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Smart Policies for Innovation Growth

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CONTENTS

LIST OF ABBREVIATIONS

ARC Fund	– Applied Research and Communications Fund
BAS	– Bulgarian Academy of Sciences
BGN	– Bulgarian lev
CL	– Central Laboratory
CoCs	– Centres of Competence
CoEs	– Centres of Excellence
EC	– European Commission
EDP	– Entrepreneurial Discovery Process
EPO	– European Patent Office
ESIF	– European Structural and Investment Funds
EU	– European Union
EUR	– euro
GDP	– gross domestic product
GEM	– Global Entrepreneurship Monitor
ICT	– information and communication technology
ISSS	– Innovation Strategy for Smart Specialisation
KIS	– knowledge-intensive services
MA	– Managing Authority
MC	– Monitoring Committee
NCR	– North Central region
NER	– North-Eastern region
NGO	– non-governmental organisation
NIF	– National Innovation Fund
NRA	– National Revenue Agency
NSF	– National Science Fund
NSI	– National Statistical Institute
NWR	– North-Western region
NYP	– National Youth Programme
OP	– Operational Programme
OPE	– Operational Programme Environment
OPGG	– Operational Programme Good Governance
OPHRD	– Operational Programme Human Resources Development
OPIC	– OP Innovation and Competitiveness
OPSESG	– OP Science and Education for Smart Growth
p.p.	– percentage points
PORB	– Patent Office of the Republic of Bulgaria
R&D	– research and development
R&I	– research and innovation
RDP	– Rural Development Programme
RFID	– Radio-Frequency Identification
S3	– Smart Specialisation Strategy
SCR	– South Central region
SER	– South-Eastern region
SME	– small and medium enterprise
SWR	– South-Western region
UK	– United Kingdom
USA	– United States of America
USPTO	– United States Patent and Trademark Office

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EXECUTIVE SUMMARY

Smart specialisation in Bulgaria

Smart specialisation is a key policy instrument of the European Commission, which European regions can use to identify and develop their competitive advantages. It is based on five guiding principles: place-based priorities; targeted investments in sectors with existing critical mass of resources; bottom-up approach; broad view of innovation that also includes social innovation; clear monitoring and evaluation mechanisms. If these are applied effectively, smart specialisation can help resolve some of the main long-term obstacles faced by the Bulgarian innovation system, such as the lack of sufficient funding for R&D and the weak link between business and science. In turn, this would help achieve **the strategic objective of the Innovation Strategy for Smart Specialisation** of moving from the modest to the moderate innovators' group in the European Innovation Scoreboard by 2020.

The implementation of the Innovation Strategy for Smart Specialisation (ISSS) currently suffers from some **important shortcomings**. The governance of the European structural and investment funds and smart specialisation in Bulgaria are concentrated at the national level, with limited participation from the local level. Thematic objectives are identified with insufficient involvement of relevant stakeholders through the Entrepreneurial Discovery Process. The linkages between the structural funds and the priorities of smart specialisation are often purely formal, not reflecting the potential impact on the innovative development of regions. The indicators used to select the ISSS thematic priorities do not reflect accurately regional priorities, which has led to limited interest from potential beneficiaries in many of the sub-priorities of the operational programmes. The monitoring and evaluation indicators are too general to be able to demonstrate a correlation between the implementation of the strategy and the development of the regions.

In order to strengthen the impact of smart specialisation on the Bulgarian economy, the Bulgarian authorities could improve the implementation of the

current strategy and apply the five guiding principles more effectively when developing the new document, by following some specific **policy recommendations**:

- Focus smart specialisation policy on addressing the structural shortcomings of the innovation system by increasing the overall amount and the effectiveness of public expenditure on R&D and fostering collaboration between business and research institutions.
- Redefine the legal framework governing the Sofia Tech Park, Centres of Excellence, Centres of Competence and other similar intermediary institutions to ensure their financial sustainability through a clearer management structure and a higher share of for-profit activities.
- Define new NUTS II regional boundaries based on the economic and social profiles of the areas, rather than on administrative considerations alone.
- Separate Sofia city and its immediate metropolitan area in its own region to allow for fairer competition among all other districts and regions, which are less developed.
- Select projects for funding based on thematic priorities, without additional bonus points for geographical location to ensure that companies from all regions have the same opportunities.
- Institutionalise and use the Entrepreneurial Discovery Process to its full potential in order to define priorities based on project ideas with real market potential.
- Increase dialogue with all relevant stakeholders when developing funding procedures before defining selection criteria.
- Begin integrating social innovations in strategic documents and develop appropriate funding procedures.
- Develop smarter monitoring indicators, which are closely related to each thematic priority of ISSS.

Innovation potential of the Bulgarian Economy

In 2017, funds allocated for research and development increased in absolute terms. **The patent activity of Bulgarian inventors rose.** The number of patents and utility models registered by the Bulgarian Patent Office doubled. Bulgaria kept its leading positions among the 13 new EU member states as regards patent activity in the USA. For a second year in a row, Bulgarian research organisations increased the number of their publications in journals indexed in the Scopus database.

- fundamental and applied research

Despite the growth in publications in the last two years, Bulgaria has failed to overcome its comparative lagging behind other East European countries. Innovation activity in the country is mainly low-tech. It is mainly oriented towards the **implementation of incremental product and process innovations** which are new for the local or national market, and towards organisational and marketing innovations based predominantly on "soft" skills, and to a lesser extent on new technological knowledge.

- entrepreneurship and risk-taking

The motivation index of Bulgarian entrepreneurs remained at **one of the lowest levels in Europe.** The low motivational index and low intentions for poten-

tial entrepreneurial activity in the near future, shape the weak expectations for an increase in the number of entrepreneurs and of their positive impact on the economy in terms of job creation, innovation potential, and internationalisation.

- innovation inputs

For a second year in a row, the share of R&D costs in GDP has continued to decline to 0.75 %. The decline in the number of staff engaged in R&D is 3.4 % year-on-year.

Over 67 % of the population aged 16 to 74 do not have digital skills, compared to 41 % on average for EU-28. Only 2 % of the population is engaged in forms of lifelong learning, versus 11 % on average for EU-28. Just 31 % of companies (66 % for EU-28) fund on-the-job training programmes.

The bottom line is that remaining at the 2010 level on a number of indicators of the status and development of the innovation potential, **Bulgaria forgoes a number of opportunities** and ultimately lags behind developed European economies and the new EU member states. The next two years, when the technical and substantive aspects of the strategic framework for the next programming period are to be prepared, is the time for a change in the status quo and for elaborating and applying policies for improvement. The input of the private sector in the innovation economy of Bulgaria is growing, but is hampered by the lack of competent and sustainable support from the public sector. The country should aim to **catch up with the leaders in Central Europe** by designing and consistently applying policies for smart specialisation and the national and regional levels.

INTRODUCTION

The annual report ***Innovation.bg*** **provides an assessment of the innovation potential of the Bulgarian economy** and the status and opportunities for development of the Bulgarian innovation system. It makes recommendations for improvement of the public policies on innovation in Bulgaria and the EU, building on the most recent theoretical and empirical studies in the world, taking into account the specific economic, political, cultural, and institutional framework in which the innovation system of the country develops. Over the past 14 years *Innovation.bg* has made a number of specific suggestions for improving the innovation policy and practice in the country, which were supported by business and science. The lack of concrete sustainable actions by the Bulgarian governments on the suggestions made – despite their commitment to the process at the highest political level – points to a **considerable institutional lack of capacity for development and application of relevant policies.** Bulgarian institutions need to start putting forward country-specific innovation initiatives besides the absorption of European funds. In this regard, many Bulgarian municipalities are performing better than central government and warrant a more serious attention and support.

Inovation.bg 2018 analyses the state and development opportunities of the national innovation system on the basis of five groups of indicators:

- gross innovation product;
- entrepreneurship and innovation networks;
- investments and financing of innovation;
- human capital for innovation;
- information and communication technologies.

The key topic of *Innovation.bg 2018* is the smart specialisation concept and instrument introduced by the European Commission in 2013 – 2014 in order to allow member states and their planning regions to draft their own development concepts based on the strengths of local businesses and to make better use of the European funds to be granted by 2020. For a long time, Bulgaria has had difficulties with implementing its Smart Specialisation Strategy, which was

finally adopted and approved by the European Commission only at the beginning of 2016, although discussions on it with the Bulgarian government continued. In the meantime, several Bulgarian planning regions (e.g. North Central) and municipalities (Sofia, Rousse, Gabrovo) developed their own smart specialisation strategies based on the national one, but with the intention to be more concrete. The main weakness of these strategies is the lack of a sustainable mechanism for interfacing with the innovative Bulgarian business, which would lead to improved measures and projects. Smart specialisation will continue to be a key tool for innovation support in Bulgaria by the EC after 2021. It is up to Bulgarian central and local governments to find the right solutions for an innovation breakthrough of the Bulgarian economy, which will bring the country's growth levels above those in Central Europe and the Baltic countries.

Smart specialisation in Bulgaria: making EU funds deliver for the Bulgarian economy

Smart specialisation is a key policy instrument of the European Commission, which aims to support European regions to identify and develop their competitive advantages. The long-term goal of smart specialisation is to boost private investment in research and development and support the regional scientific and innovation ecosystems across the European Union (EU). Since 2011, the European Commission (EC) has been supporting Member States and individual regions to develop their own Smart Specialisation Strategies (S3) as part of the larger effort to create synergy between Regional Policy and the Europe 2020 objectives.[1]

S3 have taken on a key role in shaping regional policy during the 2014 – 2020 programming period. Member States have been obliged to develop national or regional S3 in line with the National Reform Programmes as the first thematic ex-ante conditionality for receiving funding under the European Structural and Investment Funds (ESIF).[2] As the emphasis on innovation across the EU continues to rise, the EC has encouraged Member States to provide the needed support to their S3 priorities, while also increasing funding for their education systems, research, knowledge transfer and all types of training.[3]

The smart specialisation approach can be used to guide national and regional authorities in Europe in developing their S3, but also more broadly to manage their research and innovation systems. From a policy perspective, part of the reason why S3 has been set as an ex-ante conditionality is to ensure that it complements existing national and regional innovation policies and funding

[1] Regional Policy contributing to smart growth in Europe 2020, SEC(2010) 1183.

[2] Regulation (EU) No 1303/2013 of the European Parliament and of the Council of 17 December 2013 laying down common provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund, the European Agricultural Fund for Rural Development and the European Maritime and Fisheries Fund and laying down general provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund and the European Maritime and Fisheries Fund and repealing Council Regulation (EC) No. 1083/2006.

[3] Strengthening Innovation in Europe's Regions: Strategies for resilient, inclusive and sustainable growth, COM(2017) 376.

streams to achieve maximum results, thus stimulating private investments in the priority areas. S3 are based on five main principles:[4]

- **Place-based priorities:** each strategy considers the unique social and economic strengths of the region or nation it covers, building on the available resources and other assets in the territory.
- **Targeted investments:** financial support is provided only to sectors, which have an existing critical mass of businesses and resources.
- **Bottom-up approach:** priority sectors are identified by involving all local stakeholders through the Entrepreneurial Discovery Process (EDP). This brings together businesses and researchers to work together on common problems, allowing the authorities to select the most promising sectors based on the projects with the highest market potential.
- **Broad view of innovation:** authorities expand financial support beyond purely technological and scientific innovations to include practices based on social innovation.
- **Monitoring and evaluation:** each strategy has clear and measurable monitoring indicators and evaluation mechanisms to ensure transparency of implementation and continuous improvements and adjustments.

Bulgaria is in the process of updating its current Innovation Strategy for Smart Specialisation (ISSS) and is supposed to begin developing its new one for the next EU programming period 2021 – 2027. This calls for an objective assessment of the extent to which the authorities have applied the smart specialisation principles, how effective the ISSS has been in achieving its goals and stimulating the growth of the Bulgarian economy, and what can be improved in the process of developing the new strategy and in its future implementation.

What has been achieved so far?

Innovation performance

The EU Innovation Scoreboard has been adopted by Bulgaria as the key benchmark for assessing the overall success of S3, as the government aims to shift from the modest to the moderate innovation group within the 2014 – 2020 programming period by reaching the benchmark of 50 % of the average EU performance compared to 2010. The 2018 Scoreboard puts Bulgaria's performance at 48 %, which means that Bulgaria still falls short of its overall S3 aim.[5] Provided the gradual closing of the gap, it can be expected that the county will meet its target in 2020 but the country will not make any serious breakthroughs in its innovation performance and will remain among the laggards in Europe. Furthermore, the Innovation Scoreboard has identified the same strengths and weaknesses in the Bulgarian innovation system since 2008:

Strengths:

- High rates of employment in fast-growing enterprises (above EU average);
- Widespread access to broadband by firms (above EU average);
- Consistently high rate of upper secondary and tertiary education attainments and growing number of new doctorate graduates (at EU average);

[4] European Commission – Smart Specialisation Platform http://s3platform.jrc.ec.europa.eu/s3-platform

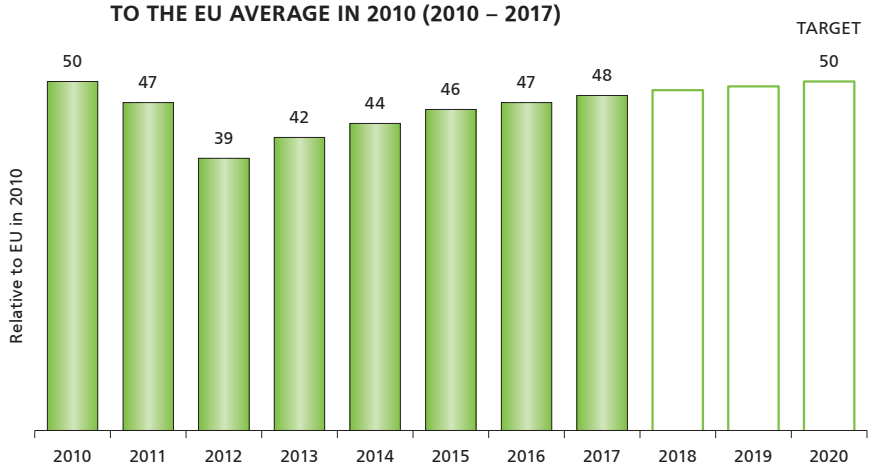
[5] European Commission (2018) European Innovation Scoreboard 2018.

- Ease of starting a business (at EU average);
- Relatively easy access to private credit for companies (at EU average);
- Steady increase in R&D expenditure in the business sector (below EU average);
- Increased in medium and high tech product exports and knowledge-intensive services exports (below EU average);
- Increased venture capital investments (below EU average).

Weaknesses:

- Very low R&D expenditure in the public sector both over time and in relation to EU average;
- Decline in sales of new-to-market and new-to-firm innovations (below EU average);
- Very few public-private scientific co-publications (below EU average);
- Low rates of licence and patent revenues from abroad and patent applications (below EU average);
- Innovative small and medium enterprises (SMEs) do not collaborate with outside partners (below EU average).

Figure 1. BULGARIA'S INNOVATION PERFORMANCE RELATIVE TO THE EU AVERAGE IN 2010 (2010 – 2017)



Source: Innovation Scoreboard Report, 2018.

In order to further improve its innovation performance, Bulgaria must increase public spending on science and R&D to match private investments in the field and foster better cooperation between business and science.

Innovation funding

The lack of targeted public funding for innovation and R&D in Bulgaria has been compensated through ESIF, but it is unlikely to provide the needed policy guidance for the country to close its innovation gap to Europe. The limited funding from the national budget for businesses, through the National Innovation Fund (NIF), and for research, through the National Science Fund, have been at best haphazard and lack any reasonable policy planning. Hence, ISSS is seen as an essential instrument to provide a focus for innovation policy and smart specialisation. While it is early to assess the ultimate impact of ISSS, a comparison of how EU and national funding has been distributed since 2007 can provide some indication of its effectiveness.

During the 2007 – 2013 programming period, innovations were supported primarily through OP "Development of the Competitiveness of the Bulgarian Economy" (OP C). The OP provided direct funding to companies, equity and debt instruments and start-up schemes (although these were not explicitly targeted at innovation activities), some intermediary bodies and research institutions. The majority of the funding went towards the modernization and technological upgrade of companies from all sectors, without a specific thematic priority. The projects focused mainly on adopting existing innovative production methods and products, rather than developing new ones, in line with Bulgaria's overall performance as a modest innovator.[6] About BGN 67 mln. was invested to establish the landmark intermediary project Sofia Tech Park, which has so far not fulfilled its potential to bring together business and science and its laboratories remain largely unused.[7] The remaining resources for intermediaries were used to establish technology centres and technology transfer offices. Most of these institutions have ceased operations, as demonstrated by the lack of reported activities on their websites, following the discontinuation of European funding support. They could not become a mainstay of the Bulgarian innovation ecosystem, in part because of the lack of overall strategic national innovation policy priorities. Funding was also provided to 33 research institutions located in national universities and in the Bulgarian Academy of Sciences (BAS) with the goal of supporting applied science. Again the majority of the project activities contributed to the upgrade of existing infrastructure and to supplementing salaries, rather than developing innovative products or collaborating with business.[8] In addition to the ESIF, the national budget supported three funding sessions of the NIF with a total funding of just over BGN 25 mln., which showcases the government's heavy reliance on EU funding to support its innovation policy ideas, so far as they can be identified.

During the 2014 – 2020 programming period, fostering the link between business, science and education are, at least formally, clearly defined priorities of the OPs. As a result of the discontent and heavy lobbying of BAS and public universities, Bulgaria has introduced a new OP "Science and Education for Smart Growth" (OP SESG). While such a programme could help upgrade the extremely outdated science infrastructure in the country, it is also likely to deepen the science – business silos. OP SESG is seen as reserved exclusively (and some claim non-competitively) for universities and BAS, while OP "Innovation and competitiveness" (OP IC) is perceived as the funding mechanism for business. While the types of funded activities are similar to the previous period, they are also much more focused, as projects under one of the priority axes of OP IC are funded only if they fall under one of the thematic priorities of ISSS:

- Mechatronics and clean technologies;
- Informatics and information and communication technologies (ICT);
- Industry for a healthy life and biotechnology;
- New technologies in creative and recreational industries.

If all the allocated funds are contracted and paid out, it is expected that in total Bulgarian companies will receive about BGN 577 mln., about BGN 100 mln.

[6] BIM Consulting under contract for the Ministry of Economy (2017) "Ex-post evaluation of the Implementation, Results and Impact of OP "Development of the Competitiveness of the Bulgarian Economy 2007 – 2013".

[7] Report by an independent panel of international experts for the European Commission (2018) "Reshaping the functional and operational capacity of Sofia Tech Park".

[8] Project activities published in the Unified Management Information System for the EU Structural Instruments in Bulgaria.

more than during the previous period, provided through a combination of individual projects and various funding mechanisms managed by the Fund of Funds.[9]

To overcome the danger of the two OPs exacerbating the silos between science and industry, during the 2014 – 2020 period the European Commission has insisted on a much greater emphasis on intermediary bodies and the collaboration between business and research. Sofia Tech Park has received additional funding for purchasing new equipment for the science laboratories and kick-starting the work of the on-site business incubator. However, according to a report by the Join Research Centre of the EC,[10] the park still faces major obstacles to effectively fulfil its intermediary role, including:

- no clear vision to guide the stakeholders' actions;
- lack of coherence and coordination between the operational plans of the governance structures and the individual components of the park, such as the incubator;
- over-emphasised focus on supporting companies in the ICT sector with little or no effort to attract businesses from the other thematic priorities of ISSS;
- lack of collaboration with BAS, thus failing to close the rift between innovative companies and publicly-funded research institutes;
- contradictory funding framework, which does not allow for additional public funding, but also does not envisage an increase in the for-profit activities of the park, leading to overreliance on selling rather than renting space to generate income.

Sofia Tech Park has demonstrated that the Bulgarian public and private sectors struggle to manage such a complex infrastructure, even within the most developed region of the country in the capital Sofia. Similar strategic, managerial and financial obstacles are therefore expected to affect to an even higher degree the newly established Centres of Competence (CoCs) and Centres of Excellence (CoEs), funded under OP SESG in line with the thematic priorities of ISSS. So far, their main purpose appears to be the technological upgrade of universities and BAS institutes, with no indication of how they will be financially sustainable beyond ESIF funding. Furthermore, the available funds have been spread to cover as many universities and institutes as possible, instead of funding excellence. Also, there has been no clear definition of their purpose, or differentiation between the two types of bodies, as they have not been defined in the National Roadmap for Scientific Infrastructure.[11] It is thus unclear how they will interact with the remaining research institutions in the country.

Upon the repeated insistence of the European Commission to offset the concentration of CoCs and CoEs in Sofia and stimulate cooperation between business and research at regional level, under private sector leadership, the government has transferred BGN 100 million. from OP SESG to OP IC for the establishment of Regional Innovation Centres. The plan is to create at least one

[9] The Fund of Funds manages BGN 1.2 bln. under four operational programmes: OP "Human Resources Development", OP "Innovation and Competitiveness", OP "Environment" and OP "Regions in Growth". The Fund's main activity is the structuring and management of financial instruments co-financed by ESIF during the 2014 – 2020 programming period. Targeting projects that could potentially begin self-sustaining, they provide investment support through loans, guarantees or equity investments.

[10] Report by an independent panel of international experts for the European Commission (2018) "Reshaping the functional and operational capacity of Sofia Tech Park".

[11] Ministry of Education and Science (2017) National Roadmap for Scientific Infrastructure 2017 – 2023.

centre for each ISSS thematic priority in each of the six NUTS II regions in Bulgaria. In order to succeed in the long-run, Regional Innovation Centres should be developed around existing private sector innovative companies or clusters in each region. The experience of the Sofia Tech Park has clearly demonstrated that it would be unrealistic to expect all centres to become sustainable, but the government should seek to stablish positive examples and practices to follow in the future.

Table 1. FINANCIAL SUPPORT FOR INNOVATION IN BULGARIA (2007 – 2020)

2007 – 2013				Type of beneficiary	2014 – 2020*			
TOTAL (BGN mln.)	Actually paid budget (BGN mln.)	Activities	Source		Source	Activities	Contracted budget (BGN mln.)	TOTAL (BGN mln.)
1,034.93	351.11	Innovation activities in companies	OP C	Business	OP IC	Development and implementation of innovations in companies	212.98	330.33
	683.81	JEREMIE Launchhub and Eleven				Fund of funds	117.35	
77.79	10.38	Technology transfer offices and Technology centres		Intermediary bodies		Regional innovation centres**	100.00	112.27
	67.41	Sofia Tech Park – Phase 1				Sofia Tech Park – Phase 2	12.27	
44.75	44.75	Applied science in research institutions		Science	OP SESG	Centres of Competence and Centres of Excellence	340.15	340.15
25.07			NIF	Business	NIF			25.22
1,182.54				**TOTAL**				**807.98**

* Data for 2014 – 2020 refers to the contracted but not paid budget up to 31.10.2018.

** The funding for Regional Innovation Centres has been transferred from OP SESG to OP IC in 2018. The funding procedure is still in preparation.

Source: ARC Fund's classification of activities based on data provided in the Unified Management Information System for the EU Structural Instruments in Bulgaria.

Policy bottlenecks

It is too early to thoroughly assess ISSS' implementation as projects in line with its thematic priorities have been funded only since 2015. However, it is possible to assess the governance structure of smart specialisation and process of developing and monitoring of the ISSS based on the five guiding principles identified by the EC and presented above.

Place-based priorities

The first guiding principle of smart specialisation is that each strategy should reflect the unique social and economic strengths of the territory it covers, building on the already available resources, thus further supporting already well-established sectors and companies.

In Bulgaria, the principle of place-based priorities is somewhat compromised because of the centralised nature of the country's governance structure and decision-making powers. Like most other policy areas, ESIF and smart specialisation governance and planning is concentrated at the national level, with limited participation from and integration of the local level. Although all six planning regions had developed regional innovation strategies around 2005,[12] ultimately these were not included in the 2007 – 2013 programming period, although some ideas from the strategies were applied in separate projects.[13] This practice was carried over to the 2014 – 2020 programming period and consequently there is only one national smart specialisation strategy for the whole country. This can be explained in part by the formal nature of planning regions, which have no administrative structures and their boundaries were determined in order to satisfy the EU requirement for establishing regions with populations of at least 800,000. As a result, districts with very different economic and social characteristics are bundled together, leading to contradicting results within and among regions. At the same time, the very formal regional separation at NUTS II level is crucial in determining funding streams at the local level, because the OP assessment criteria include both geographical location and relevance to the four thematic priorities. The ISSS does list the specific economic strengths of each district, but ultimately it was decided that each of the NUTS II regions would receive bonus points for three of the four thematic priorities, thus watering down prioritisation.

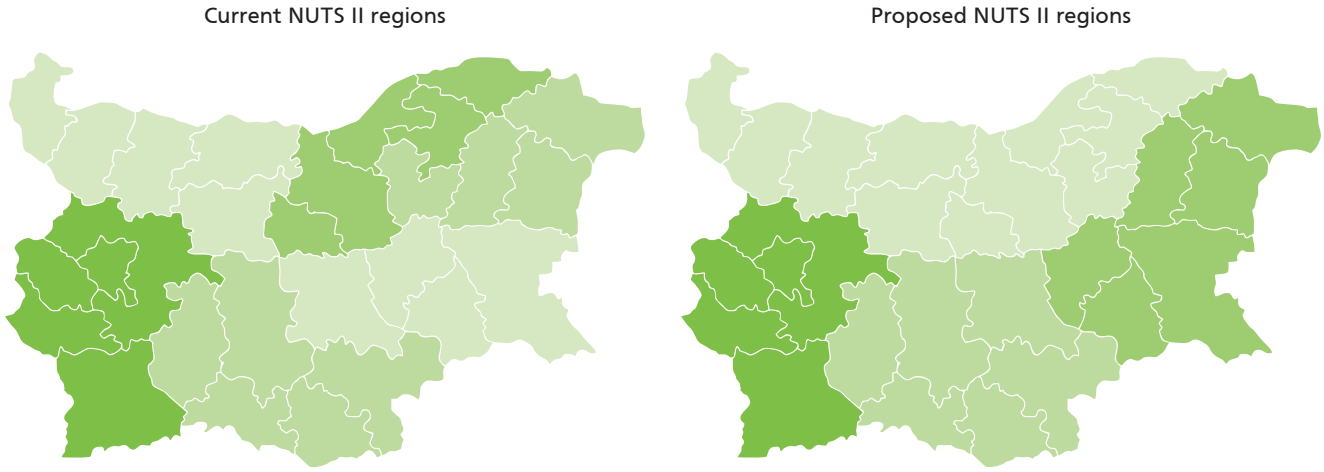
The poor regional division has different effects across the country. On the one hand, the South-Western region includes both Sofia and some of the most underdeveloped districts in the country. Due to the much higher level of development of the capital, the entire region is subject to different state aid rules, which make the participation of SMEs registered outside Sofia particularly difficult. For example, while in the remaining 5 regions companies are eligible for a 70 % grant, SMEs in the South-Western region are only eligible to a 45 % grant, thus requiring a much higher share of own co-financing, which in many cases they cannot afford. On the other hand, the ISSS explicitly stipulates that the ESIF should be used to support the development of the North-Western region, without providing a clear justification of how the three thematic priorities with bonus points were selected. The favouring of the North-Western region is a continuation of the previous programming period, which led to a disproportionate amount of project applications from the region from companies, which had purposefully registered there to receive additional points. Both of these examples can be considered as a geographic prioritisation (or discrimination), as opposed to a thematic one, which reverses the idea of supporting the strongest sectors in each region and instead supports the least developed region, where there are actually very few innovative businesses.

[12] The RIS were developed by consortia within the EU Framework Programmes for Research and Innovation. The first region to develop RIS was the South Central region, which concluded it by 2003 through a consortium led by the Sofia-based Applied Research and Communications Fund.

[13] *Innovation.bg 2006: Measuring the Innovation Potential of the Bulgarian Economy*, Applied Research and Communications Fund, Sofia, 2006.

As a result of the rapidly declining population in the poorest regions, the North-Western and North Central regions are falling below the 800,000 – population threshold, which has forced authorities to redraw regional borders effective of the next programming period 2021 – 2027.[14] Several options are being discussed and a decision must be taken by the end of 2018. The most likely outcome at this stage would lead to four regions: Danube; Black Sea, Thracian – Rhodope and South-West (which would be the only one to remain unchanged).[15] To some extent these regions would group together districts with more similar economic and social profiles, but the change in regional boundaries poses some important and yet unanswered questions. First of all, Sofia is still going to be part of a wider region, instead of becoming independent like most other European capitals. This is done to ensure that the city is still eligible for a higher share of EU funds, but would cause further marginalisation of the remaining districts in the region. A second question concerns the current North-Western region and whether the existing bonus system would be extended to the new districts in the Danube region, thus creating a North-South funding divide. Finally, it is still unclear whether and how the new regions will affect the ISSS thematic priorities. Changes to the regional system and the thematic prioritisation are likely to eliminate, or at least reduce, the progress made so far in terms of regional smart specialisation.

Figure 2. CURRENT AND PROPOSED NUTS II REGIONAL BOUNDARIES



Source: Ministry of Regional Development and Public Works.

Bottom-up approach

To be successful, smart specialisation priority sectors should be identified through the Entrepreneurial Discovery Process (EDP), as well as statistical analysis on existing infrastructures and human capital in the given territory. The EDP's main goal is to identify the most promising sectors, based on the project ideas developed jointly by businesses and researchers, which have the highest market potential. Through this interactive process, managing authorities (MAs)

[14] Ministry of Regional Development and Public Works (2018), official website: https://www.mrrb.bg/bg/mrrb-predlaga-promeni-v-obhvata-na-rajonite-za-planirane/

[15] Capital.bg: https://www.capital.bg/politika_i_ikonomika/bulgaria/2018/02/27/3137115_novite_regioni_severozapadut_veche_ne_moje_sam_a/

can prepare targeted funding procedures that support the realisation of these projects, thus contributing to the economic growth of the region.

According to the feedback provided by numerous business and research institutions across Bulgaria, and in particular those located outside Sofia, the ISSS is based mainly on the available statistical data, which is collected at the national level, but does not reflect, to a satisfactory extent, the regional and local specificities of the country. The Ministry of Economy carried out meetings in the six planning regions in 2014 and 2015, and since the strategy was adopted in 2017, additional regional and thematic meetings have been organized to collect feedback from stakeholders on the implementation of the strategy and potential changes in the sub-priority areas. However, despite these efforts from the Ministry of Economy, the Annual Implementation Report of ISSS for 2017[16] suggests that the participants in these meetings are not familiar enough with the strategy and that regional meetings are poorly attended, implying a low level of interest among the stakeholders.

The formal governance framework of ISSS and the OPs envisages several methods that aim to ensure the participation of relevant stakeholders throughout the implementation period:

- **Regional Development Councils:** District authorities at NUTS III level and municipalities are formally involved in a consultative role through the Regional Development Councils, which receive regular updates on the implementation progress of the OPs. However, they have very limited decision-making powers and technical knowledge in the field of innovation support. Even though they have a much closer connection with the local businesses and research institutions, they are not involved in the development of funding procedures.
- **Monitoring Committees:** OPs provide a formal oversight mechanism to regional authorities and stakeholders through their Monitoring Committees (MCs), which approve funding procedures. However, MCs include very few regional representatives. Businesses are represented through branch associations, which tend to be formed thematically, rather than geographically, and as they are centrally located in Sofia, companies from other regions are distanced from the process. In terms of research and educational institutions, OP IC has only one representative from the Bulgarian Academy of Sciences and none from universities. In the case of OP SESG, both Academies have several representatives, while universities only have one member in the MC.
- **Public consultations:** All stakeholders can express their opinion during the public consultation period held for every funding procedure electronically. However, the MAs don't make use of the EDP methodology to collect local level information or project ideas with real market potential. Instead, procedures are prepared centrally by the MAs and the public consultations remain formalistic, which at most can lead to some small changes in the selection criteria.

Despite the availability of formal stakeholder engagement mechanisms, interviews with regional authorities, businesses and research institutions reveal that there is a wide discrepancy between their perspectives on the development and implementation of smart specialisation and that of the MAs. The Ministries view the involvement of stakeholders as a rather formal obligation, which is technically fulfilled by following the legislative requirements for con-

[16] Ministry of Economy, (2018), Annual Implementation Report of ISSS for 2017.

sultations and regular meetings. On the other hand, regional authorities (both at district and municipal level) feel that the process of developing and implementing S3 should be decentralized to the regions, or even to the municipal level, and that the national strategy should be based on the regional strategies, rather than the other way around. Furthermore, local businesses do not feel like they have ownership over ISSS, as most of them did not participate in its inception. Instead, ISSS is mainly perceived as a formal document and the basis for the implementation of OP IC and OP SESG, without consideration of how it can impact and stimulate the business environment. The Bulgarian government should strive to set up a more dynamic and continuous consultation mechanism at the local level to receive feedback from the business more regularly.

Overall, there appears to be limited understanding among the general public of the close link between ISSS and the OPs, and even less so regarding the importance of regional specialisation based on existing economic strengths. On the one hand, this can be attributed to the fact that smart specialisation is a relatively new concept for Bulgaria. More importantly however, there is a lack of adequate information campaigns at all levels. For example, the activities of the District Information Centres tend to focus on promoting funding procedures or completed projects, without explaining the overall framework, in which EU funding is disbursed at the local level through smart specialisation.

The lack of ownership over the national ISSS and the limited involvement of stakeholders in determining regional priorities, has led to different initiatives at the local level to fill in the gap. For example, Sofia, Rousse and Gabrovo municipalities, have developed their own S3 strategic documents, despite the lack of independent funding sources for their implementation.

Box 1. "ROUSSE: FREE SPIRIT CITY" FOUNDATION AND "KNOWLEDGE AND GROWTH" FUND

An example of local level public private partnership in supporting innovation based on the needs of the city can be found in Rousse. The "Rousse: Free Spirit City" Foundation and its "Knowledge and Growth" Fund support projects related to the thematic priorities of the Municipal Smart Specialisation Strategy. The Foundation was originally established to prepare Rousse's bid for European Capital of Culture. The bid was ultimately unsuccessful, but the Municipal Council unanimously agreed to continue its activities and support local projects. Each year the municipality provides a budget of BGN 100,000, which is at least doubled through contributions from large local businesses, making the organization increasingly more financially independent. The "Knowledge and Growth" Fund is managed by the Foundation and supports projects in the fields of innovation, alternative education methods and science in partnership with Rousse University "Angel Kanchev", local schools and NGO's. The incentive for businesses to donate comes from the transparency of the Municipality-owned organisation combined with the ability to support project that contribute to the local business environment.

Source: Interview with representatives from the Municipality of Rousse.

Targeted investments

Smart specialisation aims to provide financial support only to those sectors, which already have a critical mass of businesses and resources. These sectors should be selected not only on the basis of the EDP, but also using statistical analyses. As discussed above, stakeholders were not sufficiently involved in the development of the ISSS and therefore economic indicators played a key role in determining the thematic priorities. According to the ISSS methodology, the indicators used aimed to assess "the attitude of the state and the busi-

ness activity related to the quality development of the economic activities and services".[17] The following five indicators were used:

- **Financed projects under OP "Competitiveness of the Bulgarian Economy" 2007 – 2013 and State support for the creation and development of technology transfer offices and centres:** although there was a dedicated priority axis for innovative projects, the projects funded mainly focused on the implementation of existing innovations, rather than the development of new ones. As the projects were funded through competitive procedures, they didn't have a specific economic specialisation. Furthermore, no impact assessment has been performed to assess their contribution to the innovation ecosystem. With regards to the technology transfer offices and centres, most of them are no longer operational and there is limited evidence of their results they achieved.
- **Financed projects under NIF:** between 2005 and 2014, 457 projects with a total national subsidy of BGN 39.8 mln were funded under the NIF. However, NIF has been marred by several unsuccessful funding procedures due to unclear selection criteria and poor administrative capacity. The majority of the projects between 2005 and 2015 fell under six main sectors, with no more than 45 projects each: ICT, electronics, optics; metal products; motor vehicles and trailers; chemicals; pharmaceuticals; food production. There is no clear criteria to assess the innovativeness of the products developed under the project and their market performance.
- **Number of patent-holding firms** and **number of trademark owning firms:** Patent activity and trademarking in Bulgaria is rather low compared to the EU average. Furthermore, patents and trademarks are mostly held by individual inventors, rather than companies and research institutions. SMEs rarely protect their intellectual property, in part due to the long and costly procedures, but mostly because small and medium enterprises seldom have the resources to develop such innovative products in-house.

In addition to the shortcomings outlined above, none of the listed indicators have a regional dimension that can determine for example where the companies funded under NIF or those holding the most patents are located geographically. Therefore, it is reasonable to conclude that the indicators used to identify and select the ISSS thematic priorities do not provide an accurate overview of the regional or even national economic strengths. Instead, it is likely that the indicators simply perpetuate existing government funding patterns, rather than uncover and support the emergence of strong regional and local specialisations.

The selected thematic priorities are four, which seems low compared to other countries, where the average is eight.[18] At the same time, they include quite wide sectors and even a more horizontal priority under ICT, which can be applied in any economic area. The relevance of the thematic priorities can be assessed though a preliminary overview of the project application (presented in Table 2 up to the end of May 2018), both in terms of the interest of companies towards the priorities and regional specialisation.

Thematic priorities "Mechatronics and clean technologies" and "Informatics and ICT" received almost twice as many project proposals and approved projects

[17] Ministry of Economy (2017) *Innovation Strategy For Smart Specialisation The Republic Of Bulgaria 2014 – 2020.*

[18] Bogdanova, M. and Parashkevova, E. (2017), "Smart Specialisation in Planning Documents for the Development of Bulgaria", Scientific Proceedings International Scientific Conference *High Technologies. Business. Society 2017.*

as the remaining two priorities, perhaps due to the much broader application of the products and services in these fields. Furthermore, there are significant differences in terms of project proposals under each thematic priority. Under "Mechatronics and clean technologies" the most popular sub-priorities are related to clean technologies and machine building in the energy and transport sectors, production of basic mechanical elements and "smart home" systems. Under "Informatics and ICT" over 70 % of the proposal were either in the field of web applications or 3D, Big Data, Grid and Cloud technologies. The most common sub-priorities under "Industry for a healthy life and biotechnology" are personalised medicine, diagnostics and therapies and the production and distribution of typical Bulgarian food products. Under the priority "New technologies in the creative and recreational industries", the most common sub-priorities are computer and mobile applications and creative industries such as architecture, audio-visual art, cultural heritage and design. It should be further noted that under many of the sub-priorities in all four thematic priorities there were fewer than 20 project applications, about 20 % of which were approved. The funding period is still ongoing and the interest of companies to apply does not necessarily correlate to their total number and market share. However, the preliminary data suggests that the thematic priorities do not reflect accurately the profile of innovative companies in Bulgaria.

From a regional perspective, there are also some clear tendencies. The biggest share of project proposals originates from the South-Western region where the largest share of Bulgarian businesses are located, followed by the North-Western region, which receives bonus points as the least developed region. On the other hand, there have been less than 100 project proposals from the North Central region, where there are many companies in the mechatronics, ICT and recreation fields. Furthermore, within each region there is a clear

Table 2. PROJECT APPLICATIONS UNDER OP IC UNTIL 31.05.2018 BY THEMATIC PRIORITY AND BY NUTS II REGION

Thematic priorities	Nuts II regions – project applications						Applications/ approved	
	NWR	NCR	NER	SWR	SCR	SER	number	%
Industry for a healthy life and bio-technology	**123**	**14**	**33**	**143**	**63**	**20**	396/76	19%
Mechatronics and clean technologies	**273**	**40**	**67**	**142**	**90**	**67**	679/208	31%
New technologies in creative and recreational industries	**161**	**7**	**33**	**91**	**9**	**9**	310/77	25%
Informatics and information and communication technologies	**38**	**34**	**28**	**475**	**63**	**25**	663/130	20%
TOTAL	**595**	**95**	**161**	**851**	**225**	**121**	2048/491	24%

* Highlighted cells correspond to thematic priorities in the region.

Source: Ministry of Economy.

front-runner among the thematic priorities, which has received the largest share of project applications, again suggesting that the funding procedures do not meet companies' needs.

Broad view of innovation

Smart specialisation is most often associated with technological advancements. However, one of its guiding principles is that authorities should not only focus on funding technological and scientific innovations, but rather they should also support practice-based social innovations.[19] During the 2021 – 2027 programming period the European Social Fund is expected to integrate the current Employment and Social Innovation Programme.[20] It is therefore crucial that Bulgaria begins to elaborate its own social innovation objectives and develop mechanisms to support such projects. Thus far neither ISSS, nor any other strategic documents in the country address the issue of social innovation or how it will be supported during the 2021 – 2027 programming period.

Monitoring and evaluation

As with any other strategic document, the ISSS is subject to monitoring indicators and evaluation mechanisms, in order to guarantee transparent implementation and its continuous improvement and amendment based on feedback provided by the relevant stakeholders, as well as on statistical data. The monitoring process has recently been transferred to the Bulgarian Small and Medium Enterprises Promotion Agency, which may lead to some delays in the process. So far, only one Annual Implementation Report of ISSS for 2017[21] has been prepared, which is only available upon request from the Ministry of Economy. Also there have been no evaluations of the strategy yet, which precludes any in-depth analysis of the evaluation mechanisms.

The ISSS itself sets out a wide range of indicators, through which the authorities will measure the progress on the strategic and operational objectives of the strategy and each of the four thematic priorities. The strategic objective of Bulgaria to move to the group of moderate innovators will be measured through the indicators of the EU Innovation Scoreboard, although they are too general to determine a causal link between the implementation of ISSS and general improvements to the innovation system.

The indicators related to the four thematic priorities derive solely from OP IC and OP SESG and have no sectoral or regional relevance. Instead, they measure overall innovation performance in three main groups of indicators related to companies introducing new products and collaborating with research institutions, individual researchers' work in improved facilities and training and joint research projects. The indicators are the same for all four thematic priorities and therefore it is not possible to make any meaningful comparison about individual progress under each of them.

[19] European Commission, DG Growth (2018), *Social Innovation*. According to the EC definition "social innovations are new ideas that meet social needs, create social relationships and form new collaborations. These innovations can be products, services or models addressing unmet needs more effectively".

[20] http://ec.europa.eu/social/main.jsp?catId=1081

[21] Ministry of Economy, (2018), *Annual Implementation Report of ISSS for 2017*.

Some impact indicators are also included in the Annual Implementation Report[22] per thematic priority, but it is not clear how any changes in the indicators can be considered even an indirect result of ISSS and the related OP's, or more general trends in the given sectors. Furthermore the provided data is for the years 2015 and 2016, before ISSS effectively came into force, although projects were already funded under OP IC. The thematic impact indicators include:

- Mechatronics and clean technologies:
  - Innovation potential;
  - Quality of research;
  - Company expenditure on R&D;
  - Business – university cooperation.
- Informatics and information and communication technologies:
  - Registered patents in the field of ICT;
  - Access to ICT infrastructure;
  - Use of ICT;
  - Expenditure on computer software.
- Industry for a healthy life and bio-technology:
  - Arable area for organic farming;
  - Number of researchers and engineers;
  - Number of ISO 14001 certificates for Environmental Management Systems;
  - GDP per unit of energy use.
- New technologies in creative and recreational industries:
  - Number of employees in knowledge-intensive services;
  - Export of cultural and creative services;
  - Number of produced films;
  - Printing and editing activities.

The Annual Implementation Report also includes information about implemented activities related to ISSS and to OP IC and OP SESG at the local level, provided by the district authorities. However, information has not been provided by all districts, suggesting an inconsistent data collection method, as well as overreliance on the local authorities with the lowest involvement in the business and research community, as well as little research performed locally by the unit preparing the report. Furthermore, interviews with district authorities suggest that they were asked to collect information on activities, but once this was submitted, they received no feedback from the central government and did not have the opportunity to make suggestions or recommendations for future funding procedures, confirming once again the lack of opportunities for bottom-up initiatives.

Policy recommendations

In order to strengthen the impact of smart specialisation on the Bulgarian economy, the authorities could improve the implementation of the current strategy and apply the five guiding principles more effectively when developing the new document, by following some specific policy recommendations:

- Focus smart specialisation policy on addressing the structural shortcomings of the innovation system by increasing the overall amount and the

[22] Ibid.

effectiveness of public expenditure on R&D and make targeted efforts to foster collaboration between business and research institutions;

- Redefine the legal framework governing the Sofia Tech Park, Centres of Excellence, Centres of Competence and other similar intermediary institutions to ensure their financial sustainability through a clearer management structure and a higher share of for-profit activities;
- Define new NUTS II regional boundaries based on the economic and social profiles of the districts, and not on administrative considerations alone;
- Separate Sofia city and its immediate metropolitan area in its own region to allow for fairer competition among all other districts and regions, which are less developed;
- Select projects for funding based on thematic priorities, without additional bonus points for geographical location to ensure that companies from all regions have the same opportunities;
- Institutionalise and use the Entrepreneurial Discovery Process to its full potential in order to define priorities based on project ideas with real market potential;
- Increase dialogue with all relevant stakeholders when developing funding procedures before defining selection criteria;
- Begin integrating social innovations in strategic documents and develop targeted funding procedures;
- Develop smarter monitoring indicators, which are closely related to each thematic priority of ISSS.

Innovation Potential of the Bulgarian Economy

Gross Innovation Product

The gross innovation product, or the innovativeness of an economy, is assessed by the new products and services introduced, the new technologies created and the scientific outputs. It involves and results from the interaction of the innovation, technological and scientific products of a country. It is a major benchmark for innovation policy because it allows decision-makers to compare the outcome of the innovation system in temporal and geographical terms, as well as to estimate the need for changes in the organisation and resources of the innovation process.

Innovation product

The innovation product results from innovation activity in the form of new and significantly improved processes, products and services based on new and/or adapted existing knowledge and know-how. It is determined by the innovation activity of enterprises in the country and is the most important indicator for assessing the national innovation system. Innovation activity in business and innovation demand by the public, along with the factors which determine these, comprise the innovation potential of an economy – its capacity to develop based on new knowledge.

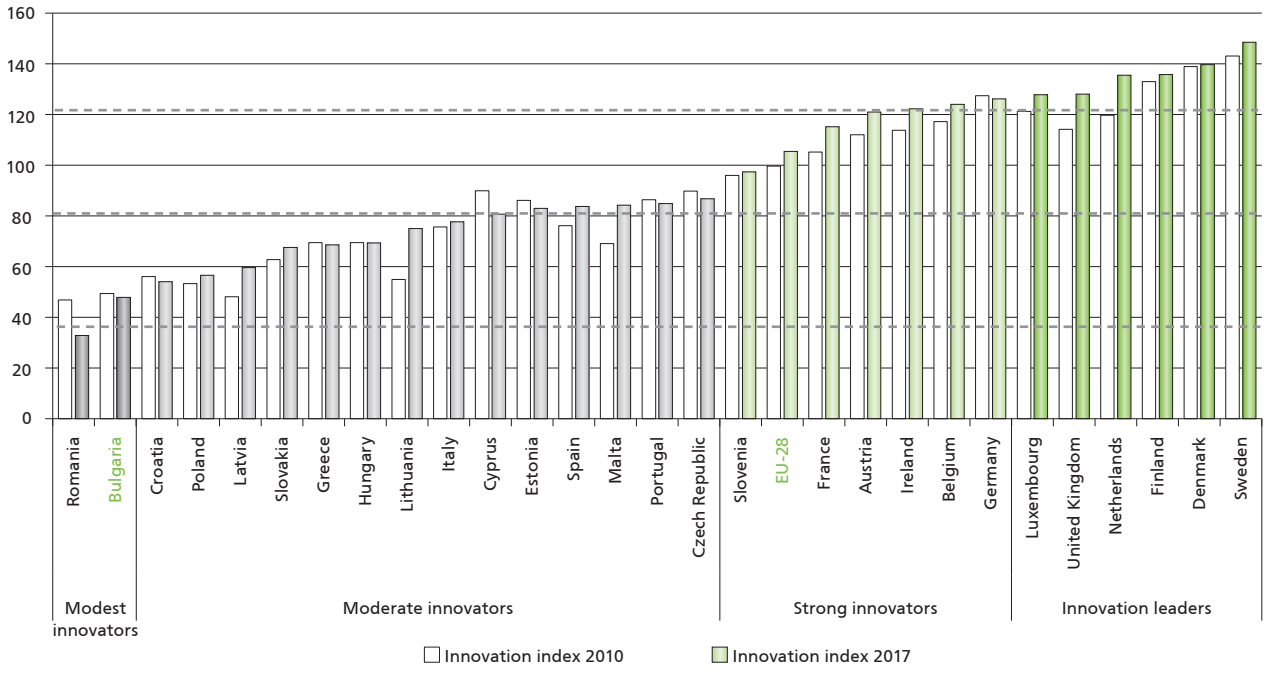
Bulgaria's place on the international innovation map

Modesty may be becoming for an individual but applied to the innovation results of institutional sectors it spells no good. Following a minimalistic move ahead, **for yet another year Bulgaria and Romania share the title "modest innovators" in the EU.**

According to the European Innovation Scoreboard the innovation potential of the European economy has improved compared with the previous year, with the baseline year of 2010 and with its international economic peers. This is attributable to the higher values of the index for innovation leaders, a confirmation that **their positions are the result of long-term sustainable policies**. The group of strong innovators has also grown, except for Germany, which ceded its position in the top group of innovators to Luxembourg.

Eighteen EU member states have seen improvements in their innovation index, ranging from over 20 p.p.

Figure 3. EUROPEAN INNOVATION SCOREBOARD 2018



Source: European Innovation Scoreboard, 2018.

Figure 4. INNOVATION INDEX, BULGARIA, 2010 – 2017

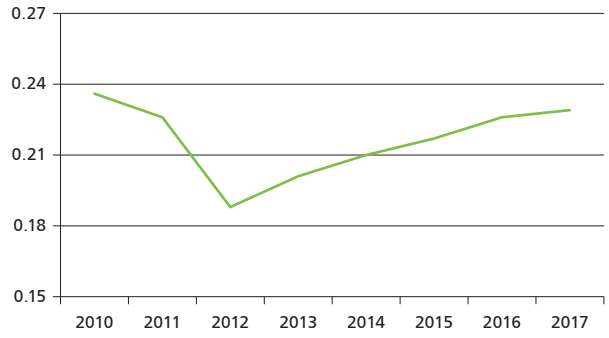


Figure 5. INNOVATION INDEX – PERFORMANCE CHANGES, BULGARIA, 2010 – 2017

Source: European Innovation Scoreboard, 2018.

for Lithuania and around 15 p.p. for other moderate innovators to 10 p.p. for strong and lead innovators. The most drastic declines occurred in Cyprus (-9.2 %) and Romania (-14.0 %).

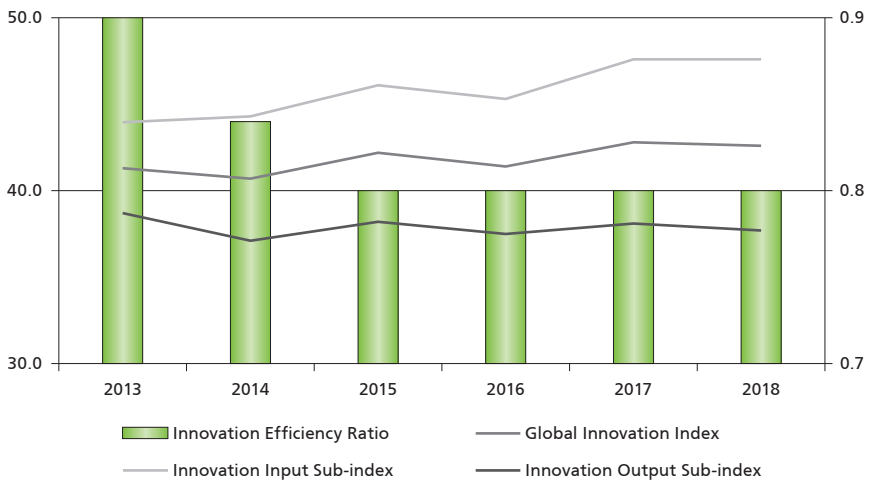
The green swallow of innovation activity in Bulgaria has not been able to spread its wings as in the baseline 2010. By most indicators the country lags considerably behind the EU average levels, either in absolute terms or in terms of progress/change.

The European Innovation Scoreboard data shows, **Bulgaria is at the bottom of the ranking in five dimensions**:

- R&D environment;
- finance;
- innovation;
- linkages;
- sales impacts.

Another negative finding of the European Innovation Scoreboard is **the loss of momentum**. Several years ago, less innovative countries tried to make faster progress to offset their lagging behind and bridge the gap with lead innovators. This trend is no longer existent. **The efforts for pursuing innovation-friendly policies are slowing down** (see section Smart specialisation in Bulgaria: making EU funds deliver for the Bulgarian economy) with predictably negative results on innovation performance.[23]

Figure 6. GLOBAL INNOVATION INDEX, 2013 – 2018



Source: https://www.globalinnovationindex.org

Another trend weakening Bulgaria's innovation potential and undermining the capacity for positive results is **the worsening of the imbalances** among regions in the country. South-Western Bulgaria and Southern Bulgaria have further improved their positions against the background of ongoing deterioration of the indicators for Northern Bulgaria.[24]

The results of another international study of the innovation potential of national economies – **the Global Innovation Index 2018** draw a similar picture.[25] In this ranking, which is based on the juxtaposition of the results from innovation and the inputs for their achievement, Sweden again is one of the top three innovation leaders. **Bulgaria has retreated from** form 22nd place among EU member states in 2017 to 23rd place in 2018. Traditionally, Poland, Greece, and Romania come after Bulgaria in this ranking.

[23] European Innovation Scoreboard 2018, http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_en

[24] Regional Innovation Scoreboard 2017, https://ec.europa.eu/growth/industry/innovation/facts-figures/regional_en

[25] Cornell University, INSEAD, and WIPO (2018). *The Global Innovation Index 2018: Energizing the World with Innovation.* Ithaca, Fontainebleau, and Geneva. https://www.globalinnovationindex.org/gii-2018-report

Table 3. INNOVATION POTENTIAL OF BULGARIA COMPARED TO THE EU-28 AVERAGE, 2017

Indicators	Less than 50 % of EU average	From 50 and 90 % of EU average	Between 90 % and 120 % of EU average	Over 120 % of EU average
Innovation index	**45.4**			
Human resources		**54.2**		
New doctorate graduates		72.7		
Population with tertiary education		63.2		
Lifelong learning	12.2			
Attractive research systems	**28.0**			
International scientific co-publications	38.3			
Most cited publications	27.4			
Foreign doctorate students	23.5			
Innovation-friendly environment		**52.9**		
Broadband penetration		75.0		
Opportunity-driven entrepreneurship	31.2			
Finance and support	**21.0**			
R&D expenditure in the public sector	10.1			
Venture capital expenditures	32.1			
Firm investments		**51.4**		
R&D expenditure in the business sector	41.2			
Non-R&D innovation expenditures			97.6	
Enterprises providing ICT training	25.0			
Innovators	**14.3**			
SMEs product/process innovations	11.3			
SMEs marketing/organizational innovations	17.4			
SMEs innovating in-house	13.9			
Linkages	**32.0**			
Innovative SMEs collaborating with others	19.0			
Private-public co-publications	26.9			
Private co-funding of public R&D exp.		50.5		
Intellectual assets		**85.8**		
Patent applications	18.2			
Trademark applications			112.4	
Design applications				125.3
Employment impacts			**102.4**	
Employment in knowledge-intensive activities		52.9		
Employment fast-growing enterprises				144.1
Sales impacts	**33.0**			
Medium and high tech product exports	38.4			
Knowledge-intensive services exports	41.3			
Sales of new-to-market/firm innovations	16.2			

Source: European Innovation Scoreboard, 2018.

According to the methodology of the Global Competitiveness Index 2017 – 2018[26] and the World Digital Competitiveness Index 2017[27] **neglecting innovations as a factor of economic well-being for yet another year** leaves Bulgaria a country where growth is driven not by innovation but by the higher efficiency of the economy. **Bulgaria is the only EU member state in the group of such countries** in the company of 30 countries from the Western Balkans, Asia, Africa, and Latin America.

For yet another year, **corruption** (17.8), **inefficient public administration** (12.0) and **taxation levels** (9.3) are cited among **the factors most seriously hampering business development**, including innovation activity in Bulgaria.

Technological product

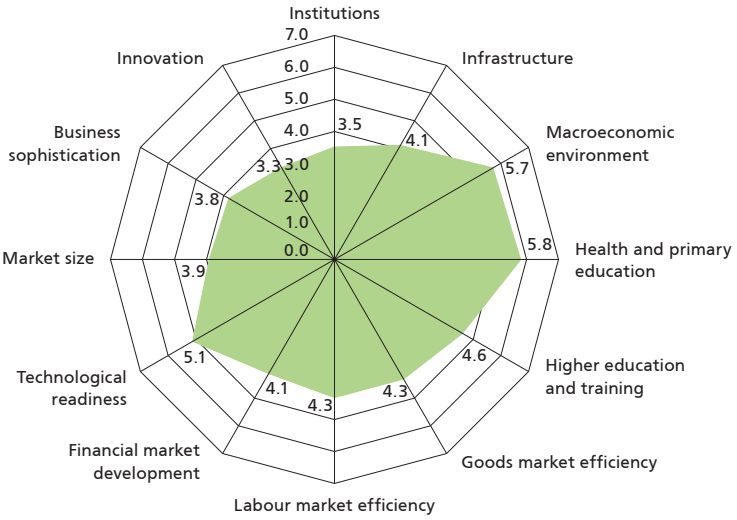
The technological product (protected and unprotected new technological knowledge) is a result of the creative activities of various participants in the innovation process. It has unique characteristics and economic significance which make it attractive as an object of transfer. The analysis of application and patent activities, as well as the attitudes of Bulgarian and foreign persons in this field make it possible to assess an essential aspect of the innovation system operation and to seek ways of improving it.

In 2017, the patent activity of Bulgarian inventors increased. The number of registered patents and utility models doubled to 79 (or 198 % growth year-on-year) and to 440 (or 212 % growth) respectively.

[26] *The Global Competitiveness Report 2017 – 2018*, World Economic Forum, 2017. https://www.weforum.org/reports/the-global-competitiveness-report-2017-2018

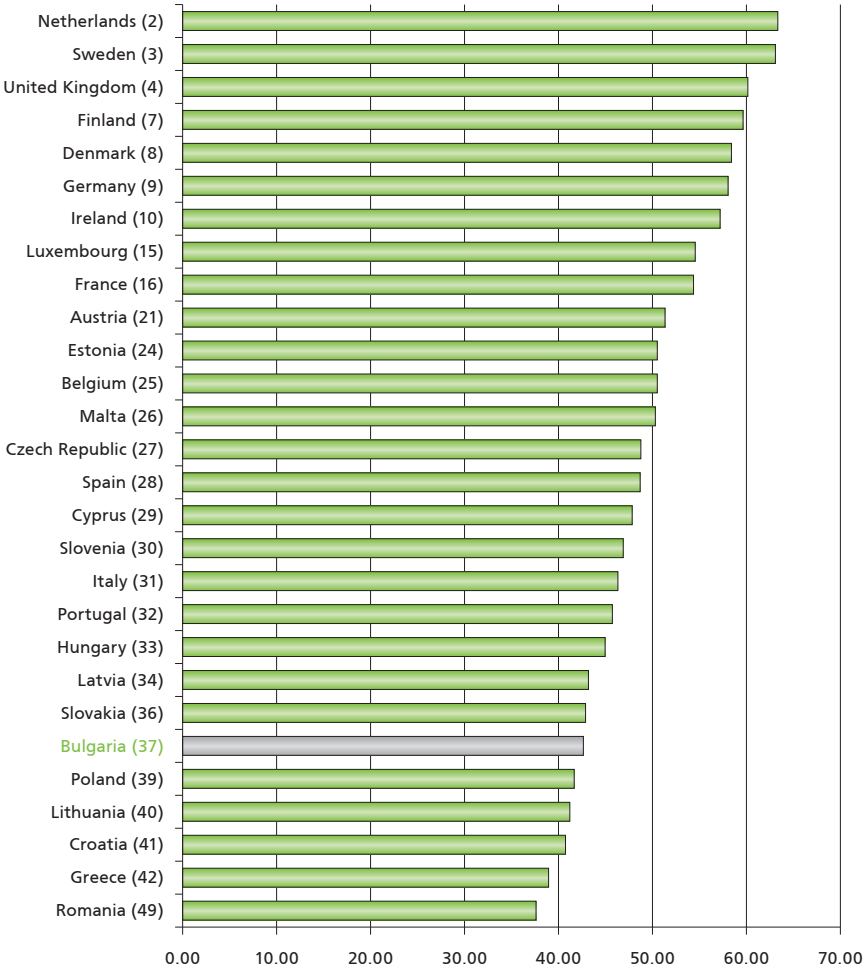
[27] IMD World Digital Competitiveness Ranking 2017, https://www.imd.org/wcc/world-competitiveness-center-rankings/world-digital-competitiveness-rankings-2018/

Figure 7. FACTORS OF NATIONAL COMPETITIVENESS, BULGARIA, 2017 – 2018



Source: The Global Competitiveness Report 2017 – 2018.

Figure 8. THE GLOBAL INNOVATION INDEX, EU-28, 2018*



* The figure in the brackets shows the ranking of the country among 126 countries.

Source: Global Innovation Index 2018.

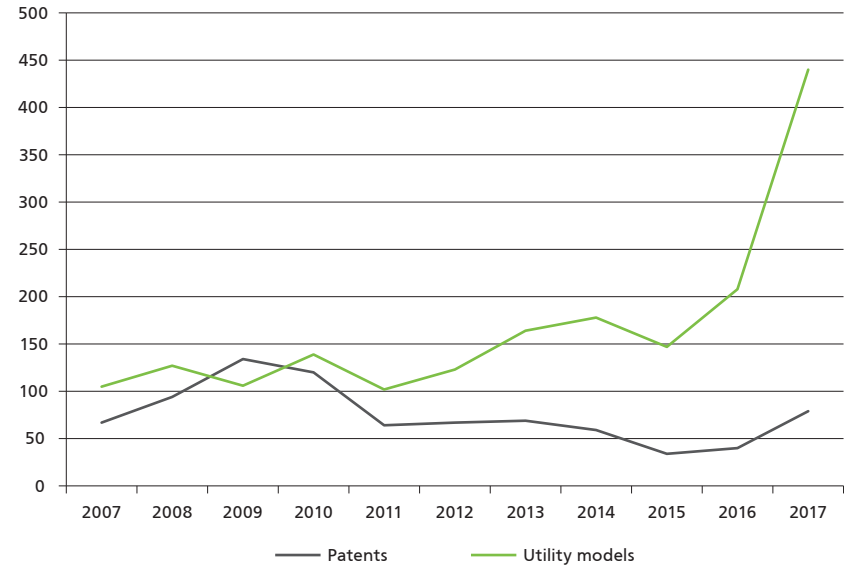
The interest of Bulgarian inventors is increasingly focused on seeking short-term protection in the form of utility models (one-off within 4 years) **at the expense of patents** (maximum protection period of 20 years). Since 2009, when the number of patents exceeded the number of utility models by about a third, the ratio has been in favour of utility models. The reasons for this trend are complex and include, but are not limited to, the impact of the following key factors:

- **Innovation activity in the country is mainly low-tech.** As the data from the Innovation Index of Bulgarian Enterprises of the Applied Research and Communications Fund show, the innovation activity of Bulgarian enterprises is focused mainly on the implementation of incremental product and process innovations, new for the local or national market, as well as on organisational and marketing innovations based mainly on "soft" skills and to a lesser degree on new technological knowledge. This finding is confirmed by the European Innovation Scoreboard (see the Innovation product section).
- **The procedure for patent protection is more complicated, expensive, and time-consuming**. Unlike patents, registration of utility models takes much less time – about a year on average, and costs less to the applicant.
- Often the strategy of inventors is to start with the most affordable methods of protection, such as keeping the invention secret or registering a utility model, and only at a later stage seeking a longer-term protection solution.

The two institutional sectors with the highest shares of patent activity are businesses and individuals. **As regards patents, the business sector is ahead of individuals for a second consecutive year** (2.6 times in 2016 and 1.3 times in 2017). With few exceptions the enterprises have the leading role in utility models too.

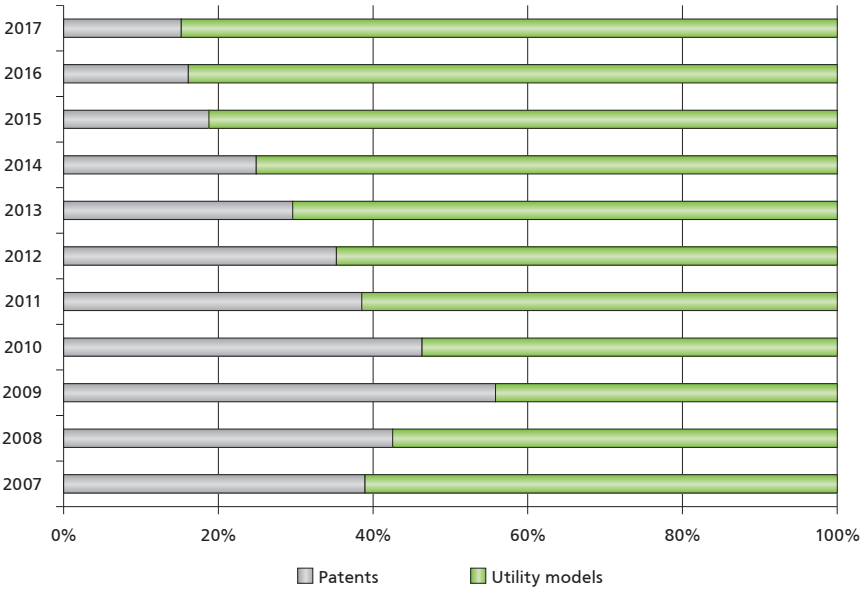
The behaviour of the business sector and the individuals in terms of protection of patents and utility models differs substantially. The registration of patents by enterprises has been staying at about 22 patents on average per annum since 2001. Unlike patents, utility models have grown continuously, which has been most noticeable in the last two years. On the other hand, the nearly

Figure 9. PATENT ACTIVITY OF BULGARIAN INVENTORS AT PORB, NUMBER, 2007 – 2017



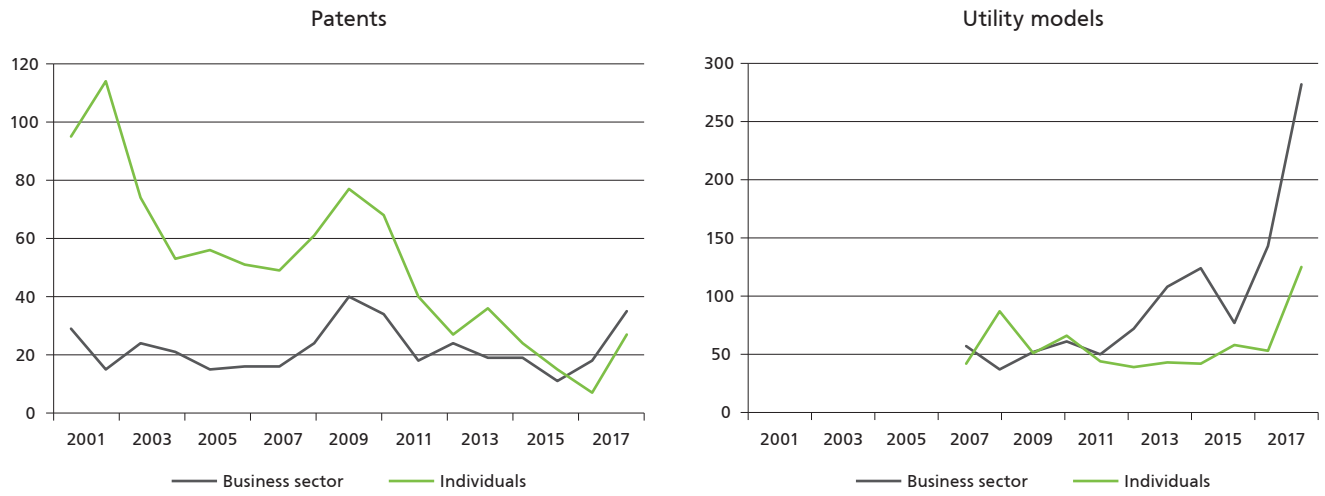
Source: PORB, 2018.

Figure 10. RATIO BETWEEN PATENTS AND UTILITY MODELS REGISTERED WITH PORB BY BULGARIAN INVENTORS, %, 2001 – 2017



Source: PORB, 2018.

Figure 11. PATENT ACTIVITY OF THE BUSINESS SECTOR AND INDIVIDUALS, NUMBER



Source: PORB, 2018.

invariable number of 60 utility models on average per annum registered by individuals has been accompanied by a drastic fall in the number of patents.

In 2017, the business sector registered 35 new patents. The companies with more than one patent are Asarel Medet AD of Panagyurishte (4, incl. 1 at the EPO), Mauer Locking Systems EOOD of Varna (3 at the EPO), Hyundai Heavy Industries Co. Bulgaria AD (3) and Himax Pharma EOOD of Sofia. **Over 52 % of enterprises which have registered patents after 2001 are in Sofia.**

Traditionally, the higher education sector accounts for a small share in the institutional structure of patent activity – 3 % for patents and 1 % for utility models in the period 2007 – 2017 or 23 patents in total and 22 utility models in total. The leader is the Technical University of Varna (10 patents and 7 utility models), followed by the Technical University of Sofia (4 patents and 2 utility models) and the University of Chemical Technology and Metallurgy in Sofia (4 patents and 1 utility model). A total of 13 institutions of higher education have been active in protecting the new technological knowledge which they have created.

Table 4. TOP 5 ENTERPRISES HAVING REGISTERED PATENTS WITH PORB, NUMBER, 2001 – 2017

		2001 – 2017	After 2007
1	Hyundai Heavy Industries Co. Bulgaria AD, Sofia	27	26
2	Sopharma AD, Sofia	21	20
3	VMZ EOOD, Sopot	14	9
4	BIOVET AD, Peshtera	9	1
5	Balkanpharma – Dupnitsa AD, Dupnitsa	7	0

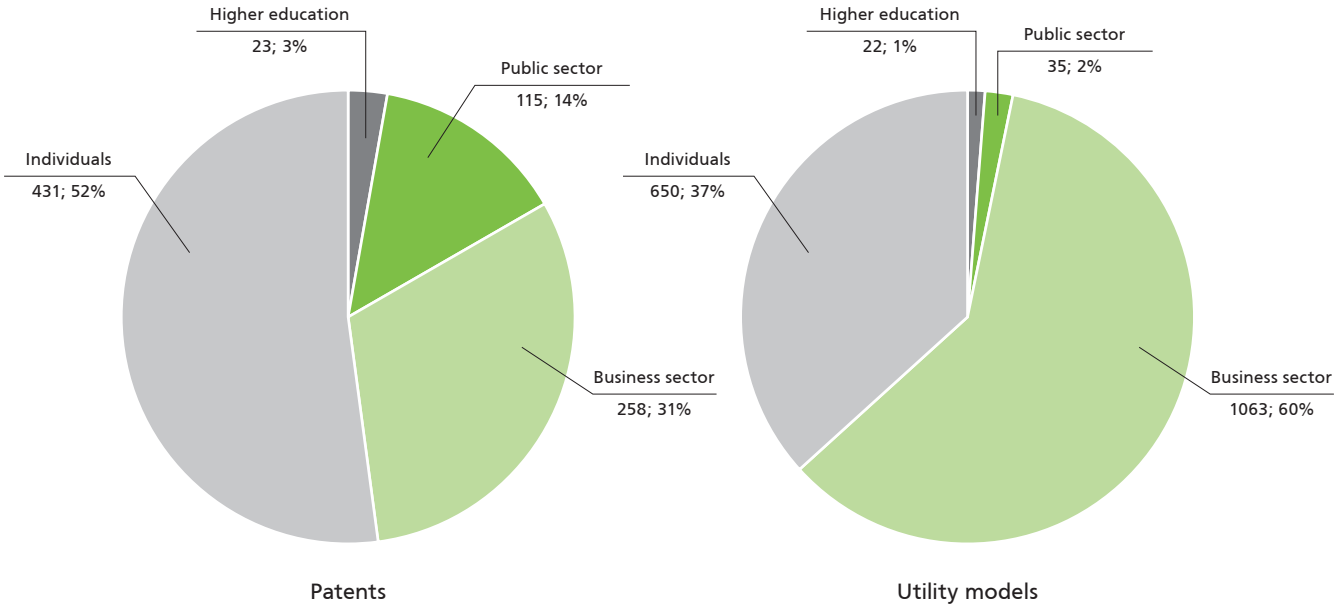
Source: PORB, 2018.

The public sector is represented mainly by the institutes of BAS and the Agricultural Academy (AA). In the period 2007 – 2017, **BAS institutes registered 100 new patents and 26 new utility models.** The leading positions are held by the Institute of Robotics (41 patents and 1 utility model),[28] followed by the Institute of Metal Science (12 patents and 4 utility models) and the Institute of Mechanics (11 patents). As a result, the patent portfolios of the various research fields within BAS are as follows:

- information and communication sciences and technologies – 54 patents and 3 utility models;
- nano-sciences, new materials, and technologies – 34 patents and 9 utility models;
- astronomy, space research, and technologies – 5 patents and 8 utility models;

[28] The Institute of Robotics at BAS is the legal successor of the Institute of Systemic Engineering and Robotics set up in 2010 by combining the Institute of Management and Systemic Research at BAS and the Central Laboratory of Mechatronics and Instrumentation at BAS.

Figure 12. INSTITUTIONAL STRUCTURE OF PATENT ACTIVITY OF BULGARIAN INVENTORS AT PORB, %, 2007 – 2017



Source: PORB, 2018.

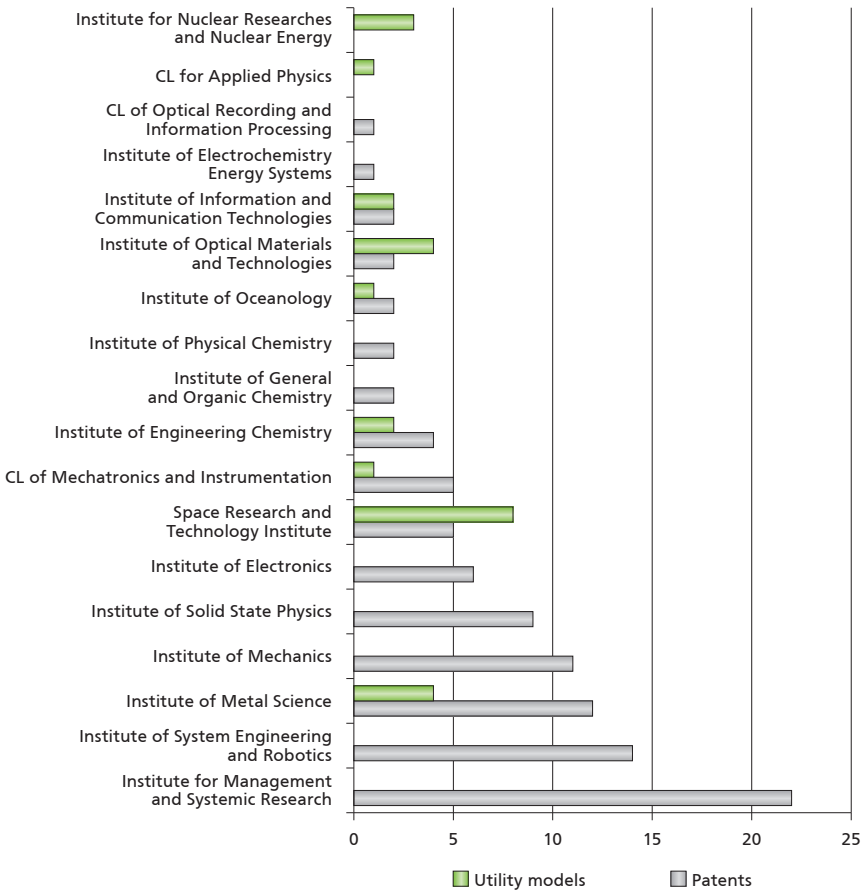
- energy resources and energy efficiency – 5 patents and 5 utility models;
- climate change, risks, and natural resources – 2 patents and 1 utility model.

The AA registered 5 new patents in the period 2007 – 2017 through the Institute of Agriculture in Shumen (2), the Institute of Soil Science (1), the Institute of Wheat and Sunflower in General Toshevo (1) and the Institute of Cryobiology and Food Technology in Sofia (1). In addition, the patent activity of the Academy coves 7 utility models.

Companies and individuals register mostly utility models, whereas research institutes and universities in the country create inventions, which require patent registration. As the activity of the sector of individuals results mainly from the refusal, deliberate or due to negligence, of

[29] The Institute of Optical Materials and Technologies was established in 2010 based on the Central Laboratory of Photo Processes and the Central Laboratory of Optical Recording and Information Processing.

Figure 13. PATENT ACTIVITY OF BAS, NUMBER, 2007 – 2017[29]

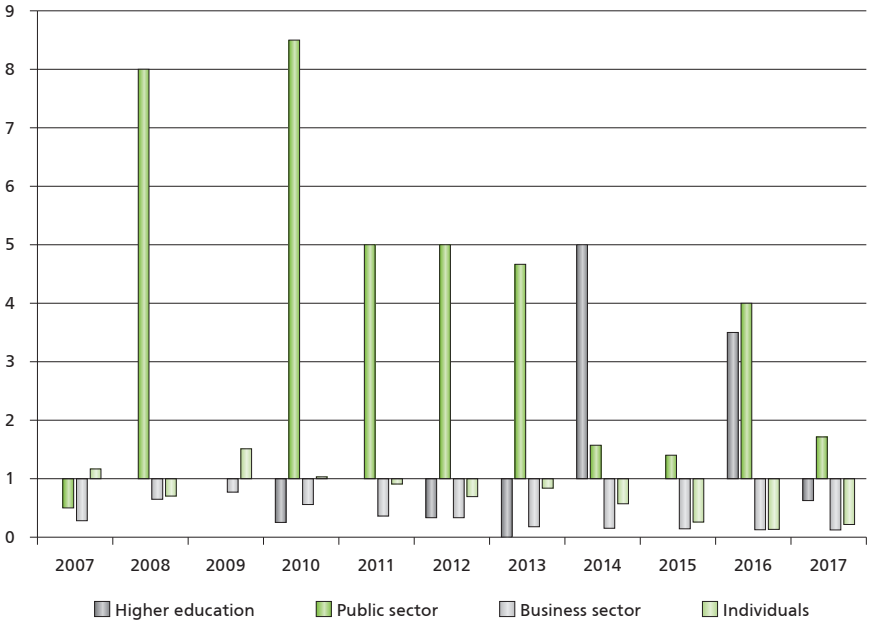


Source: PORB, 2018.

some of the other sectors to institutionalise the protection of their intellectual property objects, data on the individuals largely reveal where the latter create new technologies: in the laboratories of research institutes or at R&D business centres.

As regards foreign patent activity in the period 2001 – 2017, it is important to note that **98.2 % of the patents of foreign patent holders have been granted by the European Patent Office and are effective for the territory of Bulgaria**. In 2017, there were 2,150 European patents effective on the country's territory. Among them, leading positions have patent holders from the United States (561 patents issued for 2017), followed by Germany, Switzerland, and France. Japan ranks seventh with 74 patents. Only **7 of the foreign patent holders sought protection under the national procedure in 2017**. Save for one, they pertain to the chemical industry, including three patents in the pharmaceuticals sector. Four of the foreign patents are institutional and the other three are held by individuals from Russia, Ukraine, and Greece.

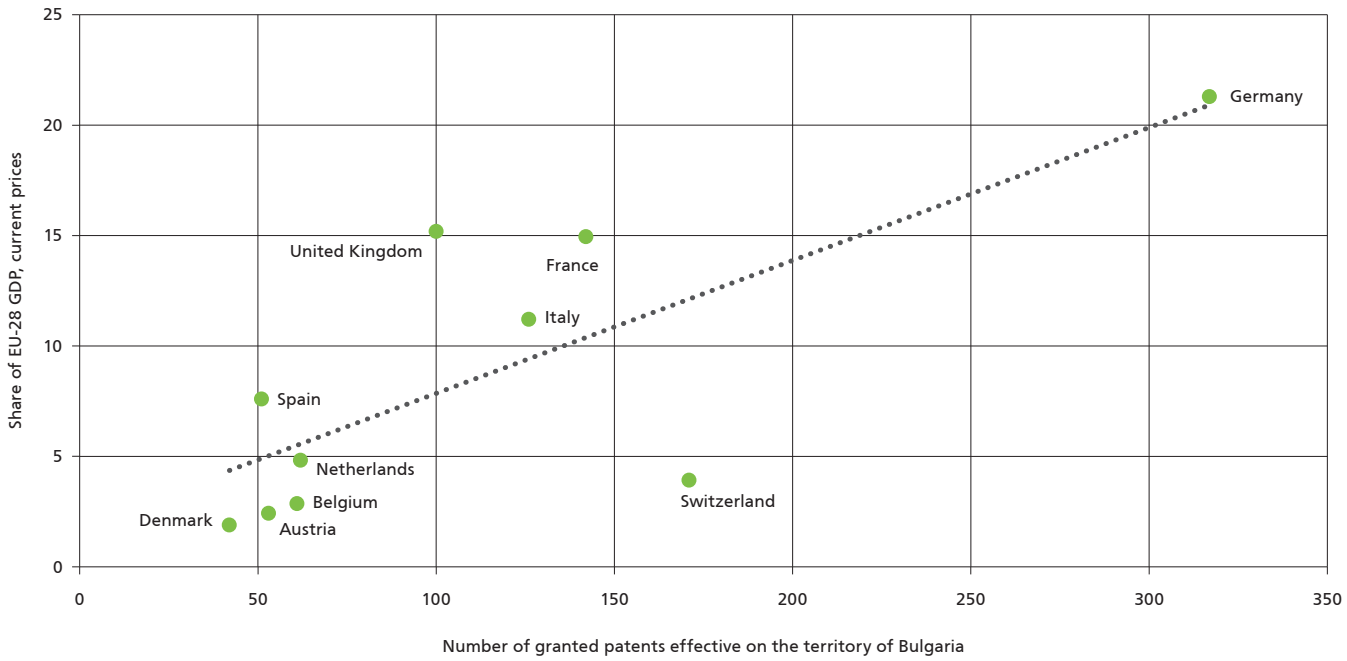
Figure 14. PATENTS/UTILITY MODELS RATIO BY INSTITUTIONAL SECTOR, %, 2007 – 2017



Source: PORB, 2018.

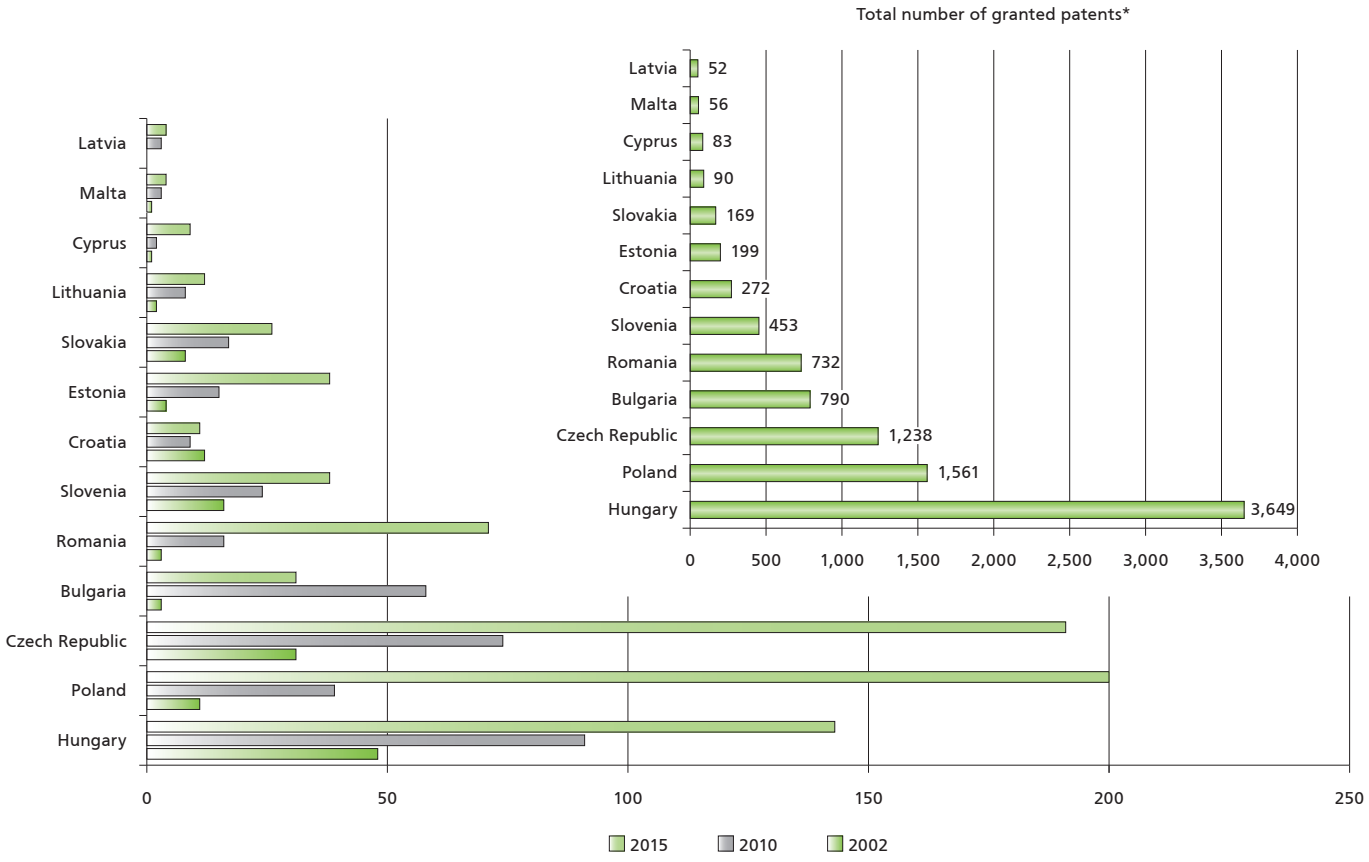
Bulgarian applicants prevail in terms of utility models – 1,841 in total for 2007 – 2017 versus merely 101 utility models of foreign applicants.

Figure 15. TOP 10 EUROPEAN ECONOMIES WITH PATENT ACTIVITY ON THE TERRITORY OF BULGARIA, 2017



Source: PORB 2018; Eurostat 2018.

Figure 16. PATENTS GRANTED FOR INVENTIONS IN THE USA, NUMBER



* Data on the Czech Republic and Slovakia do not include 2,121 patents granted before 1993 and generated by Czechoslovakia, which would have improved the present positions of the two countries.

Source: USPTO, 2018.

Mostly because the European Patent System does not differentiate inventions from utility models, **all foreign applications for utility models,** unlike for patents, **are filed in accordance with the national procedure**, i.e. they are fully consistent with the intentions of the applicants to seek protection of their technological novelties created on the territory of Bulgaria as part of their strategy for international coverage.

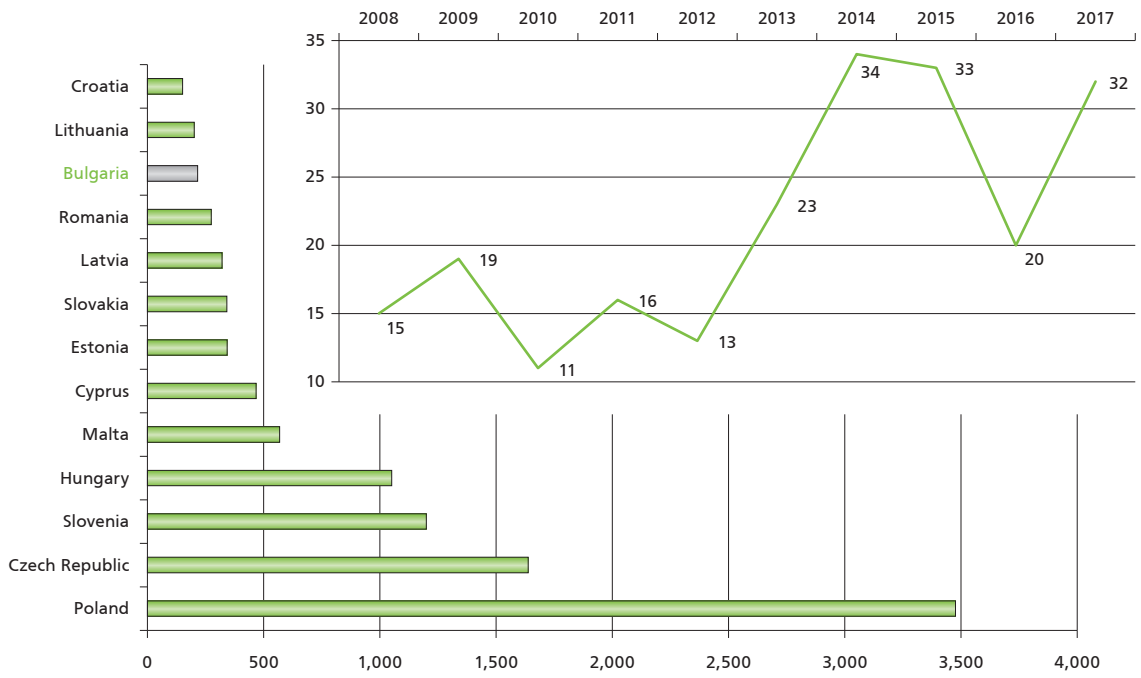
The reasons for the low interest of foreign applicants may be sought in several directions. On the one hand, utility models are not a very popular form of patent protection; in fact, there are countries which do not provide that option of rights protection for technical solutions and their nationals are not always aware of it. Moreover, they are considered a more unstable form of protection. In Bulgaria, **a utility model is registered without an expert examination of the newness, the inventive step, and the industrial applicability of the technical solutions.** This means that the grounds for registration of a specific technical solution could always be challenged and often justifiably disputed, and hence the rights arising from its registration could be lost.

Foreign utility models originate from 24 countries, with **the highest interest in protecting technical solutions in this form coming from applicants from Russia, the Czech Republic, and Turkey,** with approximately equal number of registrations. This is not surprising, given the shared history with these countries in certain periods in the past. Although registered by foreign persons, the analysis of these utility models shows that the holders (and/or inventors) indeed are persons of Bulgarian origin or dual nationality (in some cases of registration by Russian applicants). The same is true for registrations of holders from countries such as the United Arab Emirates, France, and the UK.

More than 2/3 of foreign applicants (mainly individuals) for utility models preferred to file an application to the Patent Office of the Republic of Bulgaria. The remaining applications, mainly institutionalised utility models, were filed under the Patent Cooperation Treaty through EPO.

Despite fluctuations, **Bulgaria maintained its leading positions within the 13 new EU member states in respect of patent activity on the**

Figure 17. PATENT APPLICATIONS TO EPO, NUMBER, 2008 – 2015



Source: EPO, 2018.

territory of the USA. Bulgaria holds fourth place with an overall of 790 patents granted by the US Patent and Trademark Office (USPTO) by the end of 2015, trailing only Hungary (3,649), Poland (1,561), and the Czech Republic (1,238).

The ratio of the number of patents to the number of persons engaged in R&D places Bulgaria in the top 3 countries from the former socialist block. With 26.7 patents per 1,000 R&D employees, the country is behind only Hungary (64.89) and Cyprus (28.41).

Serbia and Montenegro dominate among the other Balkan countries, with a total number of 351 granted patents before 2006 (originating from Yugoslavia), plus 57 patents for Serbia granted after 2007, followed by Bosnia and Herzegovina, Macedonia, and Albania with 7, 6 and 2 patents, respectively.

Quite different is Bulgaria's patent activity at the European Patent Office. **Within the group of new EU member states, Bulgaria ranks 11th,** with 216 patent applications for the 2008 – 2017 period, ahead of only Lithuania and Croatia. This position remains unchanged for the indicator "patent applications per 1 million persons of the country's population."

The general rate of success of the Bulgarian patent holders in accordance with the requirements of the USPTO is 0.42, i.e. almost half of the applications (1,871) lead to granting of patent (790). Slightly ahead of Bulgaria on this indicator are Hungary (0.49) and Romania (0.45).

A relatively higher quality of patent applications is demonstrated by Bulgarian inventors at the European Patent Office. The success rate for 2017 was some 70 %, marking an improvement on the previous 2016 (55 %).

The predominant interest of Bulgarian inventors in the US market in the period 2011 – 2015 is focused in two main fields – **electrical computers and digital processing systems** and **data processing**.

Bulgarian inventors seek protection at the European Patent Office in various fields. For the 2008 – 2017 period, 34 out of total granted 77 patents (or 44 %) were in **mechanical engineering**, followed by other 31 % in the field of **chemistry** (1/3 of these are in pharmaceuticals). **Civil engineering** ranks third with 13 % and fourth comes the sector of electrical engineering with 8 %, including digital communications, basic communication processes, computer technology, audio-visual technology and electrical machinery, apparatus, energy.

Given that Bulgarian patent activity abroad is quite diverse, any summary and conclusions are possible only after a detailed review of the facts and understanding of the specific company case. Very often, when the nationality of a registered patent by the USPTO is given as Bulgarian,

this refers to a collective invention with the participation of Bulgarian scientists doing research in foreign affiliates of large multinational companies. This is the case, for example, of Red Hat – a world leader in the field of open source software.

The situation with SAP, which develops software for automated management of business processes, is different. The company has built 19 SAP Labs development centres in 16 countries around the world, including Bulgaria. According to the nationality of the researchers, Bulgaria ranks second after Germany in the number of registered patents of SAP in the USPTO, which is a high recognition of the quality of research by Bulgarian specialists.[30] This result becomes visible thanks to the specific corporate policy of SAP, allowing teams that have developed a specific software be the actual patent holders (unlike others, which patent their research through their offices in USA, but the actual developers are not the holders of specific rights).

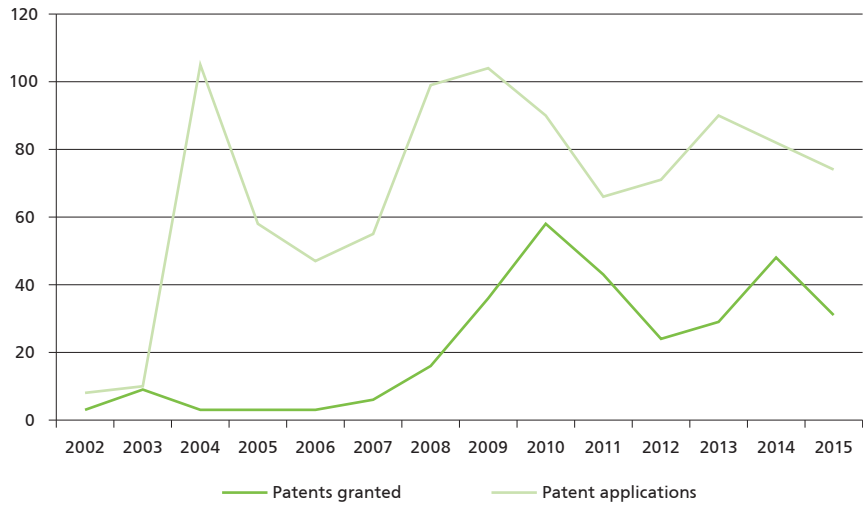
Research product

New scientific knowledge is an important condition for enhanced innovation activity in the country. The analysis of the dynamics and structure of the process of research creation reveals the potential of Bulgaria to successfully fit in the global scientific networks, its comparative advantages in various fields of knowledge and its ability to compete on the market for intellectual products.

The Scimago Institutions Ranking lists research institutions (academies, universities, private research centres) based on a composite index,[31] which combines three different sets of indicators assessing **research performance, innovation outputs and societal impact**, measured through their web visibility. **In 2018, Bulgaria was represented in the ranking by seven scientific organisations**: BAS and the leading technical universities in the country.

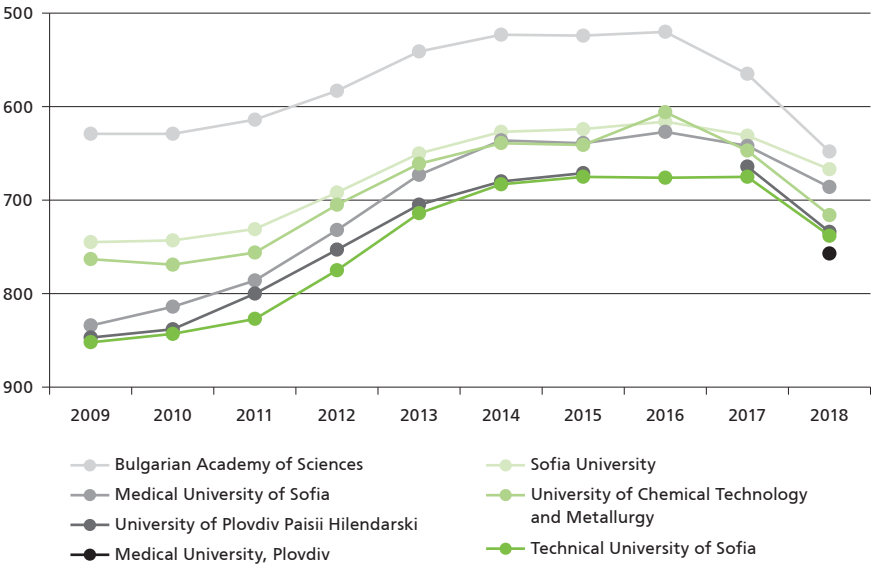
The index is comprised of 13 indicators, the values of which are monitored over a five-year period every two years. Given that the 2018 result is calculated on the basis of the 2012 –

Figure 18. PATENT ACTIVITY OF BULGARIAN PATENT HOLDERS ON THE TERRITORY OF THE USA, NUMBER, 2002 – 2015



Source: USPTO, 2018.

Figure 19. SCIMAGO INSTITUTIONS RANKING, BULGARIA, 2009 – 2018



Source: Scimago, (2007). SJR – Scimago Journal & Country Rank. Retrieved August 31, 2018, from http://www.scimagojr.com

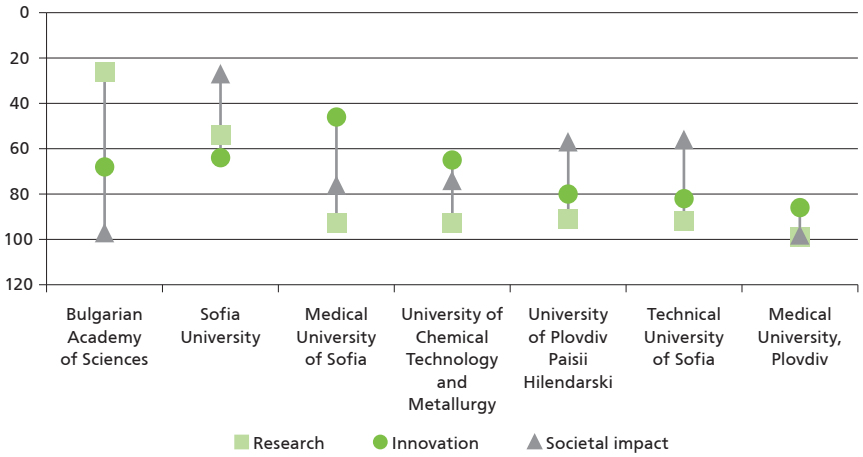
[30] Employed both in SAP Labs Bulgaria and in development centres in other countries, mainly Germany.

[31] The composite index has values in the range from 0 to 100, where the best achievements of scientific organisations are assigned lower values and vice versa, less significant achievements are assigned higher values of the index.

2016 period, it could be assumed that the weakening in 2017 of the positions of almost all Bulgarian research organisations signals the beginning of an adverse trend in Bulgaria.

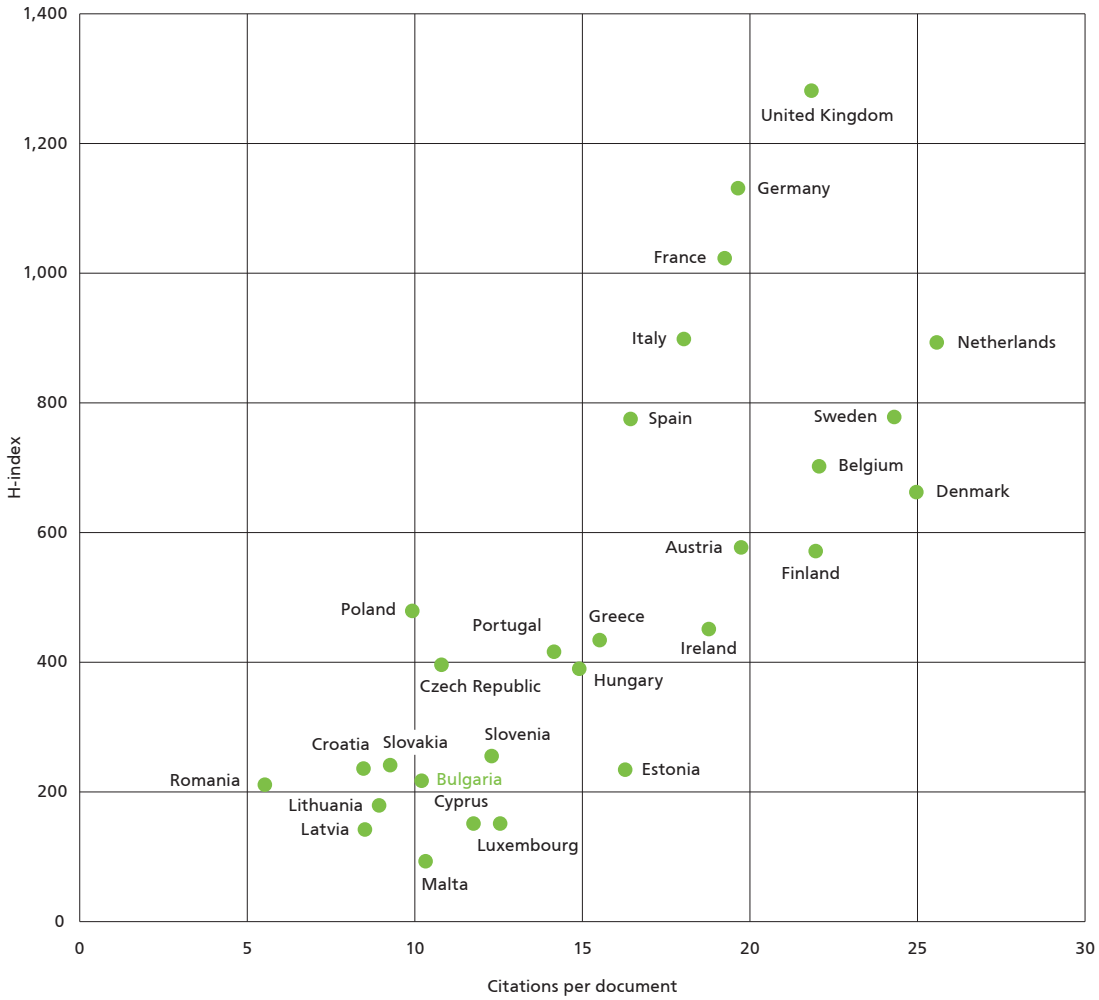
The outcomes by research category show that **BAS performs much better in research than in innovation**. Conversely, **universities focus on the transfer of existing and newly created knowledge in practice** by teaching and by resolving specific practical problems. An exception to this is Sofia University, in which innovation lags behind research, most probably owing to the wider presence of purely fundamental science units in its structure.

Figure 20. PERFORMANCE ON THE INDICATORS OF RESEARCH EXCELLENCE, BY INSTITUTION



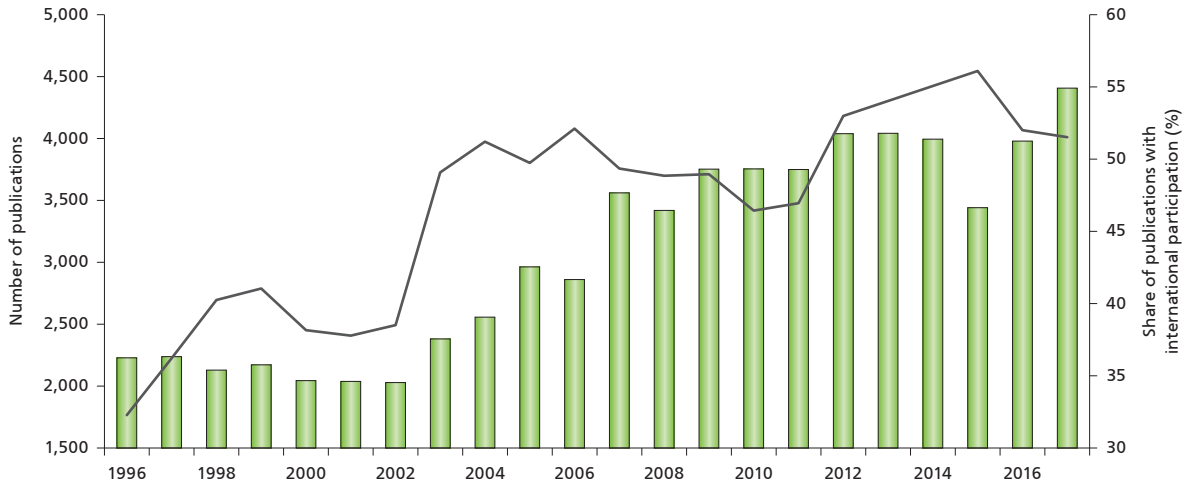
Source: Scimago, (2007). SJR – Scimago Journal & Country Rank. Retrieved August 31, 2018, from http://www.scimagojr.com

Figure 21. H-INDEX AND CITATIONS PER DOCUMENT IN THE SCOPUS DATABASE, EU-28, 1996 – 2017



Source: Scimago, (2007). SJR – Scimago Journal & Country Rank. Retrieved August 31, 2018, from http://www.scimagojr.com

Figure 22. PUBLICATION ACTIVITY IN THE SCOPUS DATABASE, BULGARIA, 1996 – 2017



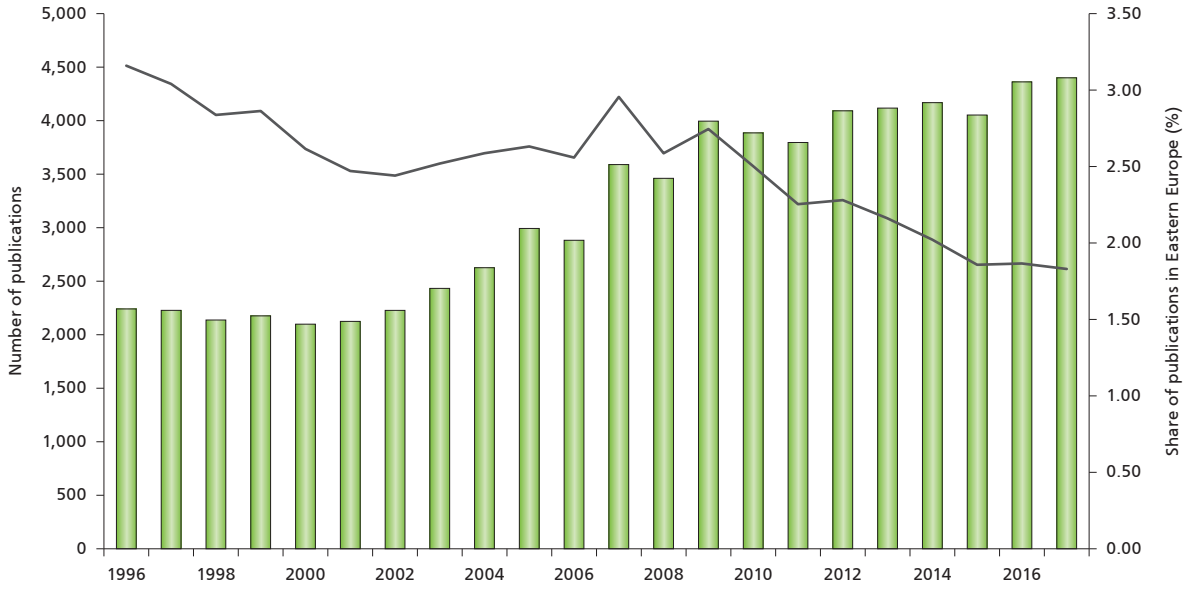
Source: Scimago, (2007). SJR – Scimago Journal & Country Rank. Retrieved August 31, 2018, from http://www.scimagojr.com

In 2018, 33 scientific journals published in Bulgaria were included in the Scopus database. In addition, researchers affiliated with Bulgarian research organisations published in 1,277 journals all over the world.

The drastic decline in publication activity of the Bulgarian research organisations in Scopus-indexed journals in the past has been entirely reversed recently. **For a second year in a row the country has had an increase in the number of publications** (10 % year-on-year) to a new peak of 4,407 publications in 2017.

Despite the increased number of publications in the last two years, Bulgaria has been unable to close the gap in its performance compared to other East European countries. **Its share in the publication activity of the region was 1.83 % in 2017,** compared to 3.16 % in the baseline 1996 year. A decline, though minimal, occurred in the publications with international participation.

Figure 23. PUBLICATION ACTIVITY IN THE SCOPUS DATABASE, BULGARIA WITHIN EASTERN EUROPE, 1996 – 2017



Source: Scimago, (2007). SJR – Scimago Journal & Country Rank. Retrieved August 31, 2018, from http://www.scimagojr.com

Entrepreneurship and innovation networks

Entrepreneurship is one of the binding elements of the national innovation system. It is embodied in newly-established companies and in the means of interaction and exchange of information, know-how and technologies among stakeholders in the innovation economy. Entrepreneurship is crucial for the robustness, adaptability and flexibility of the national innovation system. A high spirit of enterprise and a culture of innovation should underlie the national objectives of innovation policy.

Entrepreneurial activity and attitudes

In 2018, for a second year in a row, Bulgaria was included in the **Global Entrepreneurship Monitor** (GEM).[32] The study assesses the social perceptions and individual attitudes to entrepreneurship, the entrepreneurial activity at its various stages of implementation, and the framework conditions of the entrepreneurial ecosystem.[33]

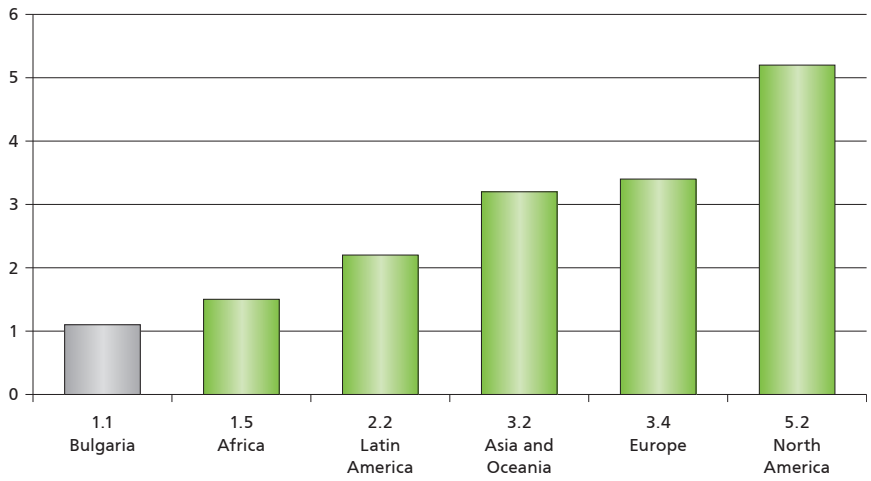
In its latest publication the analysis launches an aggregate **Entrepreneurship Spirit Index**.[34] The index value Bulgaria (-0.33, i.e. negative answers prevail) rank the country at the 48th position in the general ranking and at the penultimate 25th place among the 26 countries with efficiency-driven economies, in accordance with the methodology of the Global Competitiveness Index 2017 – 2018. European economies ranking at lower positions at this index are only Italy (0.45), Bosnia and Herzegovina (0.50), and Greece (-0.52).

Bulgaria's performance on another important indicator, the motivational index, was also low. The index reflects the percentage of those involved in early entrepreneurial activity that are improvement-driven opportunity motivated, divided by the percentage of early entrepreneurial activity that is necessity-motivated. **For 2017, the motivational index of Bulgarian entrepreneurs stayed flat at 1.1, being the lowest in Europe and in comparison with the average levels of the five main international regions included in the survey**. Only four of the countries captured by the survey have lower motivational index values.

The low motivational index and low intentions for potential entrepreneurial activity in the near future in Bulgaria, shape the weak expectations for an increase in the number of entrepreneurs and of their positive impact on the economy in terms of job creation, innovation, and internationalisation. Entrepreneurs in Bosnia and Herzegovina, Spain, Greece, and Slovakia share the same attitudes. At the other end of the scale, with the most pronounced innovation focus of entrepreneurship activity is the Netherlands, with motivational index of 10.

For Bulgaria, the lack of good prospects in entrepreneurship means preservation of the status quo, which for 2017 is **the last 54th place in the world by entrepreneurship activity**.[35] Almost as low is the coun-

Figure 24. MOTIVATIONAL INDEX OF ENTREPRENEURIAL ACTIVITY, 2017



Source: The 2018 Global Entrepreneurship Monitor (GEM).

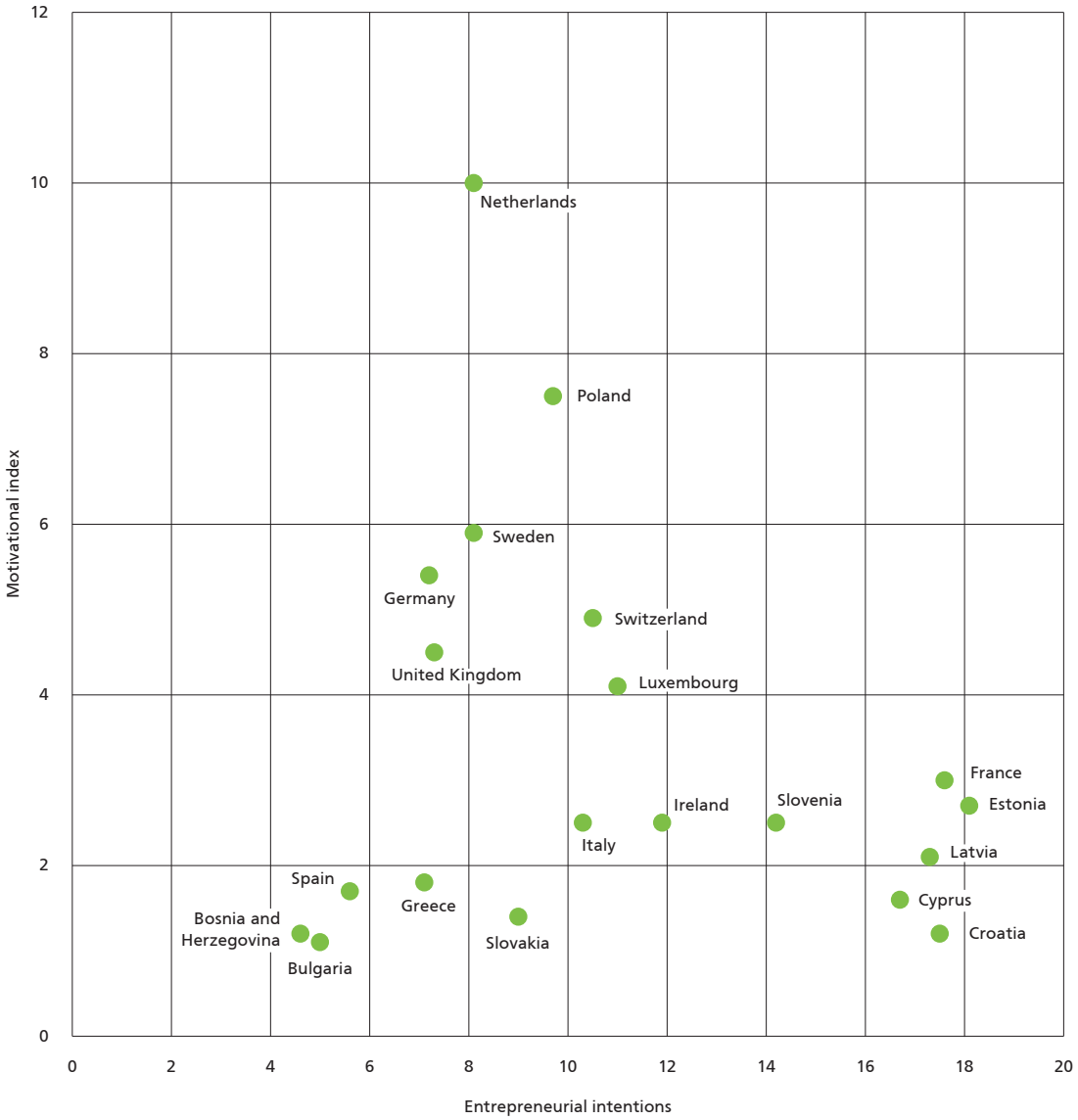
[32] http://www.gemconsortium.org

[33] REDI: The Regional Entrepreneurship and Development Index – Measuring regional entrepreneurship, http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/regional_entrepreneurship_development_index.pdf

[34] Global Entrepreneurship Monitor (GEM) 2017/2018, Global Entrepreneurship Research Association (GERA), 2018, ISBN-13: 978-1-939242-10-5. https://www.gemconsortium.org/report/50012. The index is measured on the basis of three questions related to: 1) entrepreneurial awareness ("do you know someone who started a business in the last year"), 2) opportunity perception ("do you think good opportunities exist for starting a new business on the local market"), and 3) entrepreneurial self-efficacy ("do you think you have the necessary knowledge, skills and experience for starting a new business").

[35] Measured by the share of the population aged from 18 to 64 who have started a new business in the preceding 42 months.

Figure 25. PROFILE OF ENTREPRENEURIAL ACTIVITY, EUROPE, 2017



Source: The 2018 Global Entrepreneurship Monitor (GEM).

try's position on the indicator of entrepreneurial employee activity, at which the country occupies the 48th place. Only 0.5 % of the population aged 18 to 64 is actively involved in or plays a leading role in idea development or in the preparation and implementation of a new activity for their employer, such as developing or launching new goods or services, or setting up a new business unit or subsidiary.

Bulgaria ranks equally low in the motivation for discontinuation of the venture by entrepreneurs, as it is mostly driven by emerging problems, rather than by identified new opportunities. **Bulgarian entrepreneurs rank second among the entire surveyed community on the indicator of unprofitability of the business**, trailed only by Lebanon. The only other European countries in the top ten are Spain (6th place) and Greece (7th place). Most profitable is the business of US entrepreneurs, while the leaders in Europe are Switzerland, Sweden, and the Netherlands.

Another reason Bulgarian entrepreneurs often quote for exiting their business is **difficulties with financing**. Financing is a major issue for entrepreneurs in Bosnia and Herzegovina and Italy as well. In other European countries, this barrier affects the decision on business termination to a lesser extent.

Bulgaria combines low entrepreneurial activity with weak innovation potential and expected societal impact:

- A little over 13 % of the entre-

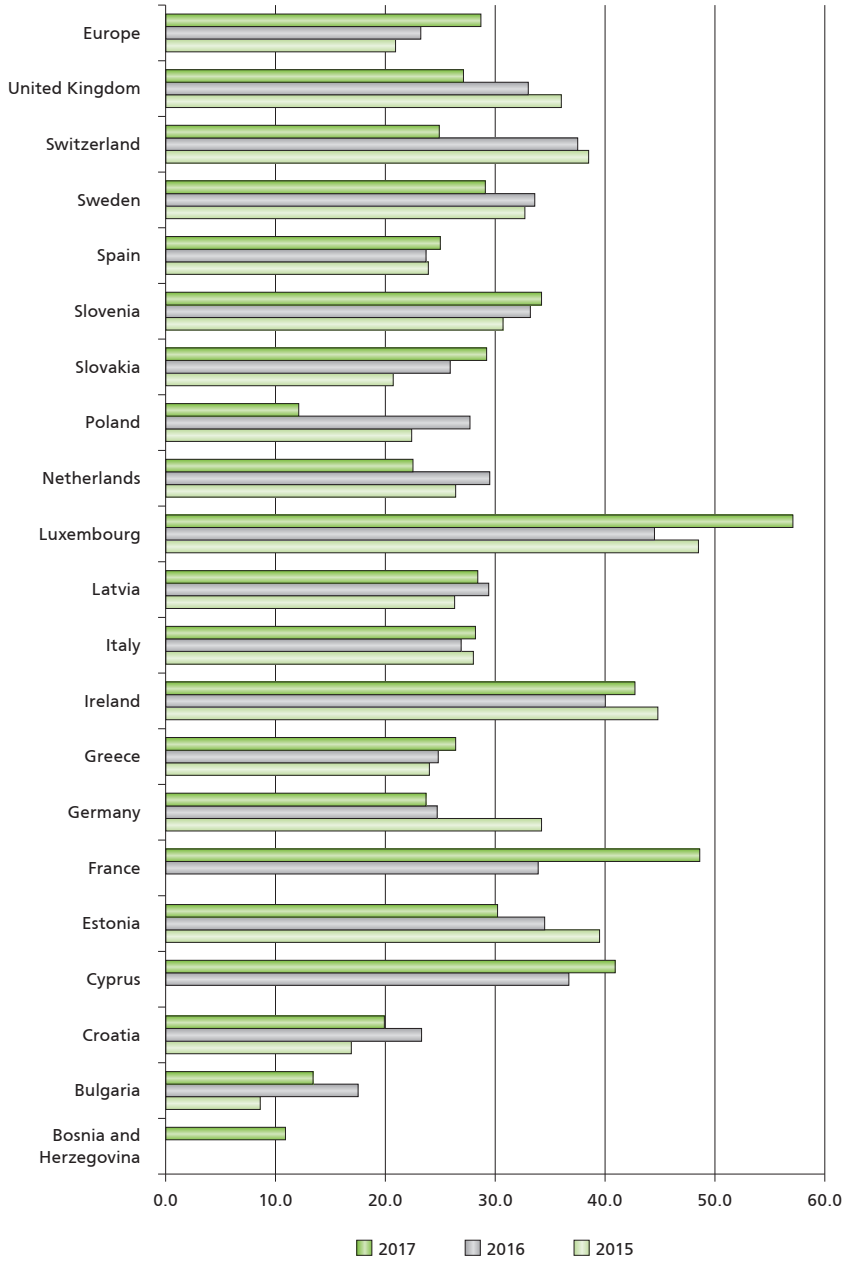
preneurs who started their own business in the last three years indicate that their products and services have novelty (at least) for some of the consumers and competitors. This puts Bulgaria at the 50th place on the international stage, one of the lowest results in Europe (ahead only of Poland with 12.1 % and Bosnia and Herzegovina with 10.9 %) and far behind the average level for Europe of 28.7 %.

- The gap is wide open also in terms of expectations for job creation. Some 9.4 % of entrepreneurs intend to expand their business and to open 6 and more new jobs in the next 5 years. About 64 % of those who started new business in Bulgaria do not plan to create new jobs and remain in the group of self-employed.

The low level of entrepreneurial activity in the country, including a decline on an annual basis, are also reflected among the different age groups. The highest share of those who started their own business in Bulgaria is that of 35-44 year olds, which despite a 5.2 % increase on the previous year, puts the country at 52nd place in the international ranking. The 25-34 year olds follow with 4.5 % and 53rd place respectively. Bulgaria's international ranking among the other age groups is similar. **For three age groups there has been a decline in entrepreneurial activity, which has been most drastic among the 25-34 year olds** (almost by half).

Bulgaria has fallen behind international trends in regard to female entrepreneurship. The share of **female entrepreneurs has dropped to merely 3 % of the population aged 18-64** (which is 70 % of the male level). This negative trend is driven by the main motive behind assuming the entrepreneurial risk: the lack of alternatives underpins female entrepreneurship to a greater extent than the opportunities for development and improvement of the status quo.

Figure 26. Level of innovativeness of entrepreneurial activity, 2017, %



Source: The 2018 Global Entrepreneurship Monitor (GEM).

Applying policies to promote female entrepreneurship is needed not only for gender equality, but also because the level of sustainability and return achieved by women entrepreneurs is higher than the corresponding results for men entrepreneurs, according to international surveys.[36] Investors, particularly in the early stages of development of the entrepreneurial idea, are pessimistic and show less trust in women entrepreneurs. Nevertheless, data shows that **newly started companies by wom-**

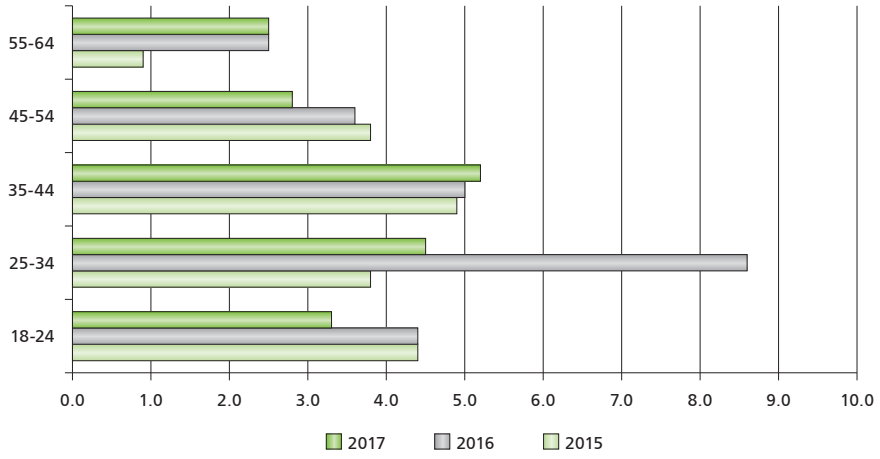
[36] Abouzahr, K., Taplett., F.B., Krentz, M. and Harthorne, J. (June 6, 2018) *Why Women-Owned Startups Are a Better Bet*, The Boston Consulting Group, Inc.

en entrepreneurs generate twice as high income and hence better return to investors compared to the level of return generated by male entrepreneurs. This makes the companies owned by women a relatively more profitable and low-risk investment in the long run.

The sectoral structure of entrepreneurial activity in Bulgaria follows logically from the low levels of innovation and motivational index of entrepreneurs in the country. **Investments are made in activities which do not require high level of professional skills and substantial investments:** mainly in retail, agribusiness and low-tech services. The ICT sector, which is **typically referred to as a "good practice"** for Bulgaria, is mainly dominated by branches (including research centres) of large multinational companies in which Bulgarian specialists find a propitious environment for development. To a lesser extent it is able to attract entrepreneurial activity compared with the average European level. The top three countries by this indicator are the Netherlands, Israel, and the UK, followed by the USA.

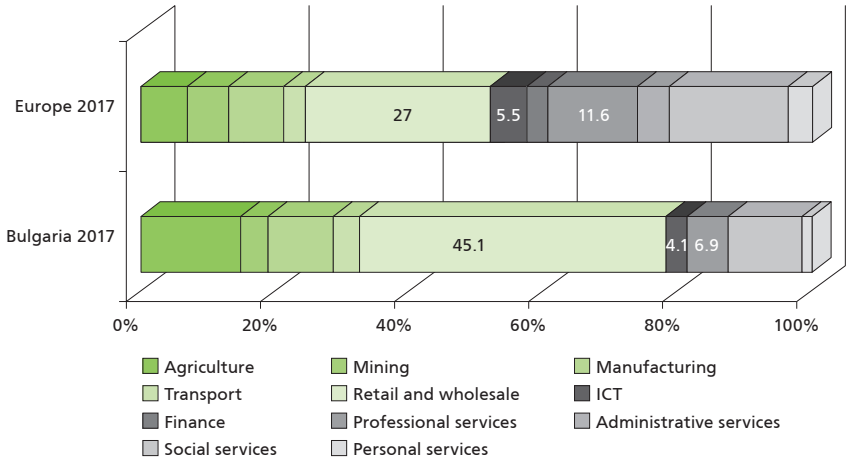
For the short three-year period in which Bulgaria has been included in the Global Entrepreneurship Monitor, no drastic changes have occurred in the business environment conditions. Bulgaria's comparative advantages lie in factors which have traditionally been regarded as ena-

Figure 27. STRUCTURE OF ENTREPRENEURIAL ACTIVITY ACCORDING TO AGE GROUP, BULGARIA, % OF THE POPULATION AGED 18-64, 2015 – 2017



Source: The 2018 Global Entrepreneurship Monitor (GEM).

Figure 28. SECTORAL STRUCTURE OF ENTREPRENEURIAL ACTIVITY, 2017, %



Source: The 2018 Global Entrepreneurship Monitor (GEM).

Box 2. VOLONTIME – THE FIRST SOCIAL NETWORK FOR GOOD DEEDS

The social media platform Volontime was established in 2017. It was the first online social network for doing good. The platform covers over 10,000 accounts of individuals, non-governmental organisations, and companies. It can be used for supporting a good cause, recruitment of volunteers, organising rummage sales, long-term commitment to corporate social responsibility, and donation campaigns. The users share information, videos, photos, comments, and contact details via the network. Thus, a community for doing good has emerged.

The network includes Volontime Store (www.store.volontime.com), a rummage sale of products to support a good cause and Volontime Articles (www.volontime.com/articles), where each organisation (business, NGO) or individual can share the story of their charity work. The platform has functionality for easily and transparently tracking donations of

Box 2. VOLONTIME – THE FIRST SOCIAL NETWORK FOR GOOD DEEDS (CONTINUED)

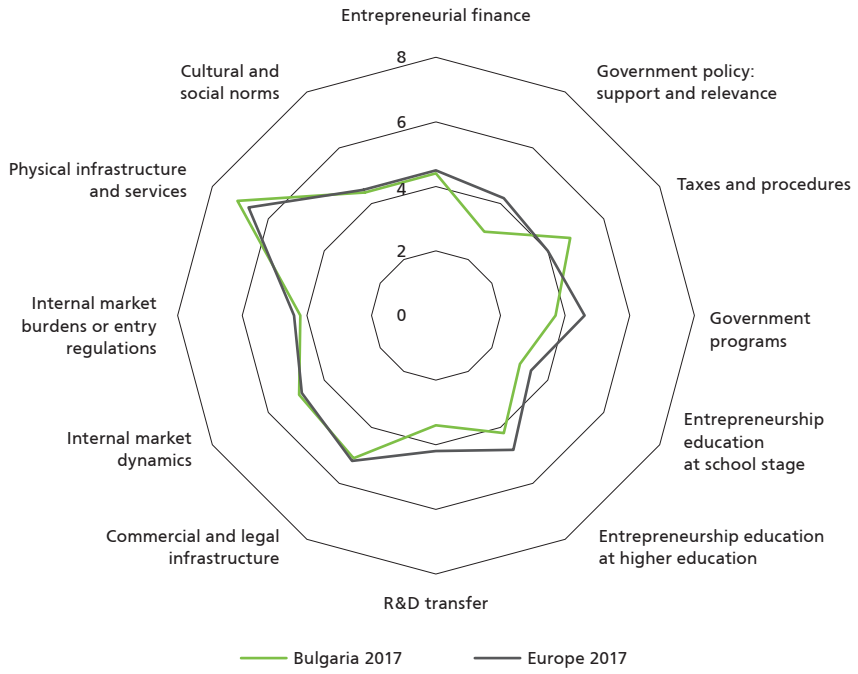
materials and funds. Among the successful campaigns of Volontime are "Flag in every home", "Plastic bag – NO, thank you!", and "You are the educator – good deeds are around us".

Volontime was a finalist in the 2017 Innovative Enterprise of the Year award. The network won the big award of the European conference for mobile applications – MobCon Demo. It is the winner in CSR DemoDay, organised by CEED Bulgaria and the Swiss Institute of Entrepreneurship.

Source: ARC Fund, 2018.

bling entrepreneurial and innovation activities, such as taxation, infrastructure, dynamics, and market access. However, these play a rather passive role and are necessary but not sufficient for vibrant entrepreneurship development. Another group of factors, including training in entrepreneurship, government support, and participation in forms of technological transfer play a proactive role and are crucial for the formation of entrepreneurial culture; it is in respect of these that national stakeholders and policy-makers have a lot of catching up to do.

Figure 29. FRAMEWORK CONDITIONS OF THE ENTREPRENEURIAL ECOSYSTEM, 2017



Source: The 2018 Global Entrepreneurship Monitor (GEM).

Access to finance is an area where entrepreneurs in Bulgaria have similar opportunities with those with the European countries. This is primarily due to the fact that along with the projects which the national government implemented at the national level, there are also some supranational initiatives by financial institutions or large multinational companies seeking solutions to technological problems through outsourcing. This enables the entrepreneurial community to be innovative in the choice of the most suitable source of finance.

Table 5. INITIATIVES FOR FINANCING ENTREPRENEURIAL IDEAS

Elevator Lab Challenge http://www.elevator-lab.com/bg/	Elevator Lab is the biggest corporate fintech accelerator in Central and Eastern Europe. It was set up by Raiffeisenbank International and aims to identify the best start-ups in the field of finance, and to build a long-term cooperation between them and the banks within the bank group. In 2018, 16 young Bulgarian fintech companies took part in the competition.
Wizz Youth Challenge https://www.wizzyouthchallenge.com	Wizz Youth Challenge is an international competition of WizzAir for university and college students, challenging them to demonstrate their potential by offering innovative and creative ideas for resolving a business problem set by the company.

Source: European Innovation Scoreboard, 2018.

Table 5. INITIATIVES FOR FINANCING ENTREPRENEURIAL IDEAS (CONTINUED)

InnoStars Awards http://www.innostarsaccelerator.eithealth.eu/innostars-awards/	Start-ups, micro and small companies dealing with the development of technological solutions in healthcare may take part in the InnoStars Awards competition. It is part of the EIT Health initiative and is supported by the European Committee of the Regions and the European Institute of Innovation and Technology.
Central European Start-up Awards (CESA) http://centraleuropeanstartupawards.com/nominate-here	Bulgarian start-ups and investors can apply for the Central European Start-up Awards (CESA) competition, which aims to distinguish the most successful participants in the Bulgarian start-up ecosystem. Anyone can be nominated in any of the 14 categories on the website of the event and the winners will be able to compete in a regional grand final. Locally, the initiative is organised by the Association of Bulgarian Leaders and Entrepreneurs (ABLE). In 2017, the regional grand final was held in Sofia and three Bulgarian companies won awards: Puzl CowOrKing in the category Best Co-working Space, Launchub for Investor of the Year, and Bee Smart Technologies for Best IoT Start-up.
Start It Smart | Pre-Accelerator www.startitsmart.com	Start It Smart is the creator of the first pre-accelerator programme in Bulgaria Start It Smart | Pre-Accelerator and of many other projects in support of young entrepreneurs – events, workshops, consulting services, entrepreneurship competitions, trainings, mentorships, etc.
DigitalK https://www.digitalk.bg/	The competition of DigitalK is part of the technological conference organised by the weekly Capital in partnership with venture funds NEVEQ and Launchub. The competition brings together international start-ups at a more advanced stage of development, which have the opportunity to present their projects to venture investors and funds from Europe and the region.
Chivas Venture	In 2018, the fourth edition of the competition for socially responsible businesses Chivas Venture was held, with a total prize fund of USD 1 million. Projects from 27 countries participated, including Bulgaria. The project of the Bulgarian team of the company Nasekomo managed to get to the semi-final of the competition, which is the best Bulgarian achievement over the years of that competition.
ClimateLaunchpad	A system for planting, ecological leather, and a platform linking chefs with clients are the projects of the winners in the fourth edition of the local competition for green business ideas ClimateLaunchpad, organised by Cleantech Bulgaria. This allows them to represent Bulgaria at the international grand final in Edinburgh where young entrepreneurs from 46 countries from all over the world participate. Ten of the best projects compete for the award of EUR 10 thousand and a place in the accelerator programme Climate-KIC Accelerator with funding of up to EUR 50 thousand.
Endeavor http://www.endeavor.bg/	Endeavor is an international network of entrepreneurs. To become part of Endeavor, the companies pass through a long selection process. One of the criteria for approval is for the business to have the potential to enter one or more markets and to be able to scale up through the resources of the organisation.

Source: ARC Fund, 2018.

Box 3. BULGARIA: EMERGING INNOVATION LEADER IN THE BOOMING FINTECH MARKET

According to a study by UniCredit Group, in 2017 there were 70 fintech companies registered and operating in Bulgaria. This puts the country at the top with the highest number of fintech companies in Central and Eastern Europe, ahead of the Czech Republic, Romania, and Slovakia. The company with the highest accumulated funding in the region, EUR 25 million, is also based in Bulgaria and is active in the financing and risk management segments.

The majority of banks in Bulgaria are foreign-owned and the technology they use is the one used by their group. The financial IT market is dominated by major global players, with only a few niche competitors, due to the low penetration of internet and mobile banking. Inadequate trust in the local banking system makes customers more conservative about adopting innovative products, especially from unknown companies. However, there are Bulgarian companies focusing on specific fintech areas such as consumer loans, debt collection, and insurance.

Source: Fintech and Innovations. Southeast Europe, SeeNews Business Intelligence for Southeast Europe, Industry Report 2018.

Box 4. A VIRTUAL CAR MAINTENANCE SERVICE

The Bulgarian company Avtoikonom started its operations at the end of 2016. The company offers a cloud-based platform and a mobile application for an interactive connection between the owner of the vehicle and the providers of services, service stations, technical checks, insurance, and lease companies. The company has special discounts for mothers with children and a specialised service station for disabled persons.

In 2017, Avtoikonom was one of the finalists in the Innovative Enterprise of the Year award. In 2018, it was declared the most innovative company of Webit, and won the big prize of the daily 24 Chasa in the competition The Big Small. The company is one of the four Bulgarian companies participating in StartUP! Germany, a fair and a competition for start-ups in Germany.

The company sets a standard for vehicle servicing. It includes both technical requirements and options for scheduling a repair, a video recording to track claims, systems for customer management and communication, an average price of the service. A professional driver takes care of the car and all the time there is a video recording of the car's route, a tracking system of the service status.

Avtoikonom plans to enter the market in several European countries – Belgium, Germany, France, Spain, Romania, and the Scandinavian countries.

Source: ARC Fund, 2018.

Box 5. WEEMSS – THE BULGARIAN SOFTWARE FOR EVENT MANAGEMENT

Weemss is a cloud-based platform for event management, launched in 2014. Its founders are one of the first Bulgarian entrepreneurs relying wholly on a virtual office with employees working from home. Today, the innovative software services users from over 80 countries on 6 continents.

Weemss is an online platform for event management and a mobile application for check-in of participants (for iOS and Android). Weemss allows integration with over 1,000 applications and services via Zapier. It is third in the Getapp ranking "Leaders in event management software" – a leading platform for finding and comparing cloud-based solutions. "The secret of Bulgarian software being that successful is simple: a constant pursuit of innovation and attention to the needs of customers", comments the co-founder of Weemss.

Source: ARC Fund, 2018.

Investment and Financing of Innovation

Spending on research and innovation is a measure of the investment in the creation, use and dissemination of new knowledge in the public and business sectors. It is considered an indirect indicator of the innovation capacity of the national economies. A high ratio of R&D financing to GDP is a factor fostering dynamic economic growth and competitiveness.

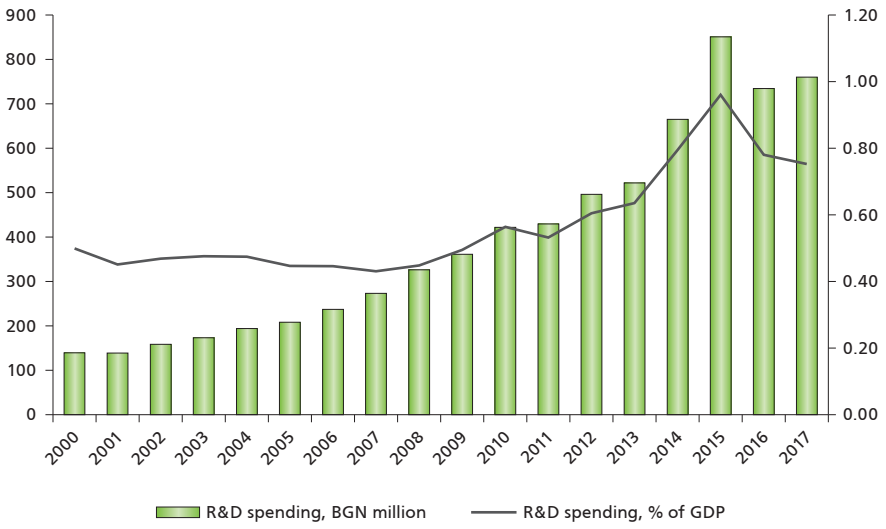
R&D spending

R&D expenditures in Bulgaria peaked in 2015 in absolute terms and as a share of GDP. In 2016 they declined by 16 %. In 2017, **R&D expenditures increased** in absolute terms by a modest 4 %. **However, their share in GDP continued to decline for a second year in a row and reached 0.75** % (versus 0.96 % in 2015). Such a trend distances the country further from the national target of 1.5 % share of R&D expenditures in GDP by 2020.

Given that in the past seven years the share of public spending on R&D in GDP has oscillated around the level of 0.19 %, changes in the "country total" indicator, in absolute and relative terms, should be attributable to the business sector. The budget of enterprises for new developments is formed mainly of own funds and proceeds from abroad. The reduced amount of funds from abroad provoked the downward change in 2017.

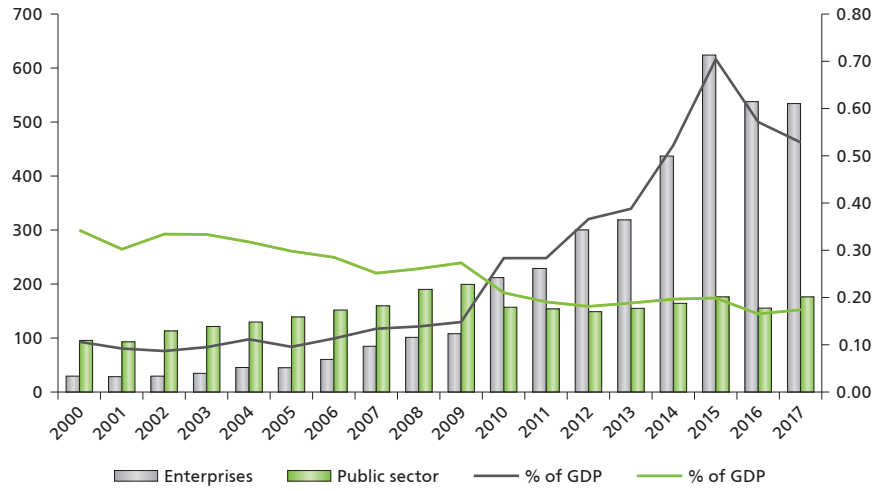
After 2009, the public sector has ceded its position as the main source of R&D funds and for the past five years the bulk of R&D expenditures in the country have been funded by foreign investments. Since Bulgaria's full accession to the EU, 80 % of proceeds from abroad intended for R&D have been the result of interest by private business investors. Slightly above 17 % of the funds have come from the European Commission, i.e. based on successful project cooperation of Bulgarian organisations. **Since 2016, the bulk of R&D has been contracted by business**.

Figure 30. R&D SPENDING IN BULGARIA, 2000 – 2017



Source: NSI, 2018.

Figure 31. R&D SPENDING, ENTERPRISES AND PUBLIC SECTOR, 2000 – 2017



Source: NSI, 2018.

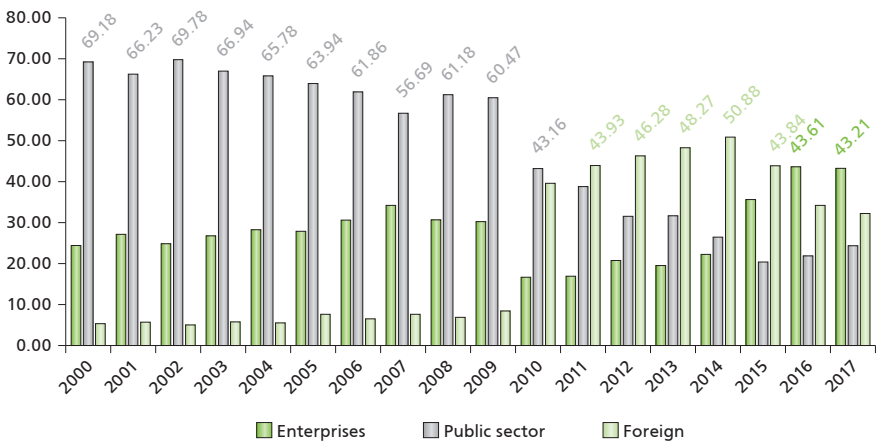
In terms of joint research, the institutional sectors remain within their confines: **95 % of business investments remain in the sector**, accounting for up to 60 % of their R&D expenditures. Similar is the situation with the pub-

lic sector – **95 % of public funds for research and development return to public research units and higher schools.** Most open to collaboration are higher schools, which channel 34 % of their R&D budget to enterprises and 36 % to the public sector. In turn, higher schools finance 40 % of their R&D costs from the public sector and 22 % from business. The expectations are that with the building of the regional innovation centres (see Box 6) the applications by business to research and academic units and associated financing will increase.

Large enterprises (over 250 employees) continue to be the main investor in R&D. They are the only businesses which increased their expenditures for R&D in 2017, while all the other groups reported a drop (by -2 % for small enterprises, and by -10 % for micro and medium-sized enterprises). This is a gross but clear sign of the ultimate lack of visible results from the government's SME support policies, including the management of EU funds for SMEs.

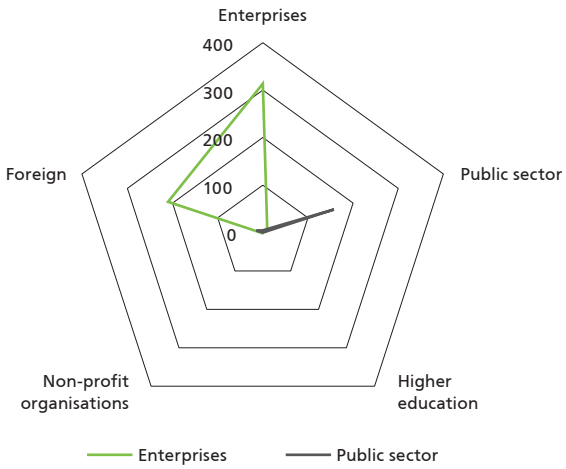
R&D spending is a function of a long-term strategy for innovation-based growth. Judging by the investments in fixed tangible assets (about 12 % of R&D expenditures of the sector in 2017), the Bulgarian **business is more interested in achieving sustainability and building competitive advantages based on research and innovation capacity**. In addition, through their capital outlays enterprises have a positive impact on the structure of R&D expenditures, as in the **public sector 98 % of the 2017 R&D spending covered running costs**. The latter is true for the university sector too, with a share of running costs at 95 %. Against this background, the Diagnostic Review of Research Infrastructure and Research Equipment in the Republic of Bulgaria[37] expectedly made numerous and profound recommendations for further development and building of the research infrastructure in the country.

Figure 32. STRUCTURE OF R&D SPENDING BY SOURCE OF FUNDING



Source: NSI, 2018.

Figure 33. R&D EXPENDITURES BY SOURCE OF FUNDING, ENTERPRISES AND PUBLIC SECTOR 2017



Source: NSI, 2018.

Although not enjoying a substantial increase in financing in 2017 (up by merely 3 % year-on-year, unlike the increase by 27 % for agricultural sciences and by 20 % for humanitarian sciences), **technical sciences continued to be the most attractive area, accounting for 57 % in the structure of total R&D expenditures.** The business sector provided the main portion of these funds (73 % of the total R&D investments of enterprises, with medical sciences accounting for another 23 %). Unlike business, which is pragmatically oriented and invests in applied research with predictable return and market results, public sector institutions invest mainly in natural and agricultural sciences (43 % and 20 %

[37] Results from diagnostic review of research infrastructure and research equipment in the Republic of Bulgaria, National Roadmap for Research Infrastructure (2017 – 2023), Ministry of Education and Science, Decision No. 354 of the Council of Ministers of 29.06.2017.

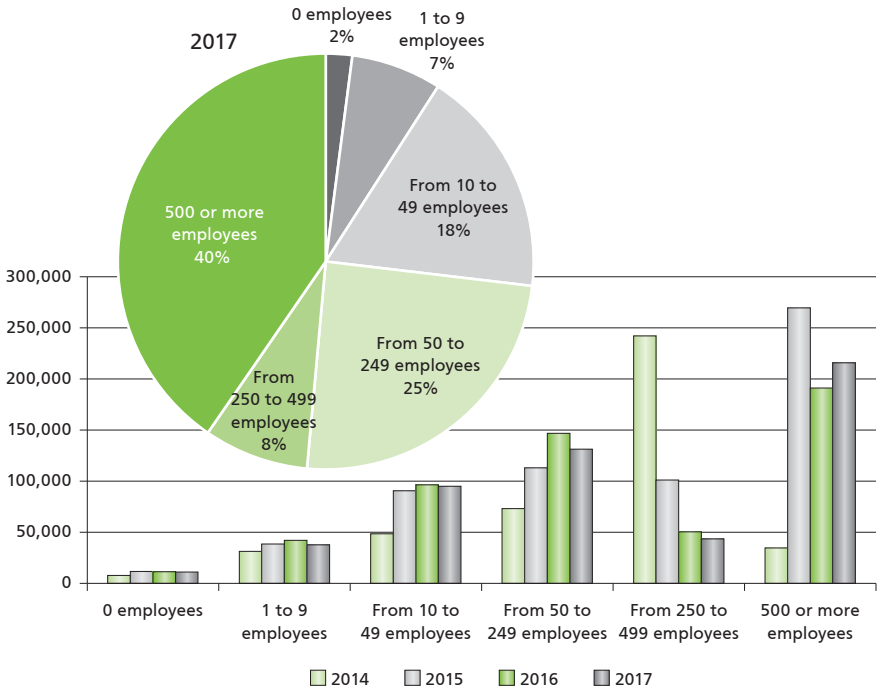
of the total R&D expenditures in the public sector). Technical and natural sciences have almost equal priority for the university sector (34 % and 29 % of their total expenditures respectively).

Over the last ten-years, public expenditures for research and development amount to BGN 2.046 billion. The expenditures in each of the main sections of the Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets (NABS 2007) have fluctuated significantly. Most pronounced have been the fluctuations in the defence sector. After growth of 400 % in 2010, through a 97 % decline in 2014, to the extraordinary jump by over 4000 % in 2017. Nevertheless, the share of budget spending on science in the defence sector continues to be among the lowest in structural terms: less than 1 % for the past year, or almost equal to the share of spending in "culture, entertainment and religious activities" (0.83 %).

Similar dramatic variations, although within smaller ranges (from some 10 % to some 600 % change year-on-year), occurred in other fields, including in research and exploitation of the surface, waters and atmosphere, development of transport, telecommunications and other infrastructure, and the production, storage, distribution and use of energy.

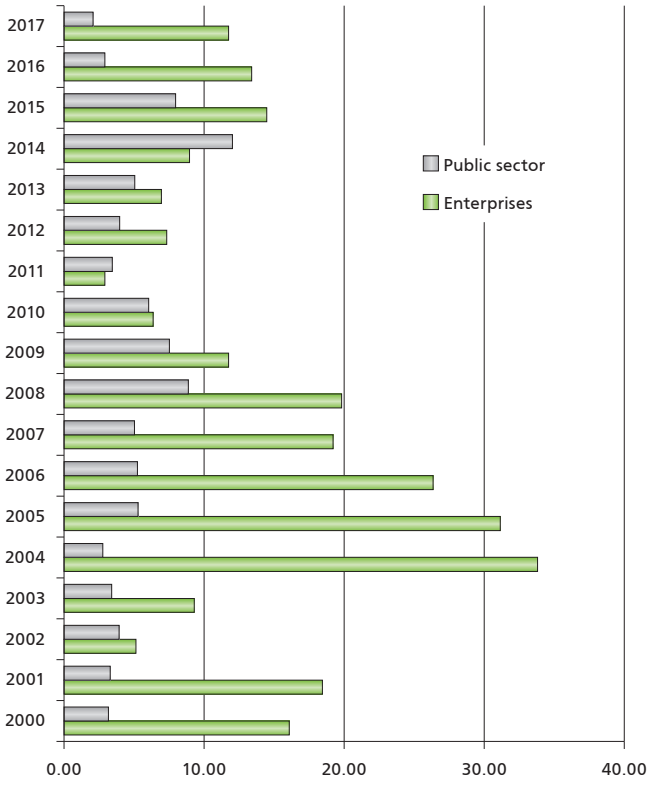
Unlike the extremely limited budget for R&D in 2016, **in 2017 government budget spending on science grew by 14** %. Apart from defence spending, public universities and space research institutes received a 40 % raise. Of all the fourteen research areas under review, there was a decline in the budget in only three areas – development of transport, telecommunications and other infrastructure, production, storage, distribution and use of energy, and improvement of industrial production and technologies.

Figure 34. R&D SPENDING BY ENTERPRISES, THOUSAND BGN



Source: NSI, 2018.

Figure 35. EXPENDITURES TO ACQUIRE FIXED TANGIBLE ASSETS, % OF R&D SPENDING, ENTERPRISES AND PUBLIC SECTOR, 2000 – 2017



Source: NSI, 2018.

In each year of the past ten-year period, two-thirds of the public spending on R&D has been allocated to the institutes of BAS (about 40 %), the institutes of AA (about 16 %) and the universities (about 8 %). The only exception was 2009, when universities received over 80 % of public sector resources for science.

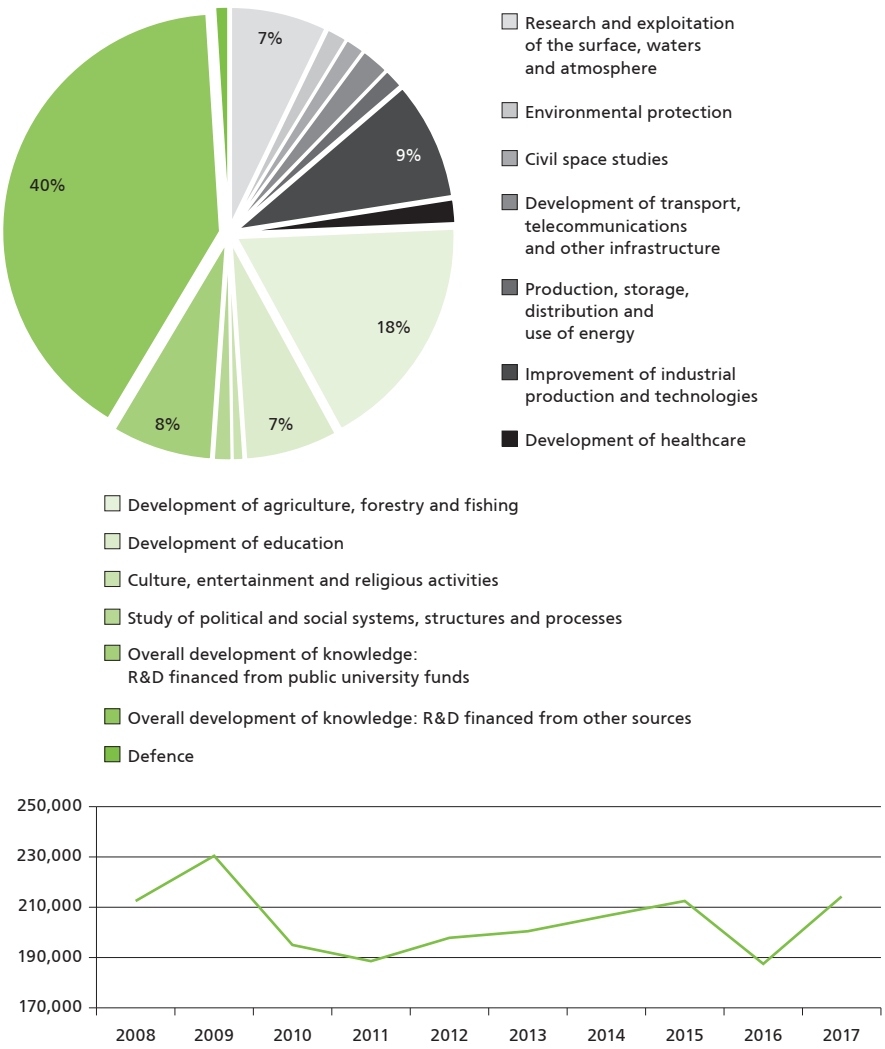
Implementation of the Innovation Strategy for Smart Specialisation of Bulgaria 2014 – 2020

Bulgaria relies on the European Structural Funds to meet the targets of the ISSS. The operational programmes are the key sources of funding with additional minor resources provided through the National Innovation Fund managed by the Ministry of Economy and focused on applied research and development, and the National Research Fund at the Ministry of Education and Science, which finances primarily fundamental science.

Data on the allocated EU financial resources by objective, sub-objective and source of funding show that for the financial period 2014 – 2020, EUR 1,415.6 million is dedicated to innovation development. Most of these funds (about EUR 1 billion) are allocated to priority thematic areas (see section Smart specialisation in Bulgaria: making EU funds deliver for the Bulgarian economy), with a focus on improving the cooperation between science and business. By 2018, OPIC has allocated EUR 75.5 million for the thematic areas of ISSS and about 50 % of that amount is for mechatronics and clean technologies.

As of early 2018, the contracted financial resources under ISSS account for 48.5 % of the planned budget for the period. The most tangible progress was made under the heading for building adequate environment and infrastructure for innovation (88.9 %), followed by the innovation for resource efficiency (64 %) and the implementation of ICT applications (60 %). Efficient science-business cooperation has 44.1 % of the funds allocated. Yet, regional imbalances remain significant, a problem which could be overcome by boosting SME innovation in rural areas.

Figure 36. PUBLIC SPENDING ON R&D BY SOCIO-ECONOMIC OBJECTIVE, THOUSAND BGN, 2008 – 2017



Source: NSI, 2018.

Bulgaria in the framework programmes of the EU

The largest economies in the EU, Germany, the United Kingdom, and France, retain their leading positions in the absorption of European funds under the 8th Framework Programme for Research and Innovation of the European Union, Horizon 2020.

With a total amount of contracted funding of over EUR 62.540 million, Bulgaria ranks 24th on the amount of awarded European funds among the 28 EU member states. Of the 375 projects with Bulgarian participation, in 31 a Bulgarian organisation is the coordinator out of a total of 194 organisations participating in H2020 projects.

Sofia University leads with 19 successful projects and over EUR 4,071 thousand of funding, followed by

TABLE 6. CONTRACTED FINANCIAL RESOURCES BY OBJECTIVE AND SUB-OBJECTIVE UNDER ISSS 2014 – 2020

Strategic framework			Financial source	Indicative budget 2014 – 2020, million EUR				Contracted funds as of 2018	
				Total	EFRD	ESF EAFRD	National aid	Mln. EUR	%
By 2020 Bulgaria should go to the group of moderate innovators	Focus on innovation potential in identified thematic areas	Efficient science-business cooperation	OPIC OPSESG NIF NSF Horizon 2020	992.00	438.75		553.25	437.80	44.1
		Quality human resources	OPSESG OPHRD NYP European Programmes	114.44	92.95	4.25	17.24	5.00	4.4
		Adequate environment for innovations	OPIC OPGG RDP	194.20	30.00	133.20	31.01	172.70	88.9
	Resource efficiency and ICT implementation	Innovations for resource efficiency	OPIC OPE Norwegian Programme Horizon 2020	65.00	35.00		30.00	41.60	64.0
		Implementation of ICT applications	OPIC Horizon 2020 Ecsel JU	50.00	25.50		24.50	30.00	60.0
				1,415.6	**622.5**	**137.4**	**655.7**	**678.1**	**48.5**

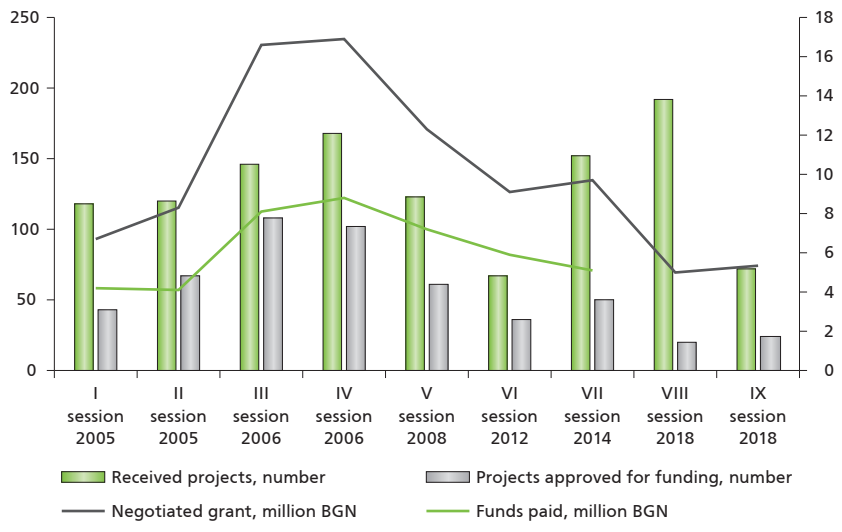
Source: Annual report on ISSS 2014 – 2020 performance.

the **Applied Research and Communications Fund** with 11 projects. In regard to the amount of funding, the leader is the **Centre for Plant Systematic Biology and Biotechnology** with contracted funding of EUR 7,350,000 for 2 projects.

In the higher education sector, 18 universities won projects under Horizon 2020. Second, after Sofia University, ranks the Technical University of Sofia both in terms of number of projects and funding, with 5 projects and a total budget of EUR 1,759,000.

The business sector is represented in Horizon 2020 by 61 companies. Pensoft Publishing House has the high-

FIGURE 37. NATIONAL INNOVATION FUND PERFORMANCE



Source: BSMEPA, 2018.

Box 6. REGIONAL INNOVATION CENTRES IN SUPPORT OF APPLIED SCIENCE AND INNOVATION POTENTIAL AT THE REGIONAL LEVEL

The main goal of OPIC's procedure for support of Regional Innovation Centres is to build and develop modern research and innovation infrastructure and expertise to conduct applied open-end research and development, thus contributing to the accelerated economic and social development of Bulgarian regions. The procedure will support projects initiated by enterprises with high innovation potential in cooperation with research organisations, aiming to create research and innovative capacity in support and development of the local economy in line with the priorities of ISSS for regional specialisation.

The total budget of the procedure is BGN 100 million with minimum and maximum amount of the grant of BGN 1.5 million and BGN 7 million, respectively. The total budget will be allocated among the six NUTS II regions, excluding the city of Sofia. The procedure will finance between one and three regional innovation centres in each region. The projects which do not receive funding under the pre-announced criteria will participate in a general ranking and will be funded until depletion of the available funds.

Source: http://opic.bg/

est number (9) of project participations with funding of EUR 1,705,000, followed by Ontotext with 6 projects and EUR 1,491,000.

In the past five years of this programming period and after 28 completed sessions of the SME Instrument of Horizon 2020, Bulgaria has 11 successful projects, including 10 in phase 1, focused on assessment of the economic viability of the idea, and one project in phase 2, the funding of which aims at innovation development and demonstration.

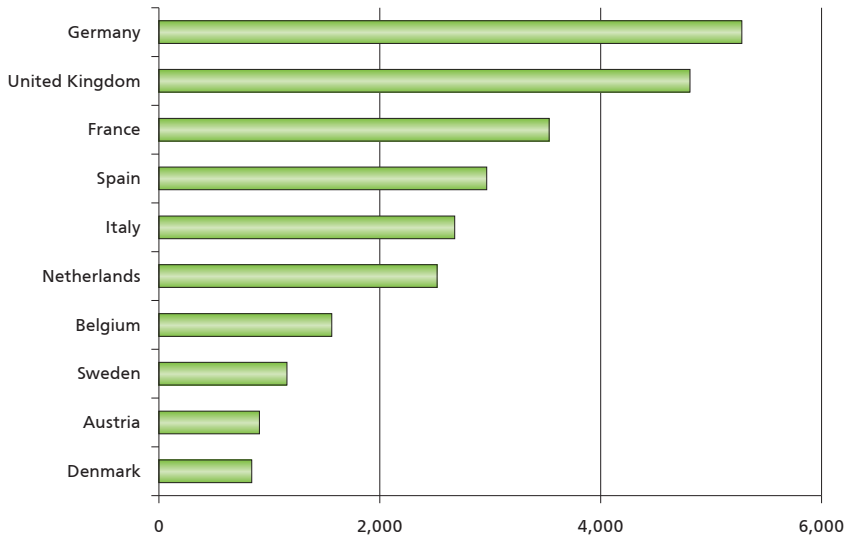
Spain remains the undisputed leader in the overall ranking both in terms of awarded projects (734), and in terms of attracted funding (EUR 283,697,980.12) in the company of 39 countries in the SME Instrument. In the Top 5 on both indicators are also Italy (with 593 projects), United Kingdom (398), Germany (286) and France (241).

Bulgaria ranks 28th by the number of successful projects and 32nd by the amount of funding (EUR 1,706,587). Among the group of EU member states, Bulgaria is ahead of Cyprus, Romania, Croatia, Luxembourg, and Malta.

The EC instrument **Innovation Radar**[38] made a further step forward in studying the impact of the projects financed by European funds in member states. Based on the analysis of data of projects implemented under Horizon 2020, under the Seventh Framework Programme, and under the programme Competitiveness and Innovations after 2007, the Radar identified projects with the greatest effect on the European economy and quality of life as a result of new technological knowledge and innovative results introduced in practice.

The Institute of Mechanics of BAS is the only representative of Bulgaria on the Innovation Radar. It participated in the VERE project funded under the Seventh Framework Pro-

Figure 38. TOP 10 COUNTRIES WITH THE HIGHEST PROJECT ACTIVITY UNDER HORIZON 2020, CONTRACTED FUNDING, MILLION EUR



Source: European Union Open Data Portal, September 2018.

[38] Prato, G., D. Nepelski, G. Piroli, *Innovation Radar: Identifying Innovations and Innovators with High Potential in ICT FP7, CIP & H2020 Projects*, European Commission/Joint Research Centre, ISSN 1831-9424 (online), ISBN 978-92-79-49057-6 (PDF), doi:10.2791/61591, 2015.

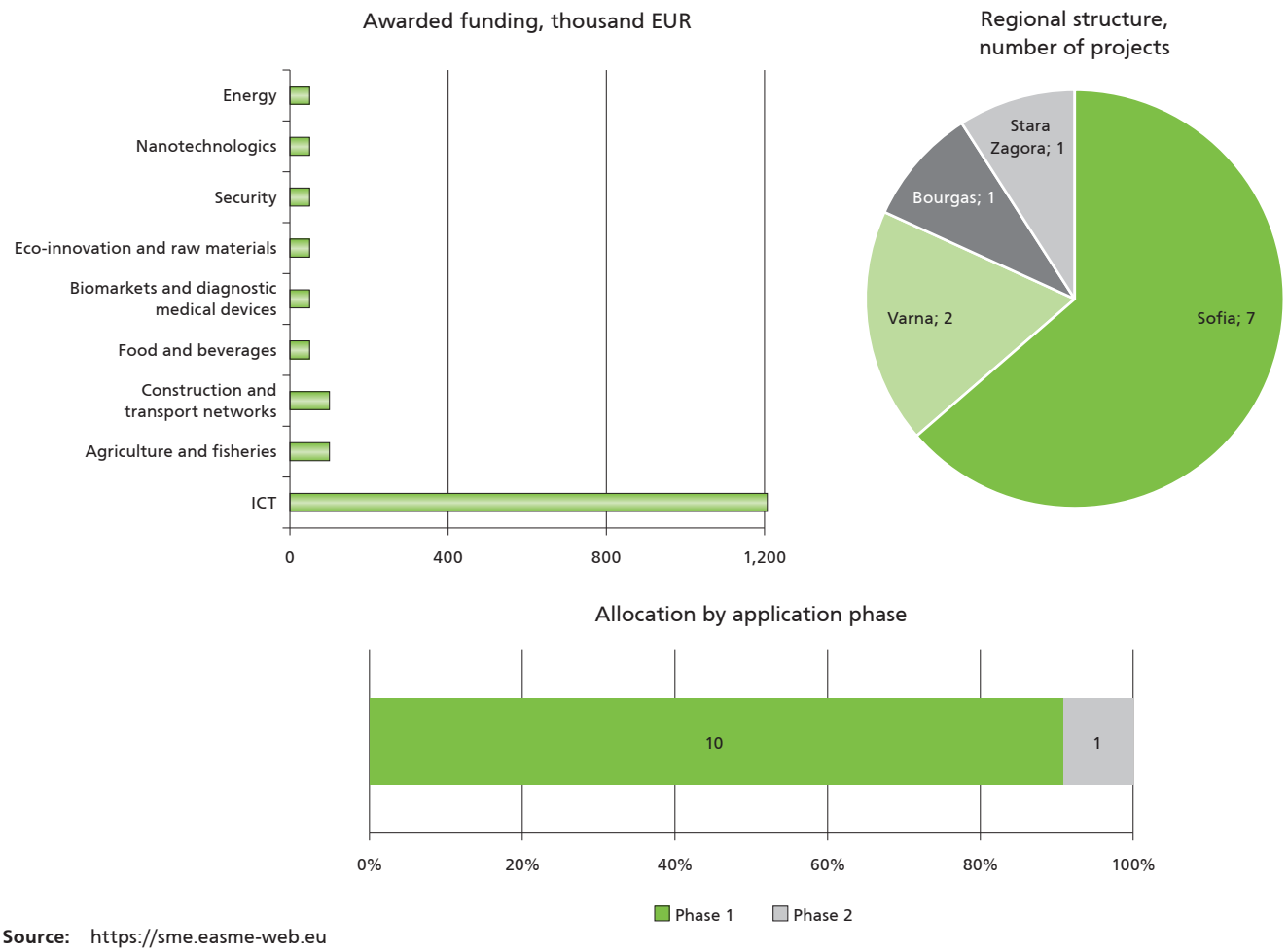
Table 7. BULGARIA'S PARTICIPATION IN PROJECTS WITH HIGH INNOVATION POTENTIAL

Project	Innovation	Phase*	Thematic area	Bulgarian partners	Consortium
MODUM (FP7)	MODUM system smart-phone interface for public transport itinerary information	Creation	Smart & Sustainable Society	Urban Mobility Centre Microprocessor Devices and Transport Systems	Austria Belgium Bulgaria Netherlands United Kingdom
EPLACE (CIP)	EPLACE: an innovative online platform for energy savers	Optimisation	Smart & Sustainable Society	Regional Energy Agency, Pazardjik Erato AD Septemvri Municipality	Bulgaria Germany Spain Ireland
	ICT tool to increase end users awareness in energy efficiency	Creation			

* Optimisation refers to technologically mature innovations considered ready for the market. Creation means innovations progressing on technology development process. Further action in terms of market-oriented actions is required. Commitment refers to innovations for which concrete market-oriented ideas are in place (e.g. market studies, business plans). Further progress on tech development is required. Exploration refers to innovations in early phases of technological readiness, with high commitment from organisations developing them.

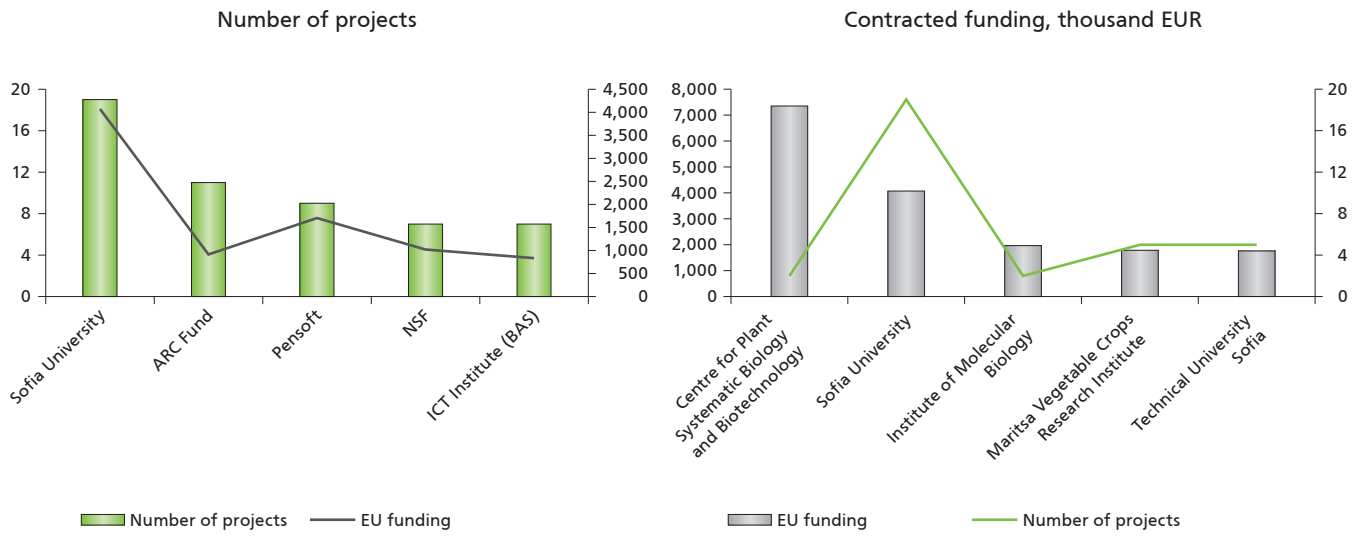
Source: European Commission, DG Connect.

Figure 39. BULGARIA IN THE SME INSTRUMENT



Source: https://sme.easme-web.eu

Figure 40. TOP 5 BULGARIAN BENEFICIARIES UNDER HORIZON 2020

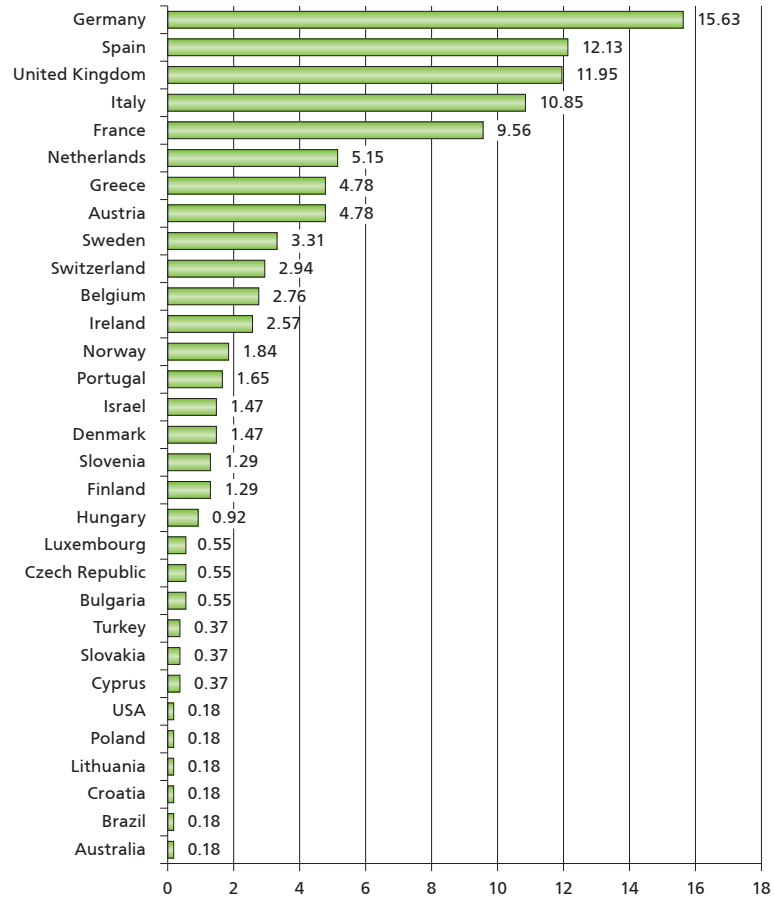


Source: European Union Open Data Portal, September 2018.

gramme, providing input to the development of active orthotic devices and linkage to virtual avatars. The project was implemented in partnership with 16 organisations from 10 countries.

According to a study by DG Connect and the Joint Research Centre (the two units of EC which have developed the methodology of the Innovation Radar), in the period May 2014 – January 2015, the organisations which were leaders in innovation were situated in 31 countries. Bulgaria ranked 22nd with a share of 0.55 %. The leader was Germany, having the highest number of organisations with strongly pronounced innovation capacity. Over 15 % of the research units which have received European framework funding were located in Germany. With shares exceeding 10 % were also Spain, the United Kingdom, and Italy. Innovative organisations from non-EU countries, such as Switzerland, Norway, Turkey, Australia, Brazil, and the USA were also included in the ranking.

Figure 41. GEOGRAPHIC LOCATION OF INNOVATORS, %



Source: https://www.innoradar.eu/

Human Capital for Innovation

Staff engaged in R&D together with those employed in scientific and technological activities comprise the human resources directly responsible for the creation, application and dissemination of new knowledge in the area of technologies. The indicator of employment in high-tech sectors characterises the country's specialisation in sectors with a high level of innovation.

The year 2017 marked the end of a five-year upward trend in the number of staff employed in R&D. **There has been an overall decline of 3.4 % year-on-year,** which is more pronounced for the technical staff, by some 9 %, and is less notable for researchers, who declined by less than 1 %. As a result, the structure of the staff engaged in R&D has slightly shifted in favour of researchers, with a share of 67 %.

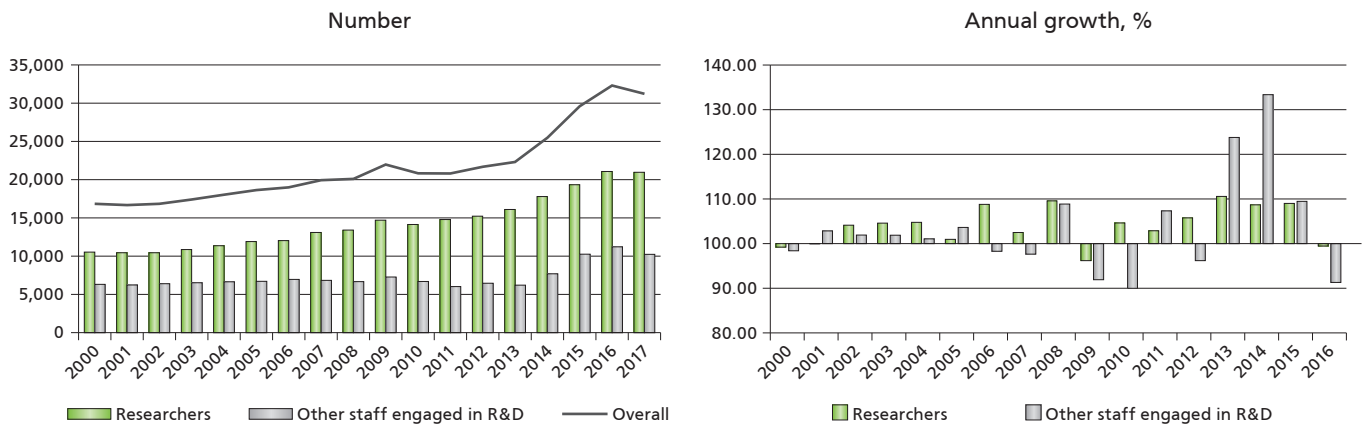
There have been different developments in the institutional sectors in regard to human resources. **The biggest drop occurred in the higher education sector** (7 %), fully offsetting the 2016 growth. There was a minor drop in the public sector but it occurred in the context of a sustainable downward trend since 2013. The outflow of human resources from the two sectors has been both a cause and a result of the decline in R&D expenditures of the universities and the institutes of BAS and AA (see section Investment and financing of innovation), as they are mainly covering running costs or salaries.

For another consecutive year, the share of enterprises with R&D staff increased (42 %), which is attributable to several factors:

- Innovative and high-tech enterprises have expanded their operations, which in turn prompted the need for qualified personnel. Quite often the expansion takes the form of serial entrepreneurship or spin-offs, i.e. the establishment of new enterprises instead of expanding the existing enterprise.
- A larger number of enterprises report statistical data for R&D and innovations, including staff employed in R&D, in their annual financial statements to the NSI. This is largely due to requirements to report R&D to receive EU funding for innovation.
- There has been an increase in foreign investments aimed at establishing production units across the country, but also at creating R&D outsourcing centres which attract a higher number of researchers.

After 2011, when the business sector started to invest more intensively in research and development, **technical sciences became the leading scientific field with the highest share of funding and R&D staff.** In fact, 73 % of the business expenditures for R&D are concentrated in the technical sciences and 23 % are targeted at the medical sciences. As medicine attracts the attention of the business sector, it is the second scientific field which has had a constant rise in staff employed in R&D since 2011.

Figure 42. STAFF EMPLOYED IN R&D, 2000 – 2017



Source: NSI, 2018.

Despite the 3 % drop in the technical sciences' R&D employment in 2017, they still account for 40 % of the total number of R&D employees. Natural and medical sciences have almost equal shares, 18 % and 17.7 %, respectively.

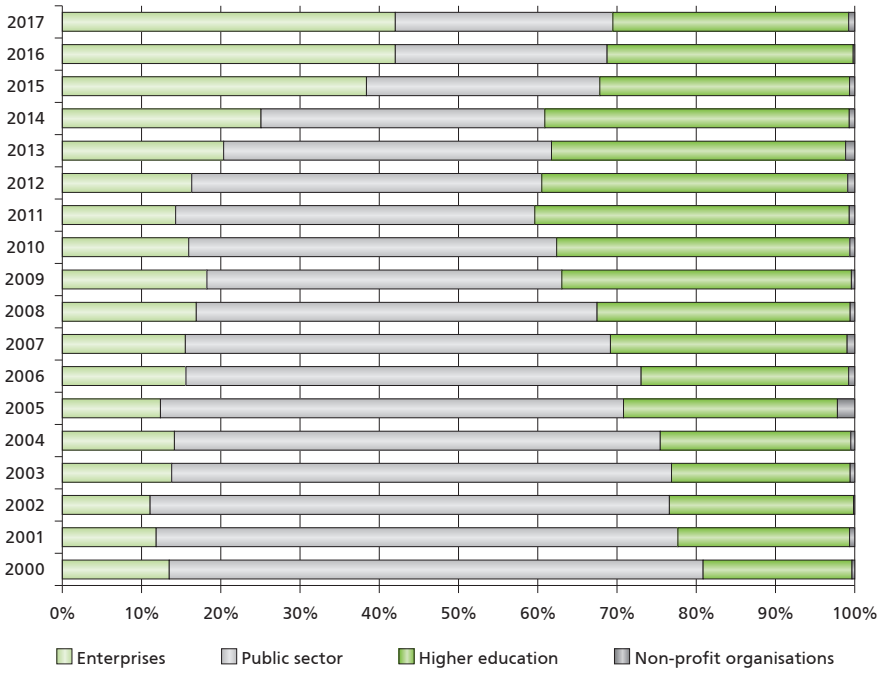
As regards the age structure of R&D staff, the public sector **employs the largest share of those aged 55-64 (28 %) and 35-44 (27 %)**. These two age groups experienced the most dramatic decline in recent years, by some 40 % from 2007. For the same period, the number of R&D staff aged 25-34 tripled, a positive trend of attracting young people to research.

A similar trend exists in the higher education sector. Compared with 2007, universities attracted four times more research staff in the under 25 age category, and twice as many R&D employees aged 35-44. Albeit at a slower rate, **universities expanded their staff in the other age categories as well, a somewhat surprising development given the decreasing number of students in the country** and no student enrolment in a number of university majors.

After the continuous annual growth in the number of employees in R&D in the enterprise sector for all size categories since 2012, in 2017 these numbers declined for all sizes of enterprises. The most significant decline was registered among medium-sized enterprises (50-249 employees) and the big enterprises (250-499 employees) – by 14 % and 16 %, respectively. A smaller decline occurred in micro (1-9 employees) and small (10-49 employees) enterprises – by 3 % and 5 %, respectively. An exception to this trend were **enterprises with over 500 employees, which in 2017 managed to increase the number of their R&D staff by some 10** %.

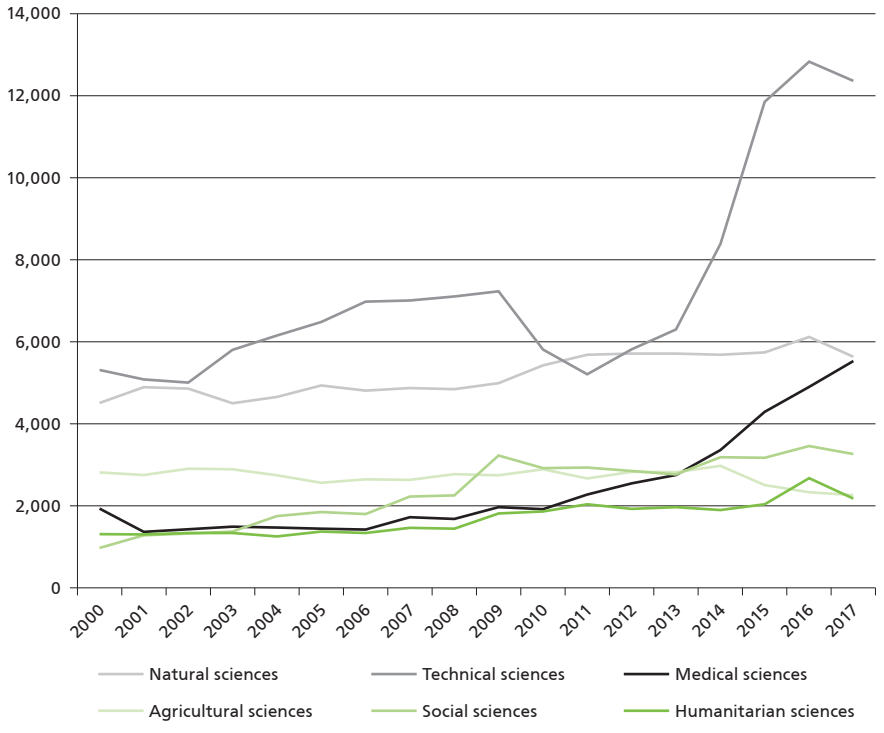
In the last several years, the efforts of the European Commission have been

Figure 43. SHARE OF STAFF EMPLOYED IN R&D, BY INSTITUTIONAL SECTOR, %, 2000 – 2017



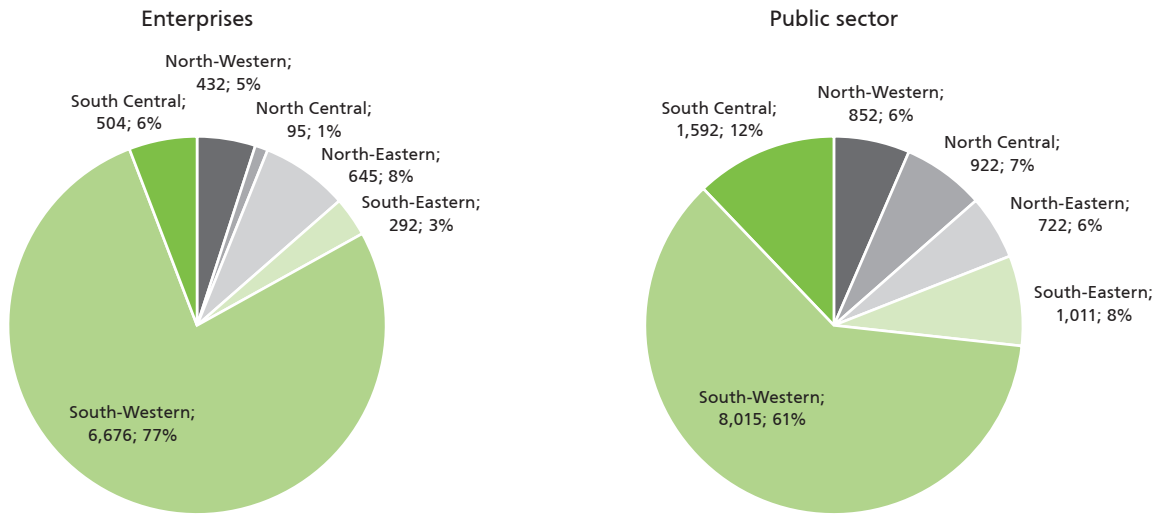
Source: NSI, 2018.

Figure 44. STAFF EMPLOYED IN R&D, BY SCIENTIFIC FIELD, NUMBER, 2000 – 2017



Source: NSI, 2018.

Figure 45. STAFF ENGAGED IN R&D, BY PLANNING REGION, 2017



Source: NSI, 2018.

focused on promoting some specific aspects of human resources development in R&D.[39] The focus is gradually shifting from the analysis of purely quantitative indicators relating to the number of university graduates and staff engaged in R&D towards areas which are more difficult to measure and manage but ensure a longer-term and sustainable impact on the quality of the labour force. The main aim is to develop skills and competences that allow more flexibility, mobility, and adaptability to labour market changes, development of technologies, and changing living conditions.

While Bulgaria has managed to perform relatively well on the standard indicators for skills and competences, i.e. the adaptability of the labour force and the population as a whole to the changing factors of the environment, the negative findings prevail for the more sophisticated indicators:

- **67 % of people aged 16-74 do not have digital competences,** while the EU-28 average share is 41 %. This is a worryingly high percentage, especially given the prediction that digital skills will be a requirement for each profession in the near future and the expectation that the digital common market will generate EUR 415 billion within the European economy.
- **Only 2 % of the population is engaged in lifelong learning** versus 11 % on average for the EU-28.
- **54 % of employers (40 % for EU-28) have difficulties in finding staff with the necessary education and competences**. Against this background, only 31 % of the companies (versus 66 % for EU-28) fund on-the-job training programmes.
- The three professions with the highest growth in Bulgaria are: a) workers in the mining and construction sectors; b) cashiers, bill collectors and bank employees; and c) intermediaries in the provision of business services.

In addition, **Bulgaria is one of the EU countries with the highest value of the index of the work force which is overqualified for their respective job**. The highest such levels are in trade (49 %), transport and logistics (39 %), and the processing industry (31 %), which had remained almost unchanged in the period 2008 – 2016. These Eurostat data fully correspond to the low motivational and innovation index of entrepreneurial activity in Bulgaria (see section Entrepreneurship and innovation networks).

Another typical **imbalance of the labour market in Bulgaria is the discrepancy between the field of occupation and the field of education**. The share of employees whose education does not match the requirements of the profession is the highest in agriculture – 74 % versus 52 % on average for EU-28. There are discrepancies in the areas of education (49 %), humanitarian sciences and arts (46 %), production and construction (42 %), too.

Based on the results of the **World Talent Ranking**[40] of the World Competi-

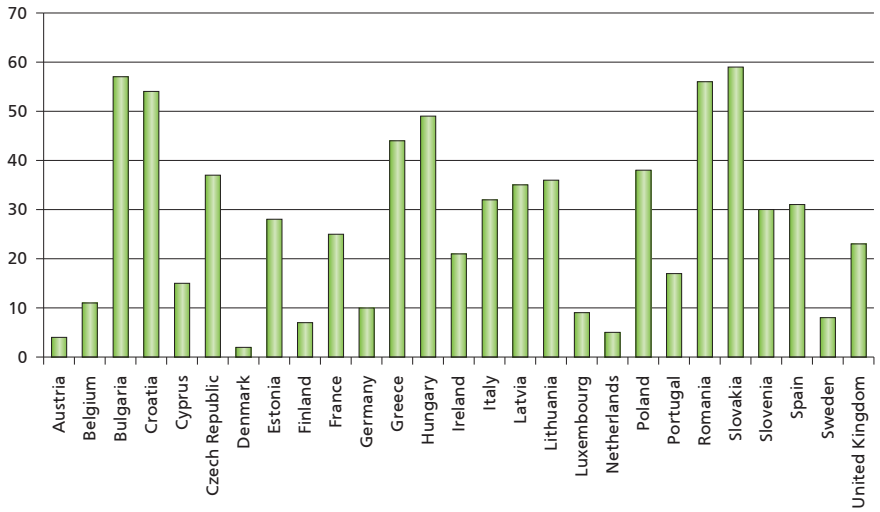
[39] *A New Skills Agenda for Europe: Working together to strengthen human capital, employability and competitiveness*, COM(2016) 381 final; Analytical underpinning for a New Skills Agenda for Europe, SWD(2016) 195 final.

[40] World Talent Ranking 2018, IMD World Competitiveness Center, www.imd.org/wcc/world-competitiveness-center/

tiveness Yearbook of the Institute of Management of Development (IMD, Switzerland), this situation is not expected to change positively in the near future. In 2018, Bulgaria holds 57th position among 63 countries in the ranking. This overall result reflects a drop by one position to 45th as regards investment; a drop by one position to 58th as regards the attraction of talents; and progress by one position to 58th in terms of technological readiness.

As the Applied Research and Communications Fund has pointed out in its evaluation of talent as a factor for successful innovation performance,[41] the most serious negative effects on the national economy from the short-sighted governmental policy on human resources are associated with the ongoing, in various forms, **brain drain** (59th place in the IMD ranking), the lack of staff motivation (55th place), on-the-job training (56th place), and **the inability to attract and retain talent (49th place)**. In 2018, the perceptions of the quality of educational and healthcare services remain at critically low levels, placing the country at 63rd and 59th places.

Figure 46. WORLD TALENT RANKING 2018, EU-28*



* Malta is not included in the 2018 ranking.

Source: World Competitiveness Yearbook 2018 (IMD, Switzerland).

[41] *Innovation.bg 2016, Innovation Powered by Talent*, Applied Research and Communications Fund, 2016.

Information and Communication Technologies

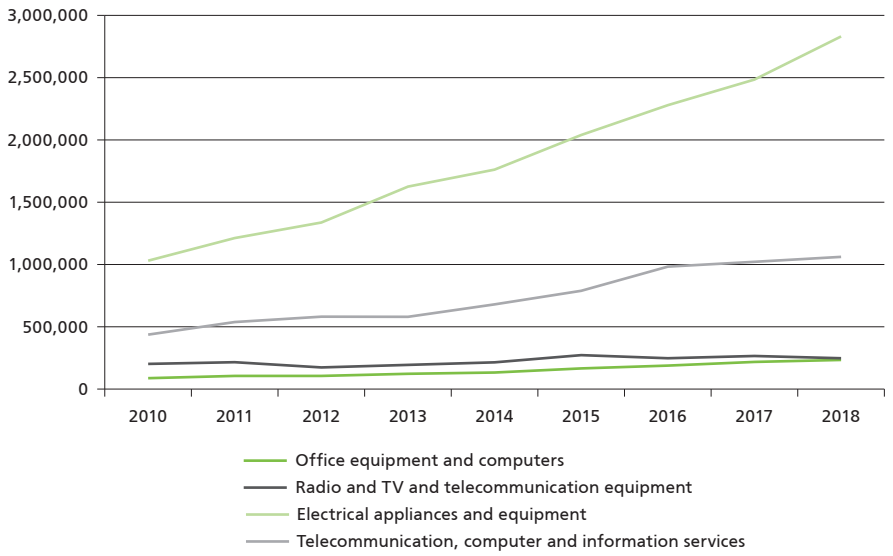
The Bulgarian ICT sector reaffirmed its impact on the country's economy and in 2017 accounted for 14 % of total exports (goods and services), and the forecasts for 2018 are for its share to be about 15 %. The commodity part of these exports (office, computer, radio, TV and telecommunication equipment and other electrical machines and devices, electrical installation items and parts for them) provides half of the exports in the machinery section of the Standard International Trade Classification, while telecommunication, computer and information services account for half of the exports of business services. ICT exports already equal exports of unprocessed (raw) materials, mineral fuels, lubricants and similar low value-added products. The latter two groups of goods lost their relative significance in exports by about 35 % compared with five years ago, which is a sign of improved overall export structure. In specific niches Bulgaria has significant international positions in exports – e.g. it exports half of amateur radio stations in the world and about 15 % of European exports of resistors. Antelope Audio (a brand of Elektrosfera)[42] has affirmed its world quality mark in digital musical technologies. Milara is the main supplier of military robots to the US army.

There are two trends of export growth. On the one hand, foreign investors in electronics (mainly automotive electronics and software) are gradually expanding their production capacities, open new jobs, create research and innovation units and export higher value added activities to the country (Integrated Micro-electronics, Sensata Technologies, Visteon Electronics, Melexis, IDT Bulgaria,[43] and other smaller ones). The most sizeable growth in development staff is planned in VMWare, which is to grow from 800 employees on average in 2018 to 1,500 employees in 2019. This trend is present in other sectors as well, where foreign companies export or expand their ICT-based testing and development activities (e.g. Liebherr Hausegerate Maritsa, which manufactures electronics for refrigerators,[45] Bosch Software, Coca Cola, Kaufland Service, the German AMK for drive and control equipment,[46] etc.).

On the other hand, the large Bulgarian exporters (Datex,[47] Samel-90, House Software,[48] the companies in the group of Opticelectron, Optics,[49] Milara, etc.) continue to grow due to their ongoing investment in innovations and search for new markets, including through investment in their subsidiaries abroad.

Acquisitions of Bulgarian IT companies continue, both by foreign and local investors. Quite often the exiting owner starts a new IT business, even after retirement age. In 2018, high-profile sales of innovative companies took place – of MM Solutions, Imperia online, BG Menu, Viant, and Dinamo Software (former Netage). Such transactions will continue in the future, as there are many attractive companies with a broad customer

Figure 47. DYNAMICS OF ICT SECTOR EXPORTS IN THOUSANDS OF EUR (2010 – 2018)[44]



Source: Comext/Eurostat and Balance of Payments, BNB.

[42] Award-winner in ARC Fund's Innovative Enterprise of the Year for 2016.

[43] Award-winner in the Innovative Enterprise of the Year for 2012 under the name ZMD Eastern Europe.

[44] Due to final data revision in Comext for 2016, the data here slightly differ (from 2 % to 5 % higher exports by group of goods) from the data in *Innovation.bg 2017*.

[45] Extremely important, because Bulgaria is one of the five largest exporters of refrigerators in the world.

[46] Award-winner in the Innovative Enterprise of the Year for 2010.

[47] Award-winner in the Innovative Enterprise of the Year for 2010.

[48] Award-winner in the Innovative Enterprise of the Year for 2012.

[49] Award-winner in the Innovative Enterprise of the Year for 2005 and 2006.

Box 7. BEST PRACTICES IN THE ICT SECTOR

The most successful Bulgarian company for mobile applications is Mobile Systems[50] (Mobisystems). Its product OfficeSuite has had 300 million installations. By way of comparison, Microsoft has 500 million installations on Android. The company is a spin-off of the publishing house Soft Press and has over 570 applications in mobile stores. About 3/4 of the applications are for the Google Play market – dictionaries. These are the first applications developed by this publisher for Palm devices. Mobile Systems released a desktop version of the office in 2017 and rely on their loyal customers from the mobile market to compete with Microsoft and on the computer market.

Trading 212, known also as Trader.BG, has 12 million installations for Android in the United Kingdom, Italy, Germany, and other countries, and was the most popular trading and investment application in the UK in 2017. In Germany, in November 2018, it reached 13th place, and in Italy it was 9th. In Bulgaria it had 200,000 downloads. Its popularity is due to the innovative business model, which offers stock trading without traditionally expensive commissions for up to ten transactions per month, each one of up to GBP 10,000, and also to the added value services – algorithmic investment advice. Trading 212 is the first company to offer such a model in the UK, following Robinhood from the USA, which was also established by a Bulgarian.

Source: ARC Fund.

base (globally), sustainable relationships with strategic customers, and innovative projects. Sectors in which similar transactions can be expected, although at lower levels, in the next two or three years, are mobile applications, blockchain technologies, as well as fintech companies and companies working for the gambling industry. These transactions, as well as the increasing venture financing (public and private) for IT start-ups in Bulgaria will continue to have a favourable impact on the entrepreneurial ecosystem in Bulgaria, which will attract both labour force and digital nomads, as well as entrepreneurs from Europe.

Bulgaria turned out to be very fertile soil for the establishment of companies in the fintech industry. Software Group Bulgaria is a leading global provider of technologies for financial institutions and in particular for micro-payments. In 2017, Devexperts opened a development centre in Sofia, producing specialised capital market software solutions, whose clients are primarily retail and institutional brokers, banks, and stock exchanges. I Card and Fire made their way through the most popular financial applications in the Google market and as of 1 November 2018 they hold 2nd and 6th place respectively, providing a digital portfolio and auxiliary services. Development of innovative solutions based on digital portfolios is possible because of the good infrastructure of contactless payment terminals, the card base, with half of the cards being contactless, and the established practice of making such payments. According to a MasterCard survey in August 2018, half of the payments in Bulgaria were made with contactless cards, up by over 150 % compared with 2017. Digital portfolios have one priority to contactless cards – they are safer and faster (do not require PIN when the transaction is above the limit). Other companies try to innovate through the contactless payment technology. One such example is Tickey Mobile Solutions,[51] which piloted its service in Varna and Sofia and already has customers outside Bulgaria.

Although Bulgaria advanced on many of the indicators for eBusiness development in the Digital Scoreboard in 2017 versus 2016, it is not sufficient to bridge the gap with the other EU member states. Slightly less than a quarter of the companies in Bulgaria use the resource management system (ERP), against the EU-28 average of one third. Much fewer – one eighth – use a system for customer and partner management, compared to the average for Europe of one fifth. This is due to the fact that production enterprises normally have few strategic buyers which are not end customers. It is no surprise that the shares of companies using a supply management system are equal to the average share for Europe – 17.6 %. This reflects the integration of supply processes along the chain of value adding which usually ends in an EU country. Bulgaria's exports are mainly directed at the EU (two thirds of exports) and many large exporting companies have sub-suppliers in the country (typical examples are the companies in the automotive industry or manufacture of clothing). Thus, the companies are under pressure to implement and elaborate systems for product identification through RFID (9.18 % of all, which is the highest value in EU-28), which are used across the whole process of labelling, packaging, transportation, entry in the resource management systems of enterprises, and final sale to end customers.

[50] Award-winner in the Innovative Enterprise of the Year for 2015.

[51] Award-winner in the Innovative Enterprise of the Year for 2016.

Bulgarian enterprises lag behind their European partners and competitors as regards the use of cloud technologies, use of websites, use of social media for business, and staff with provided portable devices for use in their work. Only Romanian enterprises are behind Bulgaria in terms of websites, and Latvia and Poland are behind us in terms of social media. Bulgaria has the highest share in Europe of enterprises with low digital intensity. Still, 8 % of enterprises use some kind of cloud technology, and 6 % use complex cloud technology (for export of data and services), which is sufficient to build capacity for cloud services on the domestic market. A visible segment on this market are schools and the need to offer different cloud services – e-logs, digital learning content, self-train systems for testing and learning, etc. One of the strongly innovative and competitive Bulgarian enterprises (registered in Switzerland) providing a global encrypted service for file sharing and based on cloud technology is pCloud. As of November 2018, the company has 8 million customers.

As expected, in 2017 Bulgaria failed to leave anybody behind on the eCommerce indicators in the Digital Scoreboard. Still, there was improvement on some indicators, though from a very low base. The enterprises actively seeking opportunities to sell online have increased by 50 % on 2016. There is a growth from 2.85 % to 3.47 % in enterprises selling online abroad. 15 % of large companies (over 250 persons) generate about 9 % of their turnover through online orders, while only 7 % of small and medium-sized enterprises (from 10 to 249) manage to generate only 4 % of their turnover online.

Individuals appear to be better prepared than businesses to trade online – in 2017, 18 % of them did that and one third of them did their shopping abroad. 8 % of individuals claimed to have sold something online (e.g. via Olx, the new shopping functionality of Facebook or in specialised car websites). Olx has over one million installations and about 120,000 active users daily (not

Figure 48. MOST POPULAR MOBILE APPLICATIONS IN FINANCE AS OF 1 NOVEMBER 2018

iPhone

#	Free		Paid	
1	Bulbank Mobile UniCredit	=	HomeBudget with Sync Anishu	=
2	UBB Mobile United Bulgarian Bank	=	Sugar Budget SugarMamma	=
3	DSK Smart DSK Bank PLC	=	iCurrency Pad Sollico	=
4	My Fibank First Investment Bank AD	=	MoneyBook - finance with flair noidentity	=
5	CCBank Mobile App Central Cooperative Bank PLC	▲3	iXpenseIt FYI mobileware	=
6	Raiffeisen ONLINE Raiffeisenbank (Bulgaria) EAD	▼1	Next for iPhone noidentity	=
7	Fibank Token First Investment Bank AD	=	MoneyWiz 2 - Personal Finance SilverWiz	=
8	ePay.bg EPAY AD	▼2	Pennies – Budget and Expenses Emile Bennett	=
9	PayPal: Mobile Cash PayPal	▲2	BUDGT - monthly finances, day by ... S. Flückiger	=
10	BankOn Mobile Societe Generale Expressbank AD	▼1	My Wallet+ Block21	=

Android

#	Free		Paid	
1	Bulbank mobile UniCredit	▲1	Daily Expenses... Michel Carvajal	▲1
2	iCard: Digital W... iCARD	▼1	My Budget Book OneTwoApps	▼1
3	UBB Mobile United Bulgari...	=	1 PESO Consecuenci...	=
4	DSK Smart DSK Bank	=	Money Manage... Realbyte	=
5	A1 Wallet - Ma... iCARD	=	10bii Financial ... Day Develop...	=
6	phyre: Digital ... Phyre JSC	▲1	Monefy Pro - M... Aimbity AS	=
7	Western Union ... Western Union	▲1	AndroMoney Pro AndroMoney	=
8	ePay.bg EPAY AD	▼2	HP 12c Financi... Hewlett-Pack...	=
9	Raiffeisen ONLI... Raiffeisenban...	=	MoneyWiz 2 - P... SilverWiz	=
10	BankOn Mobile Societe Gene...	=	Our Budget Bo... Mavi Software	=

Source: AppAnnie.

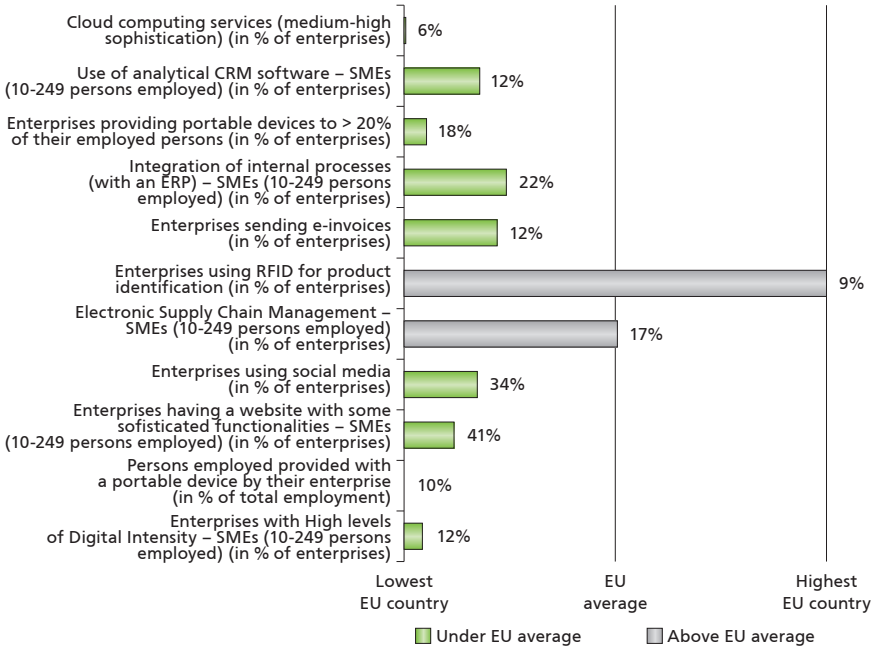
necessarily selling or buying). The most popular stores are Wish, Joom, AliBaba, AliExpress, Olx and eMAG, but due to problems with supplies from China those with the highest turnovers from Bulgaria are Olx and eMAG.

An important indicator of e-trade development in Bulgaria is the growth of courier services, and even acquisitions in the sector prompted by the need to streamline costs. Couriers offer functionalities for the most popular platforms for e-trade websites, so that when a customer orders a supply the courier can be automatically notified and go to the company, or they offer a service for store management to online merchants. A niche courier specialised in supplies of online orders from abroad is Gabco, which addresses many problems of customers who order supplies to Bulgaria from a non-EU country.

Although the overall self-assessment by individuals in Bulgaria of their digital and communication skills is high – above the European average – on the more objective criteria of whether the person had written at least one programme, Bulgaria lags behind almost all European countries. With the introduction of the compulsory subject of computer modeling for 3rd and 4th grades, and more financing for extracurricular classes in IT, science, engineering, and mathematics, in 10-15 years the country might catch up with Europe on this indicator. To this end, more pupils, students, and youths need to be involved in such activities in order to develop algorithmic and computing mindset.

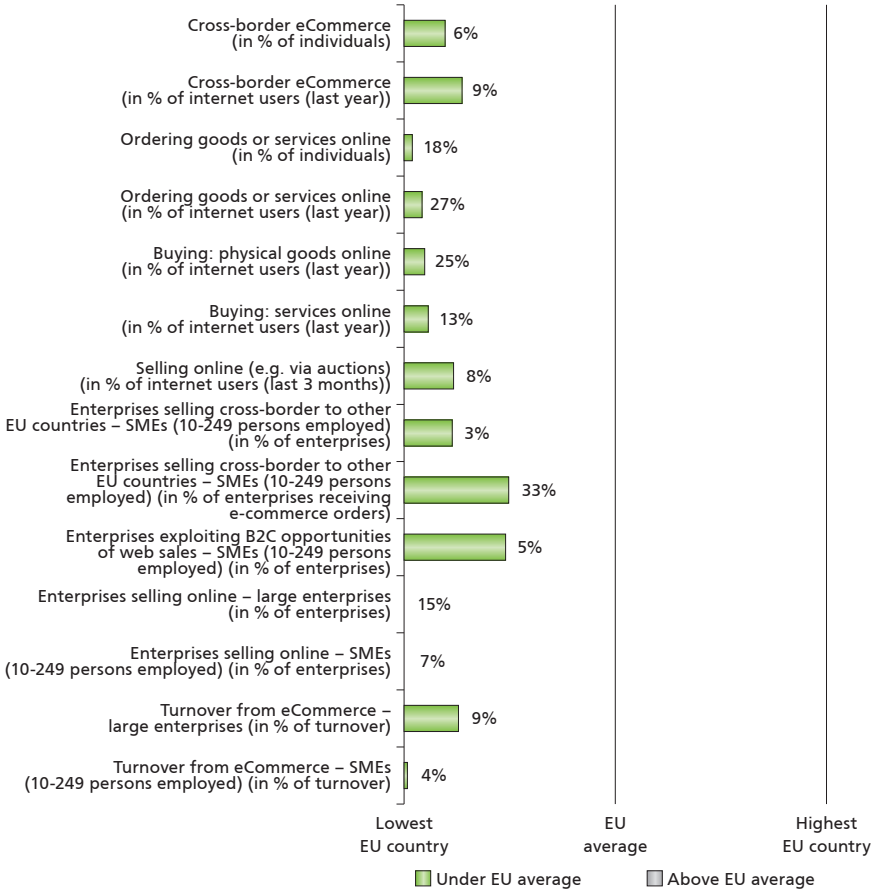
Data from the Digital Scoreboard demonstrate a digital divide between the general level of digital competence and that of ICT specialists. This is why the ICT sector has started to seek foreigners from Western and Eastern Europe and to invest in training through the popu-

Figure 49. COUNTRY PROFILE FOR BULGARIA, E-BUSINESS INDICATORS



Source: Digital Scoreboard.

Figure 50. COUNTRY PROFILE FOR BULGARIA, E-COMMERCE INDICATORS



Source: Digital Scoreboard.

lar IT academies (Telerik, the Academy of Imperia Online, etc.) and the Software University.[52] The risk of not being able to find ICT specialists (for Bulgaria it is above the average level for Europe – 48 % of enterprises claim difficulties with finding qualified staff) is managed by exporting IT activities abroad (34 % of enterprises, above the average rate for Europe).

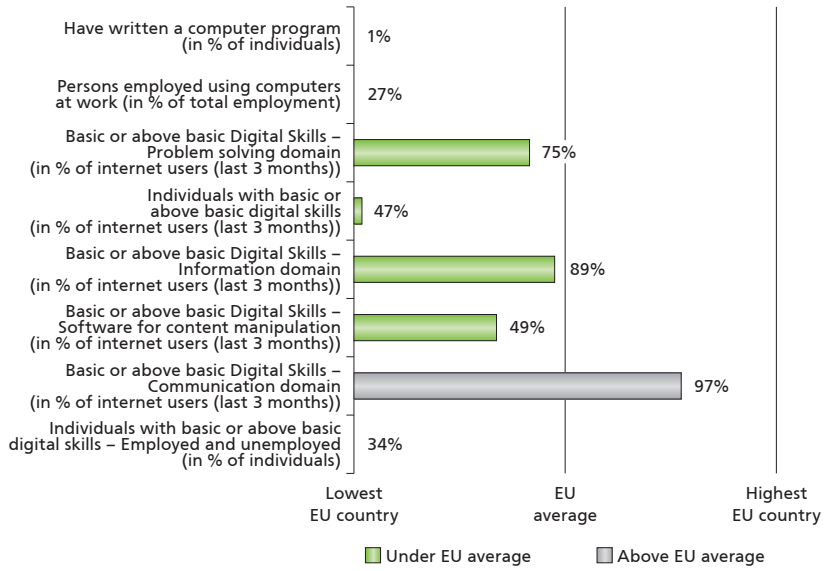
The European Commission has adopted an integrated index to measure the progress of member states in the digital economy and information society, on the basis of which Bulgaria has serious gaps in the areas of human talent, use of internet, integration of digital technologies, and provision of digital services by the public administration. Unfortunately, good performance on some indicators is not sufficient for Bulgaria to reach the average European levels on other indicators except connectivity. However, the lagging behind countries like Italy, Poland, Hungary, and Cyprus is easy to overcome. The problem is that Bulgaria's neighbours cannot provide the same "thruster" effect as the Scandinavian countries, and it is Bulgaria that would have to perform this role in the Balkans.

The country's economy has demonstrated that it can cope alone with the challenges of development, but the government can support these efforts by two instruments:

- Continuing the reform in all stages of education, based on meritocratic principles of teacher development, decentralisation and greater freedom for teachers who meet quality requirements and a shift to problem-centred, not subject-centred education (as is the approach in Finland and many states in the USA). The reforms should integrate new technologies and incorporate the principles of gamification;
- R&D financing and pre-trade orders (placed transparently online) for:
  - innovative products and services of e-government with the participation of the European Commission;
  - innovative products and services necessary for the development of the army which many companies are capable of providing as their technologies are on the borderline of IT, security, and defence. Many modern and successful innovative IT companies have a record in the defence industry in the past or at present they are sub-contractors under NATO programmes and projects.

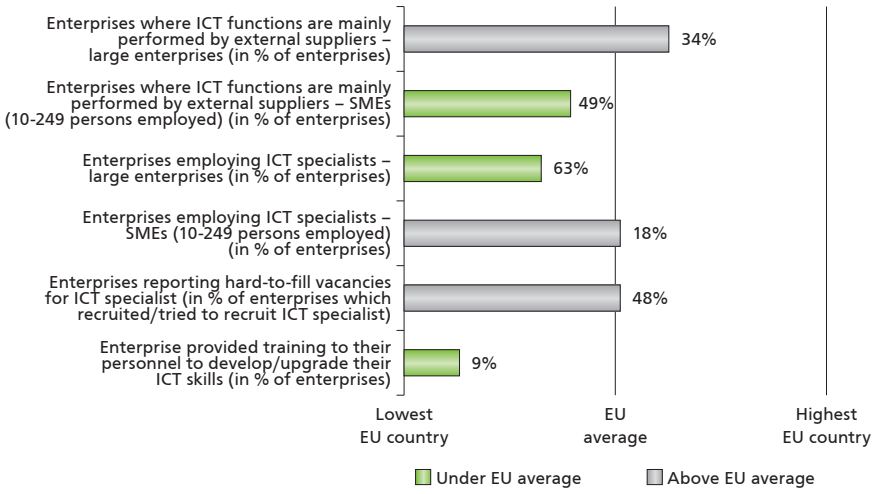
[52] Award-winner in the Innovative Enterprise of the Year for 2016.

Figure 51. COUNTRY PROFILE FOR BULGARIA, DIGITAL SKILLS INDICATORS



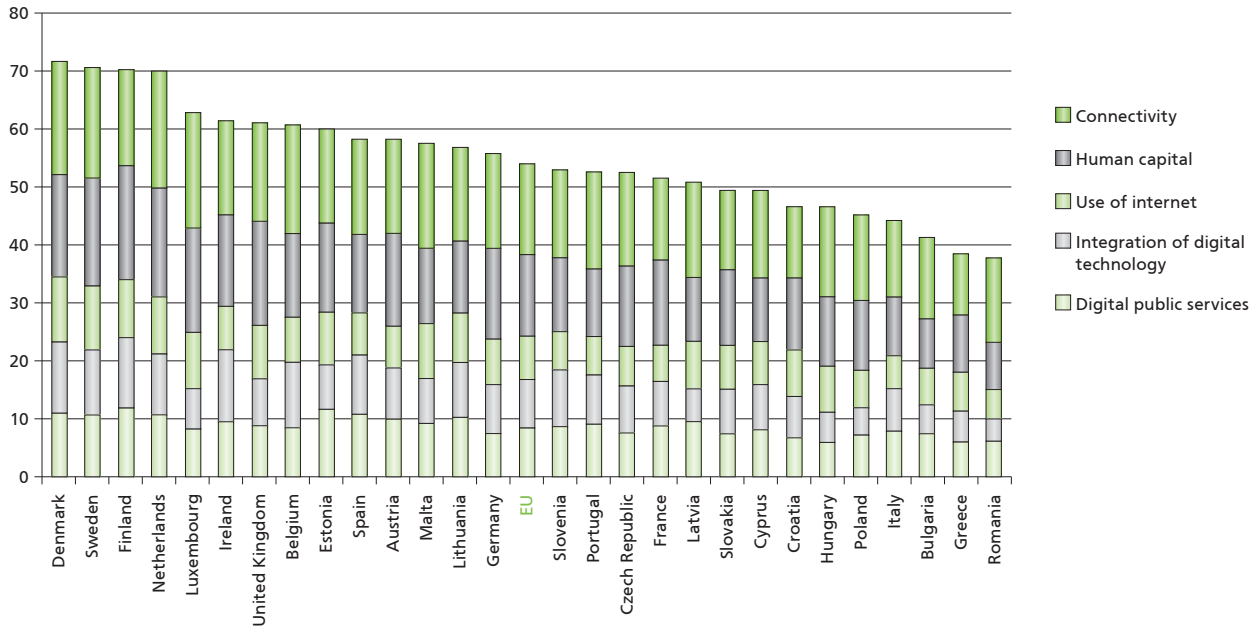
Source: Digital Scoreboard.

Figure 52. COUNTRY PROFILE FOR BULGARIA, ICT SPECIALIST INDICATORS



Source: Digital Scoreboard.

Figure 53. DIGITAL ECONOMY AND SOCIETY INDEX, 2018 RANKING



Source: Digital Scoreboard.

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APPLIED RESEARCH AND COMMUNICATIONS FUND

The Applied Research and Communications Fund is a Bulgarian research non-profit organization, registered in public benefit, established in 1991. Its mission is to support the development of innovation and the knowledge economy in Bulgaria through:

- advice and advocacy on establishing national, regional and local level policies and strategies for the country's successful integration into the global innovation economy;
- research and analyses of development trends and policy options for supporting innovation as well as information and communication technologies;
- public-private partnerships among businesses, public institutions, the academic community and civil society for addressing specific issues of ICT and innovation based competitiveness.

The Applied Research and Communications Fund has set up two functional units for the provision of IT and consulting services:

- European Innovation Centre – Bulgaria is part of the largest information and consultancy support network in Europe: Enterprise Europe Network, and coordinates its work in Bulgaria. The Network aims to assist small and medium-sized enterprises in their innovation potential development and to raise their awareness about the European Commission's business-oriented policies.
- ARC Consulting EOOD is the consulting arm of the Applied Research and Communications Fund. The company offers consulting services in the fields of innovation and information and communication technologies, as well as advisory services in the design and implementation of national and international projects under the EU Framework Programs, the Cohesion and Structural Funds.

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