.17 percent for the period, compared to 17.5 percent in the other EU candidate countries and a 21 percent average success rate for member states. Macedonian research organizations received about 10.2 million euros, which is more than the 7,362,000 euros that the country paid to FP7 as a financial contribution for the entire period (2007-2013).

129. The contribution from FP7 to Macedonia's overall R&D expenditure has been significant, representing 17 percent of GERD in the period 2007-2009, a share considerable higher than in other SEE economies.[56] The ongoing projects with FP7 funding are in the areas of food, healthcare, ICT, renewable sources of energy, scientific research, and transportation. The Ministry of Education and Science fostered

[56] Rivera Leon and Reid (2010).

its institutional capacity by appointing three persons to work on FP7. There are also plans to establish a department for FP7 within the Department of Science and Technological Development.

Other EU Programs and International Co-operation

130. The government is strengthening links with EU research and innovation institutions and programs. Macedonia actively participates in the WBCINCONET and SEEERANET PLUS projects, European Cooperation in Science and Technology (COST) (participation in 26 new actions in 2011), and EUREKA. Several bilateral cooperation agreements have been signed, such as the Agreement for Cooperation in Science and Education with Bosnia and Herzegovina, and the Protocol for Cooperation in the Field of Education with Slovenia. An agreement for cooperation in science with Serbia is ongoing. In addition, a Memorandum of Understanding has been prepared for cooperation with the Joint Research Centre. To enhance international mobility of Macedonian researchers, many bilateral scholarship agreements are available (Slovenia, Poland, Slovakia, China, etc.).

131. The World Bank Policy Questionnaire identified the following potential areas for regional collaboration within the WBCs: i) establishment of a regional innovation fund; ii) establishment of the regional guarantee fund for co-financing of international programs (IPA, FP7, CIP, etc.); iii) joint advanced Masters and PhD programs on topics related to development of high-tech and export-oriented products and services; and, iv) development of a regional network of RDI consultants, with a focus on commercialization of R&D outputs (selection, training, and certification of the consultants).

132. FYR Macedonia allocated a relatively high level of resources for international cooperation in 2007, equaling 15.9 percent of the Ministry of Education and Science's science budget. The largest numbers of bilateral projects were implemented with Slovenia, Bulgaria, Austria, and Croatia.[57] Higher education institutions primarily use the available instruments to participate in various R&D-related programs. The chief success was within the programs like TEMPUS, FP6, FP7, cross-border IPA projects. With several countries, there are bilateral contracts for collaboration in the science area (Austria, Slovenia, China, Croatia, China, etc.)

7. CONCLUSIONS

133. This Note has presented an overview of the current features of research and innovation systems in the FYRM. More specifically, it has identified policy challenges in terms of funding, governance, and reforms needed to make research systems in the FYRM more competitive and strongly integrated with the ERA, and to increase their impact on the national economy.

134. Key challenges in Macedonia's research and innovation policy are to:

- Improve conditions for research excellence in public research organizations and universities through increased competitive grant funding and enhanced career incentives, as measured by

[57] The bilateral agreements usually cover: individual specializations; experts exchange; cooperation between institutions from higher education; scholarships; joint scientific research projects; exchange of information and publications; and, other forms of cooperation that are agreed between the parties. The main areas of international cooperation are agriculture, biotechnology, food processing, chemistry, pharmaceutical research, and environmental protection.

contributions in research, education, and technology transfer. Salaries and complementary economic compensations could be considered for outstanding research quality achievements, thereby strengthening a culture of research excellence.

- Develop formal and systematic industry-science collaboration mechanisms for research and innovation through increased incentives provided by a clear legal and policy framework for technology transfer activities and public support for institutional capabilities (TTOs). Such a framework should enable universities and PROs with appropriate legal rights to engage in commercialization activities, private sponsorships, personnel mobility, and other forms of industry-science collaboration. To increase innovation capabilities in the business sector, it is essential to enhance industry-science collaboration.
- With respect to brain drain and the scientific diaspora, improve policy frameworks through immigration laws and connectivity programs (e.g., UKF), which should cover the wide range of research collaboration forms, including research fellowships; joint research programs and doctorates; mobility exchanges; training programs; and financial support for business creation and joint-ventures.

135. Many of these issues are addressed in the recently adopted National Innovation Strategy 2012-2020 and its Action Plan 2013-2015 (November 2012). In order to continuously guide, monitor, and coordinate measures derived from the Innovation Strategy, an Advisory Body for Innovation was formed. The members of the Advisory Body for Innovation were appointed by the Committee for Innovation and Entrepreneurship. The Advisory Body for Innovation holds meetings on a weekly basis and directs the technical working groups responsible for the coordination of activities within different institutions.

136. Furthermore, the development of the Department for Innovation, Competitiveness, and Entrepreneurship within the Ministry of Education and Science is an essential step for continuous coordination and evaluation of the Innovation Strategy.

137. An increased budget for the implementation of the action plan is also fundamental.

138. In advancing the policy agenda and responding to these challenges, it is necessary to have greater regional collaboration in R&D and innovation and its different components: R&D infrastructure, human capital and training, financial resources, and institutional capabilities. Regional collaboration can be helpful and instrumental in leveraging resources and infrastructure for R&D and innovation, accelerating regional research specialization and integration to ERA as well as policy learning and reforms.

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ANNEX

Box A 1: Policy Programs Related to Research and Innovation

- ***National Innovation Strategy (2012-2020)*** (adopted in November 2012). The Strategy aims to transform the country in a knowledge-based economy with four defined strategic objectives: enhancing the business sector propensity to innovate; strengthening human resources for innovation; creating a regulatory framework to support innovation; and, increasing knowledge flow and interactions between research institutions and business.
- ***National Program of Higher Education, Scientific and Research Activity 2013-2017*** (prepared final version at the end of 2012)**.** The Program determines the objectives, content, and scope of tasks in the science and research area, the research infrastructure, financing of scientific and research activities, human resources, international dimension, and relations to the economy.
- ***The Strategic Plan of the Ministry of Education and Science for Scientific Research 2008-2010:*** The Plan includes measures for determining the financial, legal, and institutional aspects of research and innovation, a pro-active approach in international cooperation, and intensified cooperation between higher education and industry. A new Plan for the period 2011-2013 is being developed by the Ministry's Scientific Council. The new Plan is supposed to contain an overview of the achievements of the implementation of the previous Plan through 2010.
- ***The National Strategy for the Development of Education 2005-2015:*** The National Strategy emphasizes the need for coordination of education and research with the changing needs of labor.
- ***The Government Program 2006-2010:*** Together with the new Law on Higher Education adopted in 2008, the Government Program recognizes the urgent need for cooperation between the business sector and the universities in the field of R&D. The Program was extended on monthly-basis starting in 2011 (details in next section).
- ***The Industrial Policy Strategy 2009-2020:*** The Strategy was developed by the Ministry of Economy and adopted by the government in 2010. It is based on five pillars of development, one of which is applied research and innovation.

Box A 2: Legal Framework for Scientific Research and Technological Development

- *Law on Higher Education* (2008). State universities are expected to be managed by a central structure, for the purpose of enabling strategic and transparent management. The goal is to transform public, state-funded universities into a central structure, while creating schools that will become a part of universities and lose their status as independent units. An amendment to this law is currently being drafted and aspires to introduce a system of external evaluation of higher education; to strengthen self-evaluation of higher education; and, to strengthen requirements for academic advancement (Government Program for 2011).
- *Law on the Macedonian Academy of Sciences and Arts*.
- *Law on Industrial and Intellectual Property Protection*.
- Numerous internal regulations and instructions for the various activities in the R&D sector.
- According to the Law on Scientific and Research Activities, the research activity is carried out via a 4-year *National Program for Scientific and Research Activities*.
- For the purpose of fund allocation, the Ministry of Education and Science adopts an annual program for technological development incentives and support.
- *Law on the Establishment of a National Agency for Nuclear Technologies* (2010) creates a legal basis for strengthening cooperation with the European Organization for Nuclear Research (CERN).
- A new *Law on Accreditation* was adopted in 2010, ensuring further alignment with the EU *acquis*. In the area of metrology, amendments to the Law on Metrology and the rulebook on measuring instruments were adopted, ensuring further alignment with the EU *acquis*.

Table A 1: Statistical Profile of the Former Yugoslav Republic of Macedonia

	MACEDONIA, FYR	WBC	EU-27
ECONOMY & BUSINESS ENVIRONMENT			
GDP (2011)	€7,504 M	€19,965 M	€12,642,729 M
GDP per Capita (2011)	€3,645	€4,454	€23,400
Population (2011)	2,057,284	22,832,917	502,404,702
Exports to GDP ratio (2010)	35.9	19.2%[58]	-
Imports to GDP ratio (2010)	58.9	40.3%[59]	-
Trade to GDP ratio (2010)	94.8	60.5%[60]	-
Net Foreign Direct Investment, % GDP (2011)	4.87	4.92 (inflows)	2.86 (outflows)
HUMAN CAPITAL AND RESEARCH & DEVELOPMENT			
Gross Domestic Expenditure on R&D, % GDP (2008)	0.23	0.33[61]	2.03
Royalties & License Fees Payments, % GDP (2011)	0.24	0.23[62]	0.58
Royalties & License Fees Receipts, % GDP (2011)	0.10	0.09[63]	0.42
Researchers[64] per Million Population (2008)	472	787[65]	3,166[66]
University-Industry Collaboration Rank 2012 (of 144 countries)[67]	105	88[68]	40[69]
TECHNOLOGY TRANSFER & INFRASTRUCTURE			
Percentage of Enterprises with Internationally Recognized Quality Certification (2009, Enterprise Survey)	21.5	19.3[70]	-
Percentage of Firms Using Technology Licensed from Foreign Companies (2009, Enterprise Survey)	41.2	25.7	-
Intellectual Property Protection Ranking 2012 (of 144 countries)[71]	73	95[72]	40[73]
Internet Users per 100 People (2011)	57	54[74]	72
Mobile Cellular Subscriptions per 100 People (2011)	109	106	125
S&T OUTPUTS AND INNOVATION PERFORMANCE			
Utility Patents Filed in the US per Million Population (2009)	0.5	2.8[75]	117
S&T Journal Articles per Million Population (2009)	27.8	125[76]	496
High-technology Exports, % Manufactured Exports (2010)	2.95	4.2[77]	15.3
Global Innovation Index Rank 2012 (of 125 countries)[78]	80	60[79]	24[80]
Trademark Applications per Million Population[81] (2010)	1,668	1,832[82]	130[83]

[58] Excluding Kosovo (This designation is without prejudice to positions on status, and is in line with UNSC 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.)
[59] Ibid
[60] Ibid
[61] Average of UNESCO's available data for Albania, Bosnia and Herzegovina, Croatia, Serbia and FYR Macedonia for 2008-08.
[62] Average of World Development Indicators data on Albania, Bosnia, Croatia, Macedonia and Serbia.
[63] Average of World Development Indicators data on Albania, Bosnia, Croatia, Macedonia and Serbia.
[64] Full-time equivalents – one person-year for example 30% time spent on R&D would count as 0.3 FTE.
[65] Average of UNESCO's data on Albania, Bosnia & Herzegovina, Croatia, Macedonia, and Serbia.
[66] Average of World Development Indicators data on EU 27 countries
[67] Global Competitiveness Report 2012.
[68] Average of Global Competitiveness Report ranks for Albania, Bosnia, Croatia, FYR Macedonia, Montenegro, and Serbia.
[69] Average of Global Competitiveness Report data on EU 27 countries
[70] Average of Enterprise Survey data on Albania, Bosnia, Croatia, Kosovo, FYR Macedonia, Montenegro, and Serbia.
[71] Global Competitiveness Report 2012.
[72] Average of Global Competitiveness Report ranks for Albania, Bosnia, Croatia, FYR Macedonia, Montenegro, and Serbia.
[73] Average of ranks of the EU 27
[74] Average of World Development Indicators data on internet users per 100 people in Albania, Bosnia & Herzegovina, Croatia, FYR Macedonia, Montenegro, and Serbia.
[75] Average of USPTO data on Albania, Croatia, Macedonia, and Serbia.
[76] Average of World Development Indicators data on Albania, Bosnia, Croatia, Kosovo, Macedonia, Montenegro and Serbia.
[77] Average of World Development Indicators' available data for Albania, Bosnia and Herzegovina, and Croatia for 2010.
[78] Global Competitiveness Report 2012.
[79] Average of ranks of 6 Western Balkan countries – Albania, Bosnia and Herzegovina, Croatia, Macedonia, Montenegro and Serbia.
[80] Average of ranks of the EU 27
[81] World Intellectual Property Organization
[82] Average of World Development Indicators data on Albania, Bosnia, Croatia, Macedonia, Montenegro and Serbia.
[83] Total trademark applications per million population in the EU 27 from World Development Indicators.

Table A 2: R&D Expenditure by Sector

	2003	2004	2005	2006	2007	2008	2009	2010
GERD (Gross domestic expenditure on R&D)/GDP	0.22	0.24	0.24	0.20	0.17	0.23	0.20	0.22
BERD (Business intramural expenditure on R&D)/GDP	0.003	0.02	0.03	0.02	0.04	0.07	0.04	0.02
GOVERD (Government intramural expenditure on R&D)/GDP	0.14	0.12	0.11	0.10	0.08	0.09	0.09	0.10
HERD (Expenditure on R&D in higher education)/GDP	0.08	0.11	0.10	0.08	0.05	0.07	0.07	0.10

Note: Ratios for 2003-2010 are the calculations of Macedonia Statistical Office

Table A 3: Trends in R&D Funding (in MKD Denars / EUR and %)

	2008	2009	2010	2011	2012	2013
Total public R&D funding from MoES	370.500.000 ~ 6 mil EUR 22%	223.998.000 ~ 3.6 mil EUR 20%	179.278.000 ~ 2.9 mil EUR	254.718.000 ~ 4.1 mil EUR	796.342.000 ~ 5.9 mil EUR	1.170.000.000 ~ 8.3 mil EUR
Funding allocated to HEIs	8%	7%				
Private sector funding	4%	4%				
Government budget outlays on R&D as share of total general government expenditure (%)[84]	10%	9%				

Source: Budget of the Ministry of Education and Science; State Statistical Office (2009) most recent available data

[84] Government Budget Appropriations or Outlays on Research and Development (GBAORD) refers to budget provisions, not to actual expenditure, i.e., GBAORD measures government support for R&D using data collected from budgets. The GBAORD indicator should be seen as a complement to indicators based on surveys of R&D performers, which are considered to be a more accurate but less timely way of measuring R&D activities. Total GBAORD is here expressed as a percentage of total general government expenditure. For more details, see http://epp.eurostat.ec.europa.eu/portal/page/portal/science_technology_innovation/data/main_tables

Table A 4: Broad Share of Available Budgets by Main Categories of Research and Innovation Measures

Broad category of research and innovation policy measure	Approximate total annual budget for 2010 (in Euro)	Commentary
1. Governance & horizontal research and innovation policies	Total: €190,000 €50,000, part of Competitiveness and Innovation of SMEs Program(PDECI) €140,000, part of PSRA	The majority of the expenses are covered by the budget. Since they mainly consist of salaries and current expenses in the appropriate ministries and institutions, it is difficult to get a correct estimate.
2. Research and Technologies	Total: €5.07m €4.3m, the measure Equipping Laboratories for Scientific Research and Applicative Activities (ELSR) €120,000, the measure The Program for Technological Development (PTD) €650,000, part of Program for Scientific and Research Activities (PSRA)	The ELSR measure is a new measure with projected funds of up to €60m for the period 2010- 2013. Therefore an increase in the funds can be expected for the next year. PTD and PSRA are standard measures along with the funds, which are allocated for these programs. There are no expectations that the allocated funds will be increased.
3. Human Resources (education and skills)	Total: €474,000 €20,000, part of the Innovation Voucher Counseling Scheme(IVCS) €54,000, part of the Program for Competitiveness of the Macedonian Products and Services (PCMPS) €400,000, part of PSRA	The IVCS measure has received increased attention and importance. Consequently, an increase in the funds can be expected. Due to the importance of the competitiveness of the Macedonian economy, it is expected that the funds for the PCMPS measure will be increased. PSRA is a standard measure with fixed allocated funds. It is not expected that these funds will be increased.
4. Promote and sustain the creation and growth of innovative enterprises	Total: €175,000 €28,000, part of the IVCS €57,000, the measure The Program for Support of the Textile Industry €40,000, the measure Program for Support and Development of Clusters' Associations (PSDCA) €50,000, part of Program for Development of Entrepreneurship, Competitiveness and Innovation of SMEs (PDECI).	Since the IVCS measure has been given increased attention and importance, an increase in the funds can be expected. Funds for PSDCA are expected to remain at the current level. PSTI is a new program and, due to the importance of the textile industry, an increase in the funds is expected. PDECI is a program co-financed by the EU. As funds for the EEN network will be increased, it is expected that the PDECI funds will also increase.
5. Markets and innovation culture	Total: €81,000 €50,000, the measure PTC €31,000, part of the PCMPS	PTC is one of the oldest measures and, due to the known fund recipients and activities, an increase in the funds is not expected. It is expected that the funds for the PCMPS measure will be increased.

Source: Pro Inno Europe/ Inno Policy Trendchart (2011) Mini Country Report/ former Yugoslav Republic of Macedonia.

Table A 5: Innovation budgets of the main government departments and agencies

Name of the organization	Innovation budget managed	Estimated share of budget earmarked for specific policy measures
Ministry of Economy	€300,000	€57,000, PSTI, 19% €85,000, PCMPS, 28% €40,000, PSDCA, 13% €50,000, PDECI, 17%
Ministry of Education and Science	€6m	€50,000, PTC, 0.8% €4.3m, ELSR, 72% €120,000, PTD, 2% €1.19m, PSRA, 20%
Agency for promotion of Entrepreneurship	€114,000	€48,000, IVCS, 42%
European Information and Innovation Centre	€190,000	€50,000, PDECI, 26%
Ministry of Information Society and Administration	€1.0m3	100% public funds for The Public Procurement of Innovative ICT based Products and Services in Education – e-content (PPIPS)

Source: Pro Inno Europe/ Inno Policy Trendchart (2011) Mini Country Report/ former Yugoslav Republic of Macedonia.

Table A 6 and Table A 7: FP7 proposals, success rates and contributions in EUR

Table A 6	Number of eligible proposals with at least one applicant in country					Number of proposals retained for funding (Main listed) in calls with closure in reference year					Success rates				
	All FP7	**2007**	**2008**	**2009**	**2010**	**All FP7**	**2007**	**2008**	**2009**	**2010**	**All FP7**	**2007**	**2008**	**2009**	**2010**
AL - Albania	148	77	29	32	10	24	6	5	9	4	16%	8%	17%	28%	40%
BA – BiH	155	78	24	41	12	23	8	4	6	5	15%	10%	17%	15%	42%
BG - Bulgaria	1,872	882	474	421	92	315	132	69	87	27	17%	15%	15%	21%	29%
HR - Croatia	878	331	233	252	61	138	50	34	35	19	16%	15%	15%	14%	31%
MK - 'FYR Macedonia'	271	113	66	68	23	47	19	14	7	6	17%	17%	21%	10%	26%
EL - Greece	7,466	3,004	1,913	2,193	339	1,278	469	286	439	81	17%	16%	15%	20%	24%
ME - Montenegro	111	51	27	26	7	24	8	9	3	4	22%	16%	33%	12%	57%
MD - Moldova	90	34	30	18	7	18	3	8	5	2	20%	9%	27%	28%	29%
RO - Romania	2,928	1,353	712	722	137	456	192	105	125	34	16%	14%	15%	17%	25%
RS - Serbia	836	323	198	263	49	114	40	27	33	14	14%	12%	14%	13%	29%
SI - Slovenia	2,094	911	504	574	102	373	148	88	109	28	18%	16%	17%	19%	27%
TR - Turkey	2,559	849	753	758	196	428	115	93	154	66	17%	14%	12%	20%	34%
UNMIK/Kosovo	8	0	2	6	0										
Sum SEE countries	19,416	8,006	4,965	5,374	1,035	3,238	1,190	742	1,012	290	17%	15%	15%	19%	28%
EE - Estonia	990	434	244	252	55	242	97	62	69	14	24%	22%	25%	27%	25%
LV - Latvia	595	249	148	161	36	130	47	34	38	10	22%	19%	23%	24%	28%
LT - Lithuania	881	411	214	202	53	180	68	45	49	18	20%	17%	21%	24%	34%
Sum Baltic countries	**2,466**	**1,094**	**606**	**615**	**144**	**552**	**212**	**141**	**156**	**42**	**22%**	**19%**	**23%**	**25%**	**29%**
All EU27 countries	**45,544**	**14,632**	**14,680**	**14,377**	**1,855**	**9,470**	**2,931**	**2,581**	**3,407**	**551**	**21%**	**20%**	**18%**	**24%**	**30%**

Source: Rivera Leon & Reid (2010)

Table A 7	Participant EC Contribution (only in signed contracts of calls closed in reference year)		Applicant Requested EC Financial Contribution (cumulative, not only of signed agreements)		Share of signed contracts in requested contributions	
	All FP7	**2007**	**2008**	**2009**	**All FP7**	
AL - Albania	765,652	369,800	167,244	228,608	1,505,469	51%
BA - BiH	1,217,869	668,482	158,073	391,314	1,409,863	86%
BG - Bulgaria	33,197,276	15,924,228	10,454,514	6,818,534	58,717,946	57%
HR - Croatia	18,206,608	8,783,021	7,483,541	1,940,046	28,012,392	65%
MK - 'FYR Macedonia'	5,414,426	2,175,478	2,779,948	459,000	7,511,762	72%
GR - Greece	312,501,101	161,099,615	88,519,438	62,882,047	469,585,643	67%
ME - Montenegro	858,821	368,436	458,385	32,000	2,413,771	36%
MD - Moldova	1,155,478	762,102	367,162	26,215	1,242,188	93%
RO - Romania	44,857,966	25,826,436	13,241,203	5,790,326	78,249,573	57%
RS - Serbia	16,447,410	10,062,498	4,124,798	2,260,114	27,406,094	60%
SI - Slovenia	41,381,966	25,164,956	10,710,571	5,506,439	69,392,504	60%
TR - Turkey	49,876,566	21,939,116	15,790,139	12,147,310	70,183,024	71%
Sum SEE countries	**525,881,138**	**273,144,167**	**154,255,017**	**98,481,954**	**815,630,228**	**64%**
EE - Estonia	32,321,024	17,606,121	9,137,879	5,577,025	44,656,793	72%
LV - Latvia	10,618,639	6,845,095	2,580,817	1,192,727	17,309,107	61%
LT - Lithuania	17,053,921	5,924,706	8,560,776	2,568,439	28,999,931	59%
Sum Baltic countries	**59,993,584**	**30,375,922**	**20,279,471**	**9,338,191**	**90,965,830**	**66%**
All EU27 countries	**15,941,623,108**	**6,248,486,973**	**4,118,181,974**	**4,609,196,801**		

Source: Rivera Leon & Reid (2010)