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Kontakt/Contact
ZBW – Leibniz-Informationszentrum Wirtschaft/Leibniz Information Centre for Economics
Düsternbrooker Weg 120
24105 Kiel (Germany)
E-Mail: *rights[at]zbw.eu*
https://www.zbw.eu/econis-archiv/

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EDITORS

Prof. Teodora Georgieva, Senior Fellow, Applied Research and Communications Fund
Mr. Ruslan Stefanov, Coordinator, *Innovation.bg* Group, Applied Research and Communications Fund

INNOVATION.BG WORKING GROUP

Dr. Todor Galev, Senior Fellow, Applied Research and Communications Fund
Assoc. Prof. Roumyana Georgieva, Technical University, Gabrovo
Prof. Teodora Georgieva, Senior Fellow, Applied Research and Communications Fund
Dr. Fani Koleva, Expert, Applied Research and Communications Fund
Ms. Denitsa Marinova, Project Coordinator, Applied Research and Communications Fund
Dr. Miglena Molhova-Vladova, Expert Projects, Zinev Art Technologies EOOD
Ms. Maya Tsaneva, Expert, Applied Research and Communications Fund
Ms. Daniela Chonkova, Programme Coordinator, Applied Research and Communications Fund
Assoc. Prof. Todor Yalamov, Department of Economics and Business Administration, Sofia University

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Assoc. Prof. Todor Yalamov, Department of Economics and Business Administration, Sofia University

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LIST OF ABBREVIATIONS

ARC Fund	– Applied Research and Communications Fund
B2B	– business-to-business
B2C	– business-to-consumer
BAS	– Bulgarian Academy of Sciences
BGN	– Bulgarian lev
EC	– European Commission
EPO	– European Patent Office
ERP	– enterprise resource planning
EU	– European Union
EUR	– euro
GDP	– gross domestic product
GEM	– Global Entrepreneurship Monitor
ICT	– information and communication technology
KIS	– knowledge-intensive services
MML	– mutual mobilisation and learning
n.e.c.	– not elsewhere classified
NGO	– non-governmental organisation
NRA	– National Revenue Agency
NSI	– National Statistical Institute
OP	– Operational Programme
PORB	– Patent Office of the Republic of Bulgaria
R&D	– research and development
R&I	– research and innovation
RFID	– radio frequency identification
RRI	– Responsible Research and Innovation
SMEs	– small and medium-sized enterprises
UK	– United Kingdom
USA	– United States of America

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EXECUTIVE SUMMARY

Ten years after Bulgaria's accession as a member of the EU and in the run-up to Bulgaria's Presidency of the EU Council, **the benefits for the Bulgarian society and the innovation business in the country in particular are noticeable**. Among the most important benefits is the alignment of Bulgarian legislation to the EU acquis and the associated higher business standards and standard of living; the right of Bulgarians to travel and work in the EU and in many cases outside its borders; the free movement of goods and capital within the single European market.

Europe has proved through its numerous initiatives that – in addition to dismantling borders – it values diversity and difference, at the core of which is the unique language, traditions and culture of each member state. Against this background, it is up to the national effort to create a desired image of the country and work for better positions in the competitive European environment.

The main achievements of Bulgaria's innovation policy and the tools for promoting entrepreneurial and innovation activity of businesses directly resulting and arising from the European policy at the national level, include:

- **An innovation strategy for smart specialisation** for the period 2014 – 2020 was adopted as a condition for allocation of funds from the European structural funds through the national operational programmes. It replaced the 2004 National Innovation Strategy – the first in the democratic history of the country – which was an obsolete document in the run-up to the second programming period for Bulgaria as a EU member as it did not incorporate the implications of membership and the effects of the financial and economic crisis and whose monitoring and reporting was discontinued three years after its application.
- **Improved administrative capacity** of the central and local public administration for managing European programmes and for providing services to businesses.
- **Disbursed payments under OP Competitiveness of the Bulgarian Economy** at the end of 2015 amounting to BGN 2,160,415,879, including BGN

340,964,407 in national funding, most of it directed at the promotion of innovation.[1]

- **Disbursed payments under OP Innovation and Competitiveness** at the end of 2017 amounting to BGN 535,484,663.92, including BGN 80.302,917.12 in national funding.[2] In response to these grants companies rapidly increased their co-financing of innovation projects and held top positions by this indicator in the European Innovation Scoreboard.
- Through **the JEREMIE initiative,** BGN 1.40 billion was invested in 7,990 small and medium-sized enterprises, including over 1,300 start-ups (for all JEREMIE tools, including portfolio guarantees for credit losses; low-interest loans [with risk sharing]; accelerators [start-up funds]).[3] In this context, **Sofia became the third entrepreneurship destination after London and Dublin** at the end of 2015, with 146 start-ups (cumulative since 2004), supported by accelerators.
- **Disbursed payments under OP Science and Education for Smart Growth** at the end of 2017 amounting to BGN 121,261,871.21, including BGN 18,189,280.8 in national funding.[4]

Furthermore, the country utilised financing directly from the European framework programmes, attracted foreign direct investments in high-tech sectors and R&D, implemented many initiatives for sustainable, social and open innovations – all of which were possible only because of Bulgaria's membership in the EU.

Unfortunately, **there are no national examples to support and multiply the effects achieved with European funds.** The National Innovation Fund operates with a token budget, works with great delays and missed sessions. In 2017, this was topped by a compromised session – and this after years of waiting by SMEs and despite the peak number of submitted proposals. The National Science Fund has been a bad example for years of illegal spending of the scarce national resources for science. The funds for the functioning of the existing Entrepreneurship Centres at several technical and technological higher schools were terminated thus precluding their future operation.

The trends in 2016 demonstrate the lack of national priorities in science, technologies and innovation, and seriously threaten the accomplishment of the national objective for 1.5 % share of R&D spending in GDP by 2020.

According to the methodology of the European Innovation Scoreboard 2017, **Bulgaria is the only member state in the EU** (an island of stability), **which has not made any progress in the innovation potential over the past seven years** (summary innovation index of 0.234 for 2010 and 2016 and an unchanging 47 % of the average EU level) – a result that might seem optimistic against the background of the most serious fall within the Union suffered by Romania (31 %), and the slowdown reported by 11 other countries.

Significant changes occurred in the institutional structure of patent activity in the country, mostly in terms of reduction of the share of individuals and increase of the share of the public sector, businesses and higher education. From 86 % in 2002, the share of individuals had decreased at least five times

[1] http://umispublic.government.bg

[2] http://2020.eufunds.bg

[3] http://jeremie.bg

[4] http://2020.eufunds.bg

to 18 % by 2016. Unfortunately, however, **the withdrawal of individuals from patent activity was not made up by a greater number of patents in the other sectors.** After two peak periods – 2001 – 2003 and to a lesser extent in 2008 – 2010 – **individual inventors with no institutional affiliation who decide to go down the long path of patenting and investing their own funds are disappearing in Bulgaria** – they start looking for opportunities outside the country or lose interest in such an exercise.

A comparison of the number of scientific publications and the number of citations for 2016 with the number of nation-wide R&D staff among Balkan countries allows for a comparative analysis of the publication activity of the countries in the region. Three categories are identified according to the results of the respective academic communities in terms of number, importance and impact of publications. The best results on each of the indicators are exhibited by Croatia and Serbia, followed by Romania, Bosnia and Herzegovina, and Slovenia. **Bulgaria takes the second-to-last place within the region before Macedonia and after Montenegro**. After ten years in the EU and constant reforms of the national scientific and innovation system as a whole, and its individual institutions in particular, Bulgaria is in the company of countries which, in the period 1991 – 2001, suffered the most serious military conflict in the new European history, are still far away from full EU membership (if this can be used as an indication of reforms, harmonised legislation and guarantees for the rule of law) and still cannot make full use of the European framework financing for science, technology and innovation.

In countries with factor-driven growth, on average 30 % of adults aged 18 and 64 indicate intention of entrepreneurship activity. In countries with efficiency-driven growth (among which, according to the methodology of the Global Economic Forum, is Bulgaria) this share is 26 %. Therefore, **in the group of countries with a similar economic situation and sources of growth, Bulgaria is distanced from the average levels by almost 20 points**. **The entrepreneurship potential of the country is still locked in low-tech industries**, even more so in 2016 than in 2015. The share of new enterprises in wholesale/retail has grown by ten percentage points at the expense of sectors such as ICT, transport and mining.

In 2016, for the first time in the past seventeen years, according to preliminary NSI data **R&D expenditure decreased** in absolute terms. The drop is significant – by nearly 14 %, which against the backdrop of the increasing GDP (1.06 on 2015 at current prices) is an even more dramatic decrease of their relative share by nearly 19 %. Data about R&D sources of financing show that the main reason is the serious drop in funds from abroad (by approximately 33 %), mainly including foreign company resources. After 2014 and 2015, when projects started in the 2007 – 2013 programming period were finalised (and funds were utilised), there has been a "stagnation", which is attributable to delayed procedures for approval of the new programming documents and "unlocking" of the new schemes for financing of project proposals.

This exemplifies the main drawback of **financing R&D in Bulgaria primarily by foreign funds** – that it makes it impossible to achieve sustainability (under the influence of external factors outside the control of the Bulgarian government) and targeted action (due to the priority financing of projects determined at the European rather than the national level) in the field of new technologies and innovation, which are said to lie at the foundation of the national and company

competitiveness. **Business was the only sector which continued to invest in innovation in 2016.**

Business also retains its active role in the indicators for R&D staff, while **the public sector and to a lesser extent higher education report a visible downturn** from their previous positions in these fields.

The ICT industry continued its turbulent development in 2016, accounting for 4 % of jobs, 4 % of revenues and 9.3 % of value added in the economy. For the first time in 2016 revenues in the sector exceeded BGN 10 billion. These results were achieved by 2 % of the companies and 3.6 % of their assets. **The most important feature of the sector, however, is its role of "anchor" for talents,** who are not only well paid but have the sense of being in "the centre" of global events. The share of the sector in total exports reached 14 % in 2016 versus 10 % in 2015. The growth is mainly due to **the higher exports of automobile electronics**, and also to increased outsourcing of business processes. The trend is expected to sustain in the next years.

However, outside the ICT sector, **Bulgarian companies are lagging well behind the average European figures on almost all indicators of e-business** monitored by the European Commission. Bulgaria has the lowest share in corporate revenues generated online – less than 4 %, compared to 16.4 % on average for the EU, and has one of the lowest shares in B2C website functionalities – 3 % versus 7.19 % on average for the EU.

Domestic demand for ICT services can also be boosted by users, who demand from retailers options for online shopping and sophisticated support services. Unfortunately, Bulgaria cannot avail of this option because **the population has low levels of digital skills and poor experience with online shopping**. The European Commission has adopted a composite index to measure **the progress of member states in the digital economy and information society**, which shows that Bulgaria has serious deficits in human resources, internet use, integration of digital technologies and provision of digital services by the public administration.

Three major priorities are defined for the six-month Bulgarian Presidency of the EU Council – **consensus, competitiveness and culture**. Resources for achieving results in these three priority areas will be sought in accelerating the establishment of a single digital market; supporting connectivity within EU; updating the regulatory framework for telecommunications; increasing the credibility and security of personal data in the digital space and development of data-based European economy. Finding the appropriate approach to the implementation of these objectives will be reflected in an improvement of the indicators which define the innovation potential of the country's economy in general.

INTRODUCTION

At the end of 2017, there is a **significant growth in business expenditure for R&D**. The 3.2 % growth of the European economy remains below the USA level of 4 % and the rest of the world at 5.7 %.[5] As in previous years, **the driver of this process were ICT-related industries. Bulgaria is leading in both aspects** – active business reporting one of the highest levels of growth in R&D investments within the EU and a very strong ICT industry contributing directly to the competitiveness of the national economy through a 4 % share in jobs, 4 % in revenues and 9.3 % in value added in the economy, and indirectly by retaining young talents and developing their creativity to the country's benefit.

The annual report ***Innovation.bg*** **provides a reliable 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 policy 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 13 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 **serious institutional lack of capacity for development and application of relevant policies**.

Innovation.bg 2017 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;

[5] *Significant Business R&D Growth in 2016*. JRC Insights – Industrial R&D, July 2017, JRC Directorate Growth&Innovation, European Commission, http://iri.jrc.ec.europa.eu/

- human capital for innovation;
- information and communication technologies.

Innovation.bg changes established concepts pertaining to the standard system of indicators for innovation measurement. Hence, shifting the focus to sector innovation systems and value added chains is more closely linked to the concept of open innovations.

The key topic in *Innovation.bg 2017* is **the technological interdependence of the national economy on a European and global scale.** A special focus is placed on the **automotive and related industries in respect of which Bulgaria is a magnet for foreign investors not only as a systems integrator but also as an R&D centre and a source of new technological solutions.**

Automotive Industry

The automotive industry[6] has been growing exponentially in Bulgaria over the past decade, with a particularly high growth over the past five years. On the one hand, more and more foreign companies have been investing in the country and building production bases, and on the other hand, existing companies (Standard Profil, SE Bordnetze, Sensata, Kostal, Yazaki, and some of them even fourth (Teklas[7]) have been expanding their business by building a second plant here. Based on available data, **about 170 companies belong to this sector, and some of them are affiliated with the biggest suppliers of global car makers such as General Motors, Daimler, Volkswagen, BMW, Audi, PSA Group,[8] Renault, Ford, Volvo**, etc. Investment interest in Bulgaria continued in 2017 and several foreign companies have reached the stage of market research or have expressed their intention to build production bases in the country. For example, Chinese manufacturers of aluminium wheel rims are exploring the market in Bulgaria and several neighbouring countries and Leoni – a German company which is a global leader in the production of cables and wiring systems for motor vehicles – officially announced that it would start building a new plant in Pleven in 2018. One of the few negative events in the sector is the declared bankruptcy at the beginning of the year of Litex Motors – until recently the only assembler of motor vehicles in the country.

With **over EUR 2 billion turnover and over 33 thousand employees in approximately 170 companies in 2016, over a decade the sector had a triple growth in terms of turnover, assets and number of employees and four times**

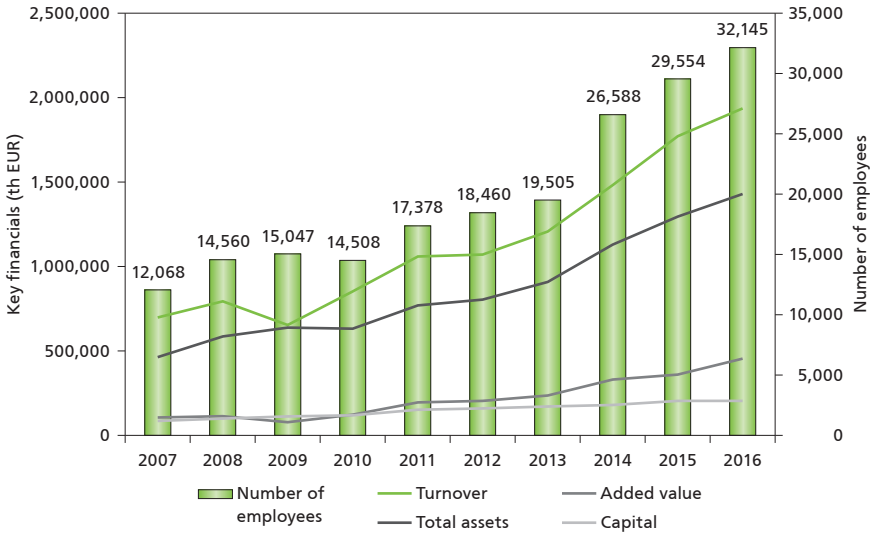
[6] According to CEA2008/NACE rev.2 the "automotive sector" includes both automotive companies (27.2 Manufacture of batteries and accumulators, 29 Manufacture of motor vehicles, trailers and semi-trailers, 30.91 Manufacture of Manufacture of motorcycles and their engines), as well as companies from other economic sectors (ICT, Manufacture of rubber and plastic products, Manufacture of machinery and equipment, Manufacture of metal goods etc.), manufacturing elements and products designed for the automotive industry.

[7] In the autumn of 2017, Teklas announced their intention to build a fifth plant.

[8] PSA Group (formerly PSA Peugeot Citroʌn) is a French multinational manufacturer of automobiles sold under the Peugeot, Citroʌn, Opel and Vauxhall brands.

higher growth in terms of value added produced.[9] Growth in value added gives grounds to assume that in the future the industry would have the potential to rank among the sectors with high value added in the country, such as ICT. With these indicators, the industry accounted for about 2 % of total turnover, value added and employees among non-financial companies in the country in the past year.

Figure 1. KEY INDICATORS IN THE AUTOMOTIVE INDUSTRY (2007 – 2016)



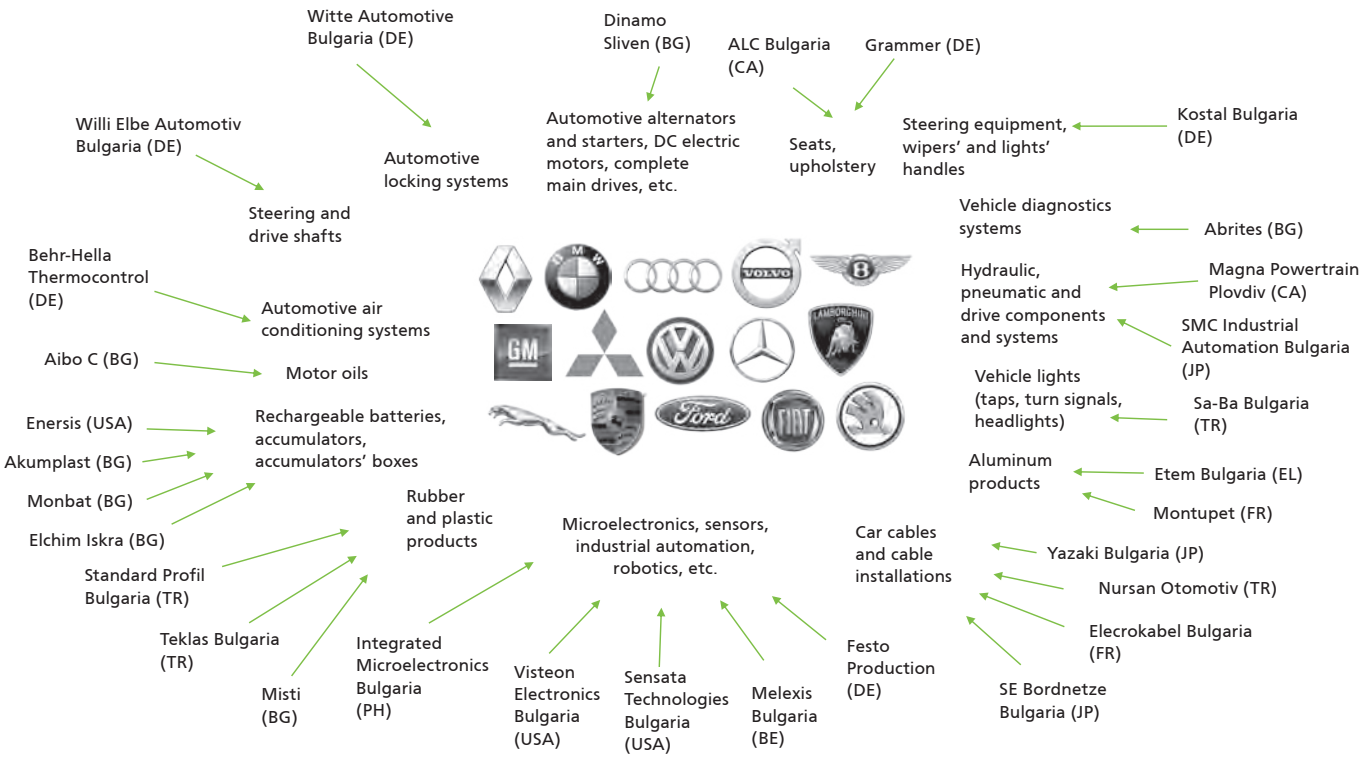
Source: Authors' calculations based on BureauvanDijk (Amadeus) and NSI data.

There are five categories of companies in the automotive industry according to their specifics and history of development.

- First, these are local branches of big multinational companies specialised in the manufacture of elements and items for the industry. German companies prevail among them (Willi Elbe Automotive Bulgaria, Kostal Bulgaria, Grammer, Witte Automotive Bulgaria, Behr-Hella Thermocontrol), followed by Turkish ones (SaBa Bulgaria, the related Koush Group and Nursan Otomotive), Canadian companies (ALS Bulgaria and Magna Powertrain Plovdiv [until recently Extetic Plovdiv, part of the German company Extetic]), French ones (Montupet, Elektrokabel Bulgaria), Japanese companies (Yazaki Bulgaria, SE Bordnetze Bulgaria), American companies (Enersis, Sensata Technologies Bulgaria) and other smaller ones.
- Second, there are the big Bulgarian companies specialised in the same area (3 companies of the Monbat Group – Monbat, Start and Monbat Recycling, Elhim Iskra, Dinamo Sliven, Remix Bulgaria, Madara Group, Aibo S, etc.).
- Third, these are companies outside the automotive sector but operating exclusively and mainly as suppliers of elements and items for big international and European car makers – regarding parts and components used in the manufacture of automobiles and components and systems for

[9] Data on the financial indicators and on the number of companies and employees are based on the international corporate database Amadeus. The list of companies includes all registered companies with main business in the automotive field (CEA2008/NACErev.2 classes 27.2 Manufacture of batteries and accumulators, 29 Manufacture of motor vehicles, trailers and semi-trailers, 30.91 Manufacture of motorcycles and their engines), as well as production companies selected additionally from other sectors but having as their main business automotive-related activities. Excluded are companies operating in retail and wholesale in automobiles and their parts.

Figure 2. COMPANIES AND PRODUCTION AREAS IN THE BULGARIAN AUTOMOTIVE INDUSTRY



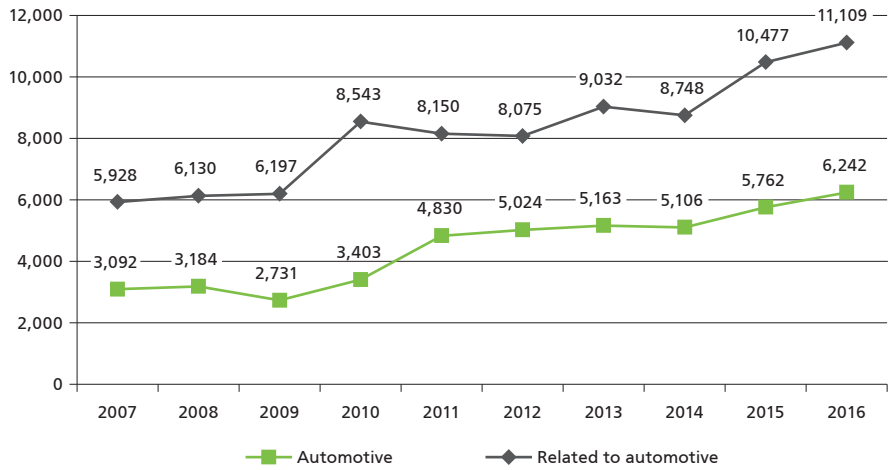
Source: Authors' research and public data.

the manufacturing processes in the automotive industry. Among them are companies operating in automotive microelectronics (the Filipino Integrated MicroElectronics Bulgaria, the American Visteon Electronics Bulgaria, and the Belgian Melexis Bulgaria), rubber compounds, seals and plastic pipes (the Turkish Teklas Bulgaria and Standard Profil Bulgaria), sensors and accessories thereof (the German Festo), pneumatic and drive components and systems (the Japanese SMC Industrial Automation Bulgaria), one of the European leaders in automotive diagnostics (the Bulgarian Abrites), etc.

- Fourth, there are the companies whose main business falls in another economic sector but they manufacture also products designed for the automotive industry – e.g. the Greek Etem Bulgaria, which manufactured aluminium joinery and façade solutions years ago, but now makes aluminium components for chassis, car doors and bumpers, or the Bulgarian Akumplast, which manufactures plastic containers in combination with battery containers.
- Last but not least comes the most numerous group of mainly micro and small companies which manufacture diverse and most often small details that are necessary for maintenance and support of motor vehicles of any type. Most of these firms are genuinely Bulgarian and many also offer development and engineering activities for the manufacture of specialised small series of products. Among them are firms engaged in the field of padding cars, seats and doors, rubber and rubber products, metal products, such as brake pads for passenger cars, light and heavy trucks and buses, exhaust pipes, rim bolts, flanges, etc., automotive ceramic fuses, battery cells and fixed and traction batteries, etc.

Over the last decade, the companies from the first four groups have reported growth on almost all indicators, while the companies in the last group remain at the same level of development with only some of the bigger firms among them making an exception. The comparison between the two big groups – the companies from the automotive sector and industries related to that sector (microelectronics, rubber and plastic products, cables, etc.) – shows that growth in the economic indicators of the sector as a whole is attributable mainly to the companies in the first group with two major exceptions. One relates to the average costs for remuneration per employee, which are twice higher in the group of companies related to automotive industry as compared to the automotive industry. At the same time, **over the past ten years these costs have doubled in the two groups, which is indicative of a sustainable growth in the average remuneration as a sign of positive developments in the industry.** Despite that growth, remunerations in companies in the sector remain comparatively low (except for some companies in the field of ICT) compared with the average level for the country but **since the big manufacturing companies are located outside the biggest cities they ensure a steady and relatively high pay in the respective regions.**

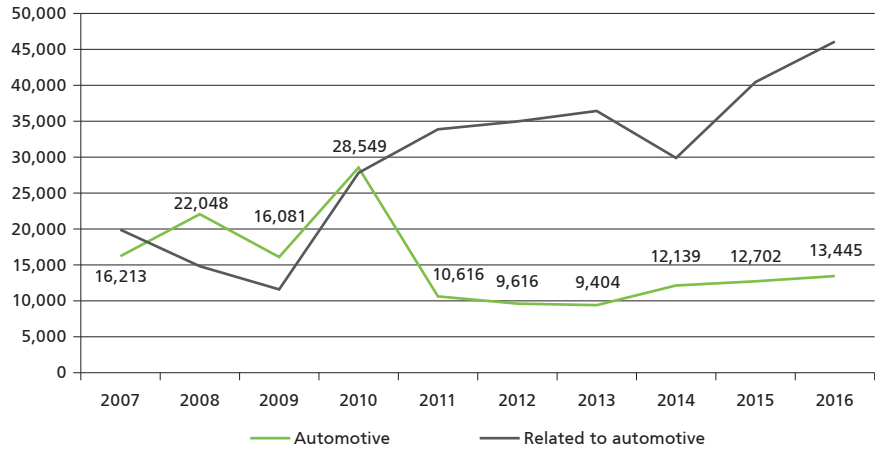
Figure 3. AVERAGE ANNUAL COST PER EMPLOYEE, 2007 – 2016 (EUR)



Source: Authors' calculations based on BureauvanDijk (Amadeus) data.

The other exception is the value added per employee, whose growth is clearly pronounced in related companies over the last ten years (about 17 % on average on an annual basis and slightly over 50 % for the whole period), while automotive companies report a slight fall on this indicator for the same period (-20 % compared with higher values in the beginning and lower values at the end of the period). This could have been caused by the global financial crisis which affected adversely the big automotive companies globally and Europe-wide, which needed more time to recover after the crisis. This resulted in fewer orders for the suppliers of components and products downstream the production chain where most of the companies in Bulgaria belong. At the same time, the value added per employee in the automotive-related companies is driven mainly by the big companies in the field of microelectronics (such as Integrated MicroElectronics Bulgaria, Visteon and Melexis), industrial automation, sensors, hydraulic and pneumatic products (e.g. SMC Industrial Automation Bulgaria, Festo) and also by some big foreign manufacturers of rubber and plastic items (such as Teklas Bulgaria, Standard Profil Bulgaria, etc.)

Figure 4. VALUE ADDED PER EMPLOYEE (AVERAGE ON ANNUAL BASIS, EUR)



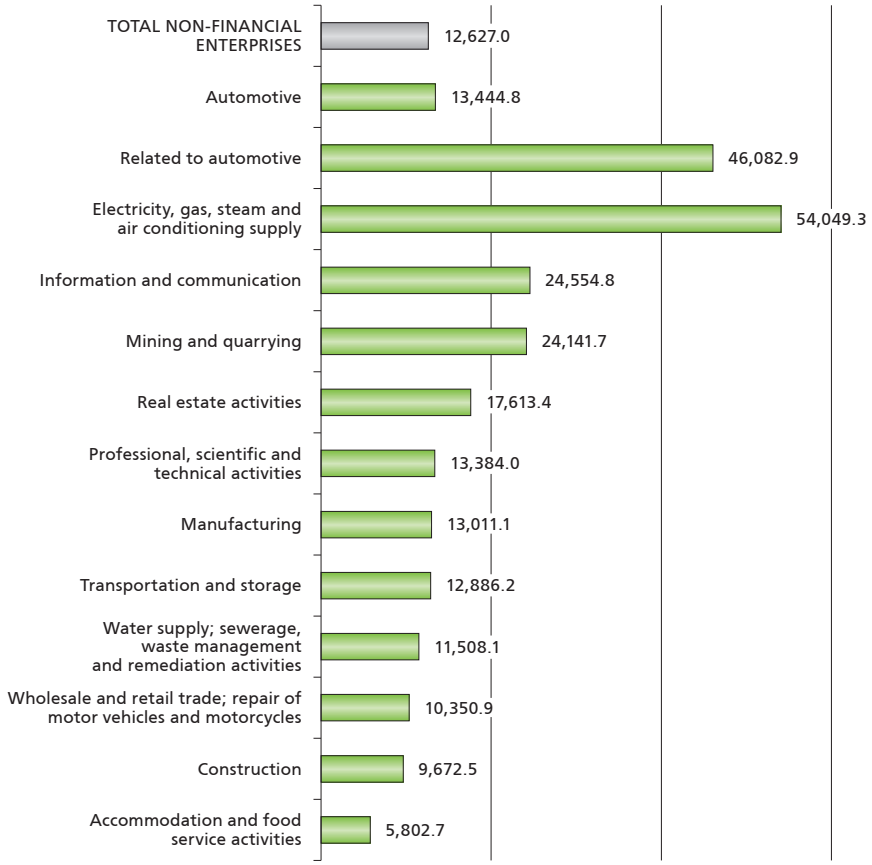
Source: Authors' calculations based on BureauvanDijk (Amadeus) data.

The industry as a whole generates value added per employee which is higher than the average for all non-financial companies, but compared with other sectors it lags well behind the ICT sector and the leader by this indicator in the national economy – electricity and thermal power generation and distribution. As regards the two main groups of companies in the sector, the automotive sector ranks in the second half of economic sectors by value added per employee, while automotive-related companies rank second among all economic sectors. The value added produced per employee for the whole ten-year period (2007 – 2016) exceeds EUR 15 thousand for the automotive sector and EUR 29 thousand for automotive-related companies.

Despite the profitability of the automotive industry in Bulgaria **over the past ten years, it is positioned as a high-tech sector but has low R&D and innovation intensity.** Some of the leading ICT and other companies in the automotive-related group make exceptions, but the automotive sector itself remains a modest innovator and its innovations include mainly implementation of new production processes by building new or upgrading existing production facilities of foreign companies in the country. There are two sub-groups of companies with R&D and innovation activities in the automotive sector. One of them includes mainly Bulgarian companies manufacturing batteries and accumulators, and some Bulgarian companies from other sub-sectors, e.g. the manufacturer of motor fuels with the brand "Helios" (Aibo S) or the manufacturer of technologies for automotive diagnostics Abrites. The second group includes branches of foreign (often multinational) companies which engage in R&D in addition to manufacturing. The leaders in this group are companies dealing in microelectronics, industrial automation and hydraulic and pneumatic products. In the past year, Teklas Bulgaria – one of the biggest manufacturers of rubber compounds and plastic pipes globally and Europe-wide – announced in addition to its intention to open a fifth plant in Bulgaria that it is building a R&D centre to support its production in the country and outside it. Overall, the development of the automotive sector in Bulgaria over the past decade shows that the country has not yet succeeded in positioning itself as an outsourcing destination for R&D and innovation-intensive production, as it has done in ICT. Nevertheless, given the history of the Bulgarian ICT sector and the role of the companies related to the automotive sector, it could be said that the **automo-**

tive sector has the potential to position the country as suitable for R&D and innovation-intensive productions in the next five to ten years.

Figure 5. VALUE ADDED PER EMPLOYEE IN SOME SECTORS OF NON-FINANCIAL COMPANIES IN 2016 (EUR)



Source: Authors' calculations based on BureauvanDijk (Amadeus) and NSI data.

For the time being, the strengths that attract foreign investments in the automotive sector are mainly associated with low labour cost, relatively high quality of specialists in machine-building, ICT and chemical technological processes, macro-financial stability, high share of Bulgarian students graduating abroad and particularly in German-speaking countries, and – what is particularly important for the suppliers of motor parts – the geographic location of Bulgaria, which reduces the time for supply to major European car manufacturers to less than a day. The latter was one of the main reasons for suppliers' withdrawal from China and other Asian countries and their reorientation mainly to East European countries. The activity of the companies also plays a role for the future development of the sector – both through their industry associations such as Automotive Cluster Bulgaria and through their efforts to improve staff qualifications by delivery of vocational trainings, improving the management skills in accordance with approved methodologies by big car makers, implementation of quality assurance systems, etc. In this regard, the automotive sector provides employment to low and medium-skilled staff and to highly skilled specialists in all main areas of work. The introduction of dual education in high schools in Bulgaria in the past three years supports these processes and many of the big companies in the sector are collaborating with

schools and universities providing education in subjects such as mechatronics, electronics, chemical and technological processes, etc. The sector's fast growth in the country, especially in the past five years, creates a shortage of both low and high-skilled staff. Many of the companies use their multinational structure to attract workers from other countries – mainly highly qualified engineers and middle and high level management staff. Based on various estimates, foreigners employed in the sector account for 4 % to 10 % of the total number of employees.

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

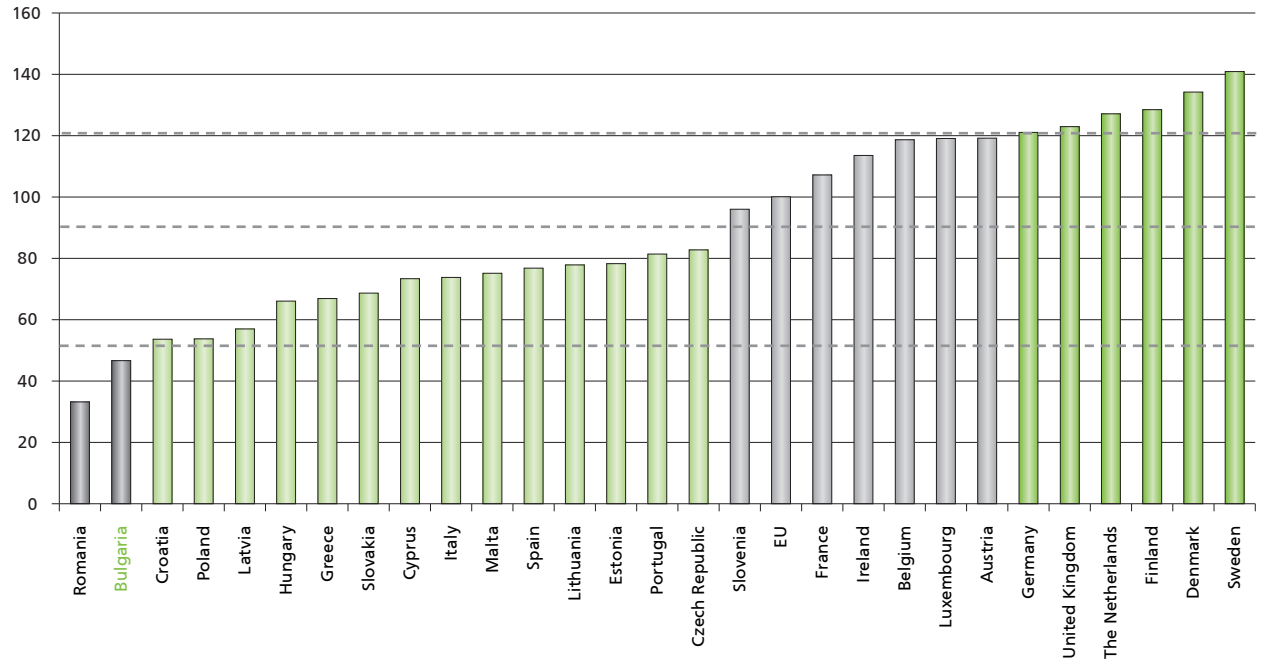
The innovation product results from innovation activity in the form of new and significantly improved processes, products and services based on new and/or adapted knowledge and know-how. It is determined by the innovation activity of enterprises in the country and is the most important indicator for 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 on the international innovation map

According to the methodology of the European Innovation Scoreboard **2017,**[10] **Bulgaria is the only EU member state** (island of stability) **not to have made any progress in its innovation potential** for the past seven years (overall innovation index of 0.234 both for 2010 and 2016 and at a constant 47 % of the EU average) – a result which may seem optimistic given the sharpest drop in the EU registered in Romania (31 %) and the falling behind in another 11 member states. **Sweden remains the undisputed innovation leader in the Community** and the most substantial progress has been registered in Lithuania, Malta, the Netherlands and the United Kingdom.

The study of the European Commission compares the achievements of member states to the 2010 baseline and adds new indicators and a new interpretation of existing ones.

Figure 6. EUROPEAN INNOVATION SCOREBOARD, 2017



Source: European Innovation Scoreboard, 2017.

[10] http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_bg

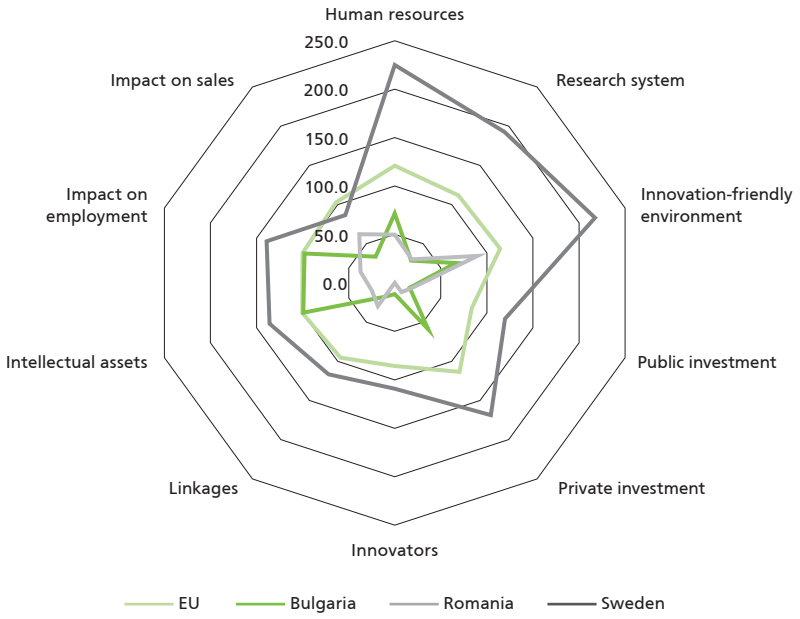
The results of the inconsistent and contradictory policy in the area of innovation have a markedly high dispersion:

- **At the average European level** with respect to employment and intellectual property (mostly low technology, see the section *Technological product*);
- **With certain "breakthroughs"** as regards human resources (such as university graduates, including PhDs), the business environment (with the main indicator of broadband penetration) and private investment in R&D;
- **With a substantial lagging** in terms of public and venture capital, R&D activities of the enterprises with a high technological intensity (product and process innovation; new innovation on international markets; and contribution of innovation to boosting sales revenues) and the interaction in R&D.

In the study of the **regional innovation systems**[11] held every two years, region BG3-Northern and Eastern Bulgaria is listed as a modest innovator while region BG4-South-Western and South-Central Bulgaria is a moderate innovator. For the past ten years, the two regions have followed the same trends in the development of their innovation potential:

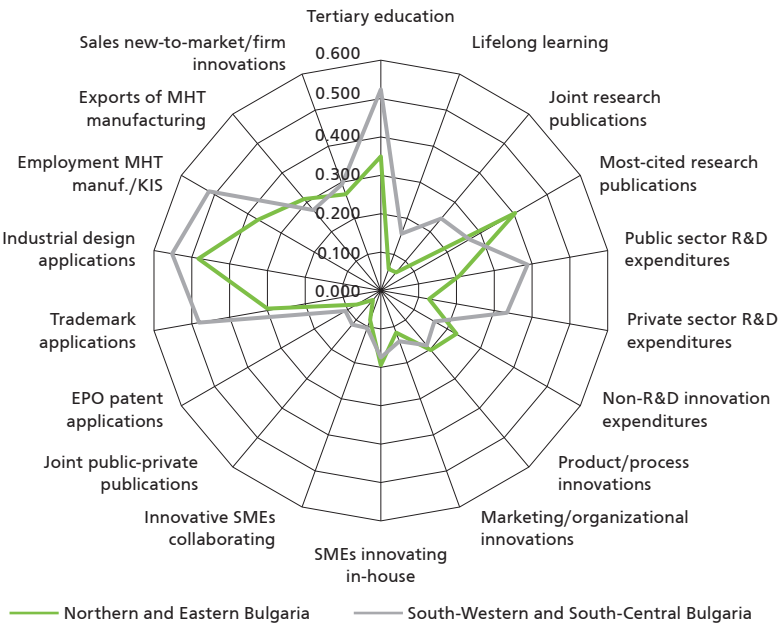
- Total growth relative to the 2009 baseline of 20 % for South-Western and South-Central Bulgaria and 117 % for Northern and Eastern Bulgaria;
- Similar dynamics throughout the period under consideration;
- Similar advantages (industrial design and trademark applications, employment in medium-high/high tech manufacturing and knowledge-intensive services, population with tertiary education) and challenges (R&D expenditure in the public sector, share of innovative SMEs, lifelong learning, scientific publications).

Figure 7. EUROPEAN INNOVATION SCOREBOARD, 2017 – COMPARATIVE RESULTS OF INNOVATION SYSTEMS



Source: European Innovation Scoreboard, 2017.

Figure 8. REGIONAL INNOVATION SCOREBOARD, 2017 – COMPARATIVE RESULTS OF THE REGIONS IN BULGARIA



Source: Regional Innovation Scoreboard, 2017.

The **Global Competitiveness Report 2016 – 2017**[12] ranks Bulgaria 50th among 138 countries which is 4 places higher than the previous year. Six EU

[11] Regional Innovation Scoreboard, http://ec.europa.eu/growth/industry/innovation/facts-figures/regional_bg

[12] The Global Competitiveness Report 2016 – 2017, World Economic Forum.

member states are behind it, including Greece which comes in 86th and Romania – 62nd (together with Hungary, Slovenia, Slovakia and Cyprus).

According to the methodology of the World Economic Forum, Bulgaria ranks best in terms of technological readiness; macroeconomic environment; and goods market efficiency, labour market efficiency, and financial development. In other words, it does well in the second subindex Efficiency Enhancers, something which does not hold true for the third subindex Innovation Factors.

The **main barriers identified are corruption** and rights protection (including intellectual property), (in)dependence of the judiciary, (non)transparency of government policies, business costs against crime and violence, organised crime. Some business practices (for example, delegating trust) and training targeted at the current needs of business remain problematic.

The lowest ranking of Bulgaria is in the two indicators for the potential to **retain talent** (125th place which is towards the bottom of the ranking) and potential to **attract talent** (110th place).

Bulgaria and Romania remain the only EU member states in the category of the efficiency-driven economies, unlike 6 other countries transitioning to innovation-driven economies and 20 other EU member states already in this first category of the global competitiveness index.

There is a slight movement upward from the 38th to the 36th place in the **Global Innovation Index 2017**.[13]

It merits note that **highest in the innovation potential ranking are the richest states**. They are able to invest in new technologies and human resources. However, the reverse is also true – the initial choice to focus on a long-term growth factor such as innovation is the basis for a better economic situation and quality of life.

In fact, Bulgaria comes in second after China in the Global Innovation Index in the group of the upper-middle-income economies which are highest in the ranking. All 35 countries higher than Bulgaria in the index are high-income economies, with the exception of China (22nd). Another positive fact is that Bulgaria is among the 17 countries with at least 10 % better results than the other countries with a similar level of development and benchmarks for gross domestic product.

The results of such studies should be interpreted carefully. For the last five-year period, the scores Bulgaria gets in the indices do not change[14] or change insignificantly. For example:

- The values for Bulgaria in the Global Competitiveness Report for the past five years are 4.3 or 4.4.
- The results for Bulgaria in the Global Innovation Index are a little below or above 42 according to the respective methodology.
- The European Innovation Scoreboard registers achievements for Bulgaria in comparison to the EU average levels between 45 and 50 with no change in comparison with the 2010 baseline.

Of course, Bulgaria's higher ranking in these studies is the result of certain improvements in individual indicators. However, it is also true that they are impacted by structural changes in the studies for each year such as the change in the number of the countries covered by the survey and the achievements registered by each country. In this sense, the lag of Romania and Greece in the past two years has a greater impact on Bulgaria's move forward than any real improvement achieved by the country.

Management practices of innovative enterprises in Bulgaria

The present analysis covers the practice of proven innovative companies, which not only have ideas of new or improved products, not only have started an innovation process or pursue independent or joint research but have also implemented innovation projects, i.e. they have developed new (for the company, at regional or global levels) products for the market, or have implemented in their practice projects for process or organisational renewal or entirely new business models.

However, the successful implementation of an innovation project is the result of the impact of many factors or a coincidence of circumstances – these are the external effects which for some reason have not been foreseen (the external environment had not been analysed or the necessary information had not been acquired or the available information had not been assessed adequately; weak signals of emerging changes in the external environment had been ignored).

In practice, it is easier to implement a single innovation project than adopt a thoroughly innovation behaviour, especially when it needs to be pursued at the expense of all internal and external barriers and temptations. The assessment of innovation management seeks to encompass all aspects of the "nature" of the company, not only those which are visible to the market but also the practices which are hidden for the external observer and which

[13] The Global Innovation Index 2017. Innovation Feeding the World, Tenth Edition, Cornell University, INSEAD, and the World Intellectual Property Organization, 2017.

[14] IMD World Competitiveness Yearbook 2017.

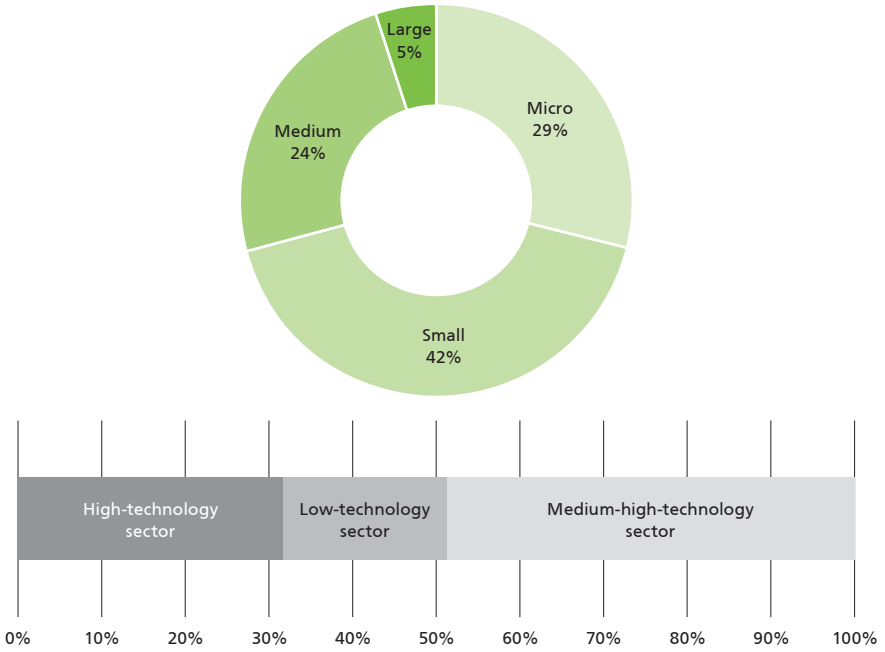
often are not fully recognised by the managers themselves.

The analysis is based on data from a representative sample of Bulgarian enterprises which have undergone an assessment of their innovation management for the period 2015 – 2017. The structure of the sample as regards the size of companies reflects the structure of enterprises in the national economy – a predominant share of micro and small enterprises accounting for 70 % and 30 % for medium-sized and large enterprises.

As was expected, companies prefer incremental changes to the creation of brand new proposals. As regards all analysed categories – products, services, processes, organisation innovations – **the ratio of radical upgrades to gradual improvement is 1:5**. An exception to this is the business models with a ratio of 1:2. The success of different categories of innovation projects decreases with the increase of the level of novelty. The implementation of entirely new business models is perceived as riskiest and 26 % of the projects have not fulfilled their pre-set targets.

Although all companies included in the study are innovative and state that they spend on innovation, only 40 % of them have included that information in their annual report to the NSI – **yet another piece of evidence**[15] **of the underestimated innovation potential of the national economy and the business sector in particular**, on the basis of which Bulgaria holds one of the last places in European and international rankings.

Figure 9. INNOVATIVE ENTERPRISES BY SIZE



Source: Applied Research and Communications Fund, 2017.

For progress to happen, efforts are needed by both the business sector – the single entrepreneur should realise the need for this information to be incorporated in official statistics (which, according to the methodology of work of NSI and NRA, does not have any implications on the level of taxation and the remaining disposable income at the enterprise) – and governmental bodies which should indirectly impose this (the declaration of costs for innovation is not a requirement on the enterprises in any EU member state) as a practice of the enterprises.

A suitable way for encouraging this is the requirement of showing evidence of three-year history of innovation practice for enterprises applying for public funding for private innovation projects. Experience in the implementation of research and/or innovation activity by enterprises (no matter whether successful, since innovations are always associated with risks and their promotion requires toleration of a permissible level of errors, which in turn generate experience) is a good guarantee for both the managing and the monitoring authorities of the respective operational programme or national/regional fund, and for the society as a whole, that the public funding would not be simply "absorbed" by an accidental player, but will support the innovation activity of a proven innovation company.[16]

[15] See *Innovation.bg 2013*.

[16] Submitting information about innovation activity and its cost to the NSI is counted as a bonus in the evaluation of projects to upgrade enterprises under OP Competitiveness of the Bulgarian Economy 2007 – 2013 and OP Innovation and Competitiveness in the current programming period 2014 – 2020. Briefly, such a requirement was part of the application procedure before the National Innovation Fund but it was removed, for unknown reasons, during the Fund's last eighth session. Such a formal requirement, unsupported by a respective check at the NSI, has led to a situation where many companies file fake R&D and innovation declarations to increase the points awarded to their projects.

Some of **the characteristics defining innovation culture or sustainable innovation behaviour** (without this being an exhaustive list) include:

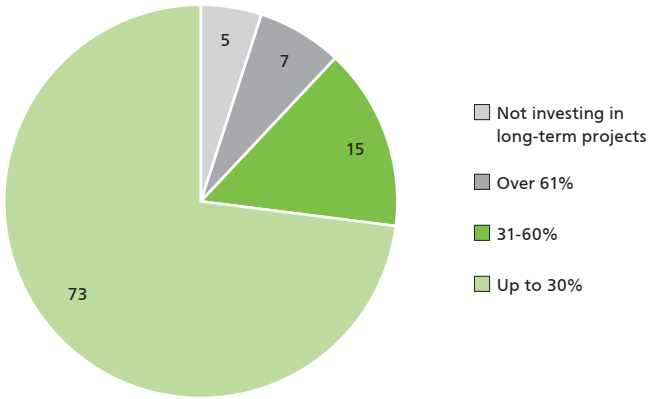
- **Innovations result from the awareness of their importance and from a consistent promotion of creativity, generation of ideas and their transformation into solutions to specific practical problems** (not necessarily understood in their negative sense) – contrary to the behaviour of the "let's see what happens", "others do the same", "nothing to lose" kind.

The implementation of this process requires from companies to study the impact of environmental factors and, based on this, to develop a strategy for development and long-term outlook for their market positions. Even better if such a strategy is adopted and staff at all levels are made aware of it. This would encourage employees to adopt company objectives as personal and make their input for the achievement of the goals on the basis of shared values. Such practice is a valuable resource for the company and ensures maximum value added of the most precious resource – the people.

Half of enterprises included in the sample (a little over 51 %) have a documented vision of their future development, which is presented to their staff. For nearly 90 % of them **the vision demonstrates the innovative nature of the company business and their self-identification as innovators.** As a result, 60-70 % of the suppliers, consumers and partners of the companies across the technological chain actually perceive them as such.

About 90 % of the companies have an innovation strategy, based on a preliminary analysis of the factors of the corporate environment and assessment of the potential for future development. For 66 % of the companies the strategy sets the objectives for implementation of the innovative function and the parameters for execution of the individual stages of the innovation life cycle – generation of ideas for renewal, their formalisation in innovation projects and further materialisation in the form of new or improved products, processes and business models.

Figure 10. INNOVATIVE ENTERPRISES WITH BUDGETS ORIENTED TOWARDS LONG-TERM PROJECTS, %



Source: Applied Research and Communications Fund, 2017.

On this basis, **a sizeable share of the surveyed innovation enterprises (95 %) invest some of their budget for R&D and innovation in long-term projects** – projects that do not ensure fast return but which may serve as a basis for future technological leadership.

For 73 % of the enterprises, up to 30 % of the budget for R&D and innovation is oriented towards the future, and for another 15 %, 31-60 % of the financing is oriented to the long run.[17] Also, there are companies (7 %) which permit themselves investments in research and innovation within the range of 61-100 %. Only 5 % of the companies included in the sample limit their budgets to the currently implemented innovation projects.

- **Continuous renewal requires good knowledge of growth sources**, traceability of each step of the innovation life cycle and evaluation of the results of the application of the technological know-how and financial resources. Underestimation of this issue places the management team in a subordinate position, as it is not able to control and channel the typically limited inflows in a direction supporting the objectives for market, technological and competitive positioning that is adequate to the current setup of external and internal factors.

Innovations of the product portfolio are most common and of major importance for the market performance of enterprises in the provision of new and elaborated products and services. Accumulated experience in this regard logically leads to the streamlining of the process through adoption of well-tested and clear work-flow procedures, criteria for advancing beyond various thresholds and shift from one stage of the

[17] The time span of the long-term projects varies by business sector. For high and medium high-tech businesses, the period may be maximum 3 years, during which period particular trends and impacts can be projected and project-based activities can be planned with high level of certainty. For traditional sectors this period can be longer.

project to another, and staff commitment.

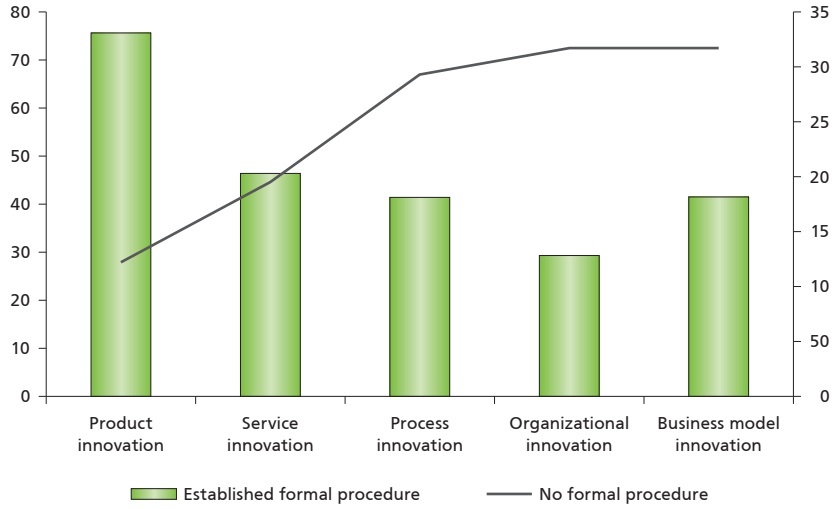
In support of this, data about enterprises included in the sample show that **in regard to product innovation the share of respondents with formally adopted procedures, clearly defined stages and expected interim and final results of the project implementation is the highest: over 75** %. Only 12 % have stated that they do not have such procedures; among the rest, slightly above 12 % have them but at a lower level of readiness and application.

For the next type of innovation – providing new services, process and organisational innovations – the ratio is gradually shifting downwards from enterprises with a formalised innovation life cycle in favour of those lacking such cycle. Renovation of business models is similar to the behaviour regarding process innovations.

Almost all (93-97 %) of enterprises start innovation projects with predefined objectives for the period of project implementation, a budget and end result quality. **Quite often, the objectives are achieved at a 50 % level of the envisaged time and up to 1/3 of the entire required investment.** As regards the quality of expected end results, there are least surprises – about 54 % of all enterprises are able to set parameters which remain unchanged by the end of the innovation project. In many cases the companies implement projects which are not generic but are geared to the requirements of a concrete client who sets the technical parameters for the end product. In such situations quality compromises are out of the question.

The implementation of a single innovation project does not normally put pressure on management. When a portfolio of projects is concerned, however, and when each of them has its specifics in terms of the so-called "project triangle" (time, budget, quality) and in regard to combined sources of finance, adding new competences and development of the existing potential (through training and/or recruitment of staff), organisational changes and external effects, a balance needs to be sought between input efforts and the effect achieved.

Figure 11. RATE OF ADOPTION OF FORMALISED PROCEDURES FOR INNOVATION



Source: Applied Research and Communications Fund, 2017.

Critically important for innovative enterprises are factors such as investments, return and risk. **All companies included in the study state that by and large they seek a balance between low and high costs for the implementation of innovation projects and between estimated return and the risk inherent in any innovation.** For 27 % of the enterprises such an evaluation is absolutely mandatory for the purposes of current survival and long-term growth.

About **25 % of the respondents evaluate the ratio between long-term and short-term projects on a consistent basis.** Little over **17 % is the share of those who consider it important to strike a balance between incremental and radical innovations**.

Over 80 % of the enterprises state that in planning and implementing their innovation activities they seek to capitalise on lessons learned – successes achieved but also errors made in previous projects. For 1/3 of them (including all high-tech companies in the sample) this is done in the implementation of each project.

Monitoring and evaluation procedures at the project level and the consequent traceability of inputs and results **provide the management team with knowledge about growth factors at corporate level and ability to exercise control on their impact.** The summary results of the surveyed enterprises show that slightly **over 34 % of them rely entirely on internal "organic" growth.** The other two factors – "External growth (mergers and acquisitions)" and "Compliance with international standards and changes in legislation" – do not have a decisive effect. For 78 % and 54 % of enterprises respectively they did not have any impact.

In most cases, internal growth is associated with the successful implementation of innovation projects

and promotion of new or improved products and services.

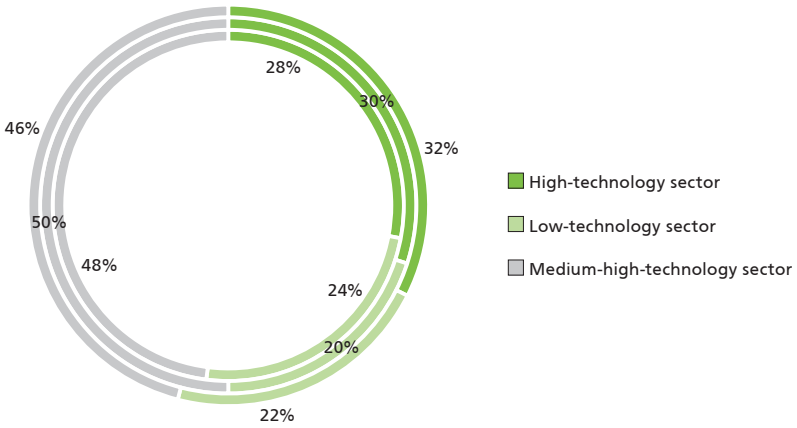
Consequently:

- 80 % of enterprises state that some of their profit is generated from innovation developments;
- for 14.6 % of the enterprises **the total profit is generated from innovations** (this applies to businesses in the high-tech sector and traditional activities; to enterprises manufacturing products and those providing services);
- for another 14.6 % of the companies, innovations ensure over 80 % of the profit.

Along with the direct contribution to the generation of a positive financial result, **innovations have also an indirect positive impact on enterprises that implement them,** for instance by streamlining production costs. Moreover, **the result is incremental over time and has cumulative effects**. For a period of four years the number of enterprises with successfully implemented process and organisational innovations has doubled, and the average weighted effect has jumped from 8.4 % to 13.5 % as regards the achieved improvement.

An interesting finding of the analysis – which supports the argument that **the success of innovative enterprises does not depend or depends to a small degree on external public financing** – is the fact that only 29 % of enterprises included in

Figure 12. SOURCES OF GROWTH, %*



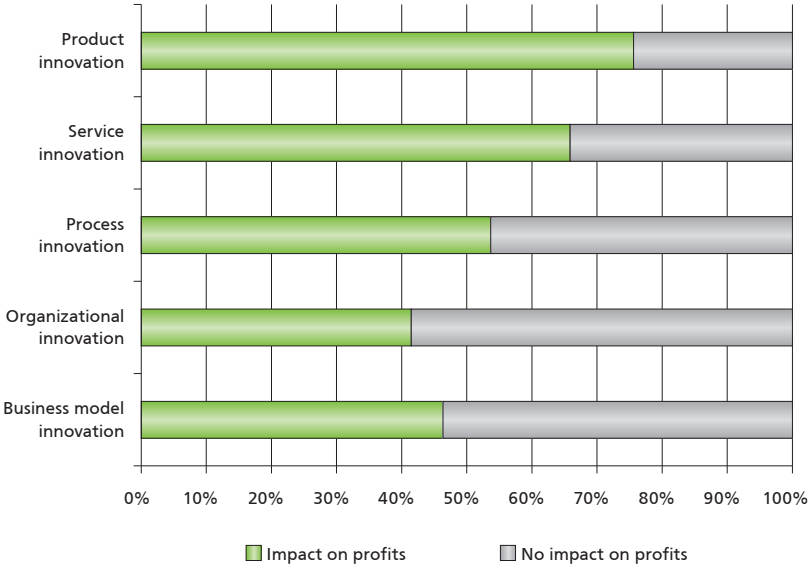
* The inner circle refers to sources of external growth, (mergers and acquisitions), while the outer circle refers to "internal organic growth".

Source: Applied Research and Communications Fund, 2017.

Figure 13. THE IMPACT OF INNOVATION ON THE PROFIT OF INNOVATIVE ENTERPRISES

80%

of innovative enterprises report profit generated from innovations



Source: Applied Research and Communications Fund, 2017.

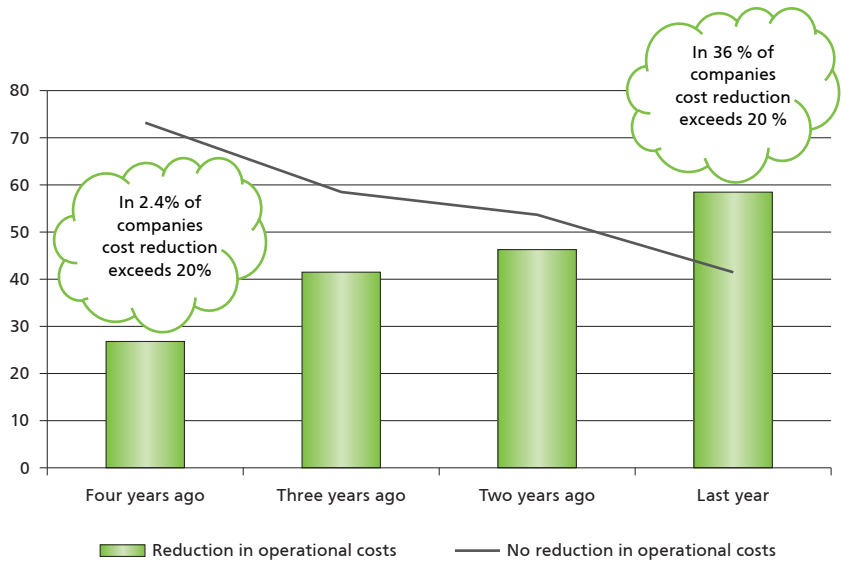
the sample have used such financing in their practice over the past 4 years. Obviously other external factors are decisive for successful innovation. The results of the latest international studies presented in this report (see further the *Innovation product* section) indicate **what these factors are** – reduction of corruption, applying the principles of the rule of law, development and retention of talents, development of entrepreneurship and innovation culture.

About 70 % of surveyed enterprises rely on external markets to a certain extent for validating the success of their innovation projects. The remaining part is entirely oriented towards the national or local market for the sale of their new products.

As people are the most valuable asset for enterprises, particularly for those which recognise innovation as the main source of competitiveness, it is no wonder that **almost all enterprises included in the sample have adopted policies for human resource motivation and development**. A relatively small share of the companies have internal awards for innovation and a procedure for their presentation (17 %). In most cases this means official recognition of the achieved results and creative thinking (80.5 %), combined with a flexible working schedule (65.9 %) and extra pay (56 %).

- Technological knowledge is dynamic, variable, adaptable in its application and suitable for combining, which means that **innovation ideas have diverse sources and the main ones, if not all, should be in the focus of management.** For the successful outcome of innovation activity, it is important to make the exchange of knowledge and technologies in all forms part of the corporate innovation strategy so that benefits forgone are minimized and successful projects are fully capitalised.

Figure 14. INNOVATIVE COMPANIES WHICH HAVE STREAMLINED COSTS AS A RESULT OF PROCESS AND ORGANISATIONAL INNOVATIONS, %



Source: Applied Research and Communications Fund, 2017.

Figure 15. STAFF MOTIVATION

Source: Applied Research and Communications Fund, 2017.

Within the national innovation ecosystem, there is typically no trust between potential partners and hence the affinity for sharing ideas, joint research and innovation and interaction across the technological value added chain is not high either. Innovative enterprises included in this study do not make an exception – **preferred partners in making innovation are final consumers** (90 % of respondents state such interaction), followed by network partners (clusters, associations, etc. – 81.6 %) and research

units and universities (78.9 %). The latter finding is mostly due to so-called academic entrepreneurships including (present and future) representatives of academia. The "science – business" cooperation in the country happens thanks to personal contacts and commitment by individuals at the expense of formal institutionalisation.

Partners down the technological chain (suppliers, companies extracting and processing raw materials) are perceived to a lesser extent as sources of ideas for improvement – only 62.5 % of enterprises interact with them within the innovation process. The share of enterprises using the services of external intellectual property experts is similar.

Box 1. RECOGNISABILITY ON INTERNATIONAL MARKETS – MISSION POSSIBLE FOR A SUSTAINABLE INNOVATOR

The company Tickey Mobile Solutions was launched in 2014. At that time, its co-founders won third place in the entrepreneurial competition StartUP Weekend with a prototype of a mobile application to buy public transportation tickets.

The company created an innovative mobile platform for payment for urban mobility services via a universal e-ticket Tickey. The system allows the users to buy tickets for different types of in-city and out-of-city transportation from a smartphone. Tickey offers the best price, combined tickets and discounts based on the user's history of travel and individual profile. "The problems with urban mobility are similar everywhere. A smart (intelligent) city is the one using the latest technologies to gather and analyse data from different sensors – about the quality of air, the flow of passengers, the public attitudes to different projects, so that the services the city offers to the citizens may be improved constantly," says Dimitar Dimitrov, Executive Director.

Tickey Mobile became part of the portfolio of the Eleven Venture Fund and obtained funding totalling EUR 100,000. Next came two years of hard work, participation in the international accelerator programmes Seedstars and Kickstart and a breakthrough on the Bulgarian and the international market at the end of 2016. In 2016, the company won an award in the Innovative Enterprise of the Year competition in the Start-Up category.

Tickey operates in the Sofia metro and in parts of the public transportation systems in Burgas and Varna. In July 2017, it ventured into the Portuguese market, in the capital city of Lisbon – offering e-tickets for trams, bike hire and other accompanying services. The company also introduced the system in Sherbrooke, Canada and a ferry operator in the United Kingdom. "This is the result of almost 3 years of work, constant contacts with municipalities and transport operators, participation in specialised exhibitions and forums. We are on the road almost every other week. Once you have 1-2 functioning projects and have been to 5-6 expos, it's clients and partners who come looking for you. Every market has its peculiarities and we are looking mainly for partners who have already implemented joint projects with local municipalities and transport organisations," Dimitar Dimitrov, Executive Director, concludes.

Source: Applied Research and Communications Fund, 2017.

Technological product

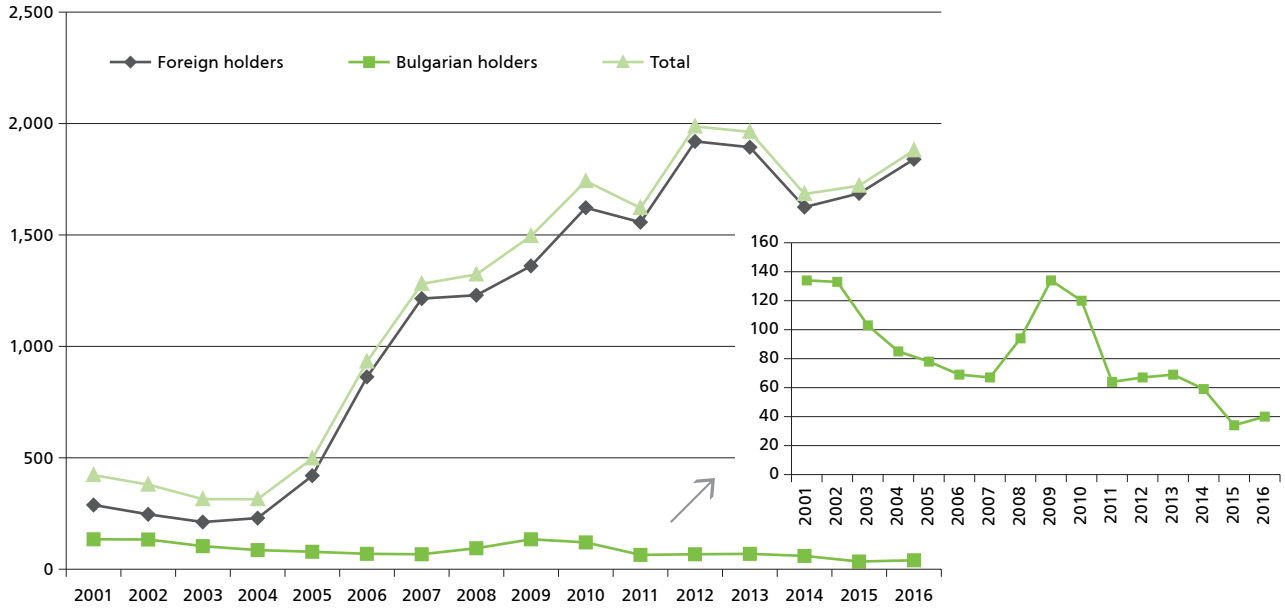
The technological product (protected and unprotected new technological knowledge) is the result of the creative activities of various participants in the innovation process. Its unique characteristics and economic significance make it attractive as an object of transfer. The analysis of applicant and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

In 2016, the patents issued by the Patent Office of the Republic of Bulgaria (PORB) for inventions to Bulgarian holders registered by the PORB **increased by 6 from the previous year** totalling 40. This increase could put an end to the six-year decline in the patent activity of Bulgarian entities on the territory of the country, even though such expectations are not supported by changes in the clumsy patent procedures of the PORB.

Rather than waiting an average of four years from application to patent issuance – a time in which the invention could become relatively obsolete and there would be benefits foregone for the company from its full use, **inventors are turning to protection of the technological novelties they have created as utility models,** i.e. in the form of the so called "small inventions." The protection period for them is smaller but this is also true for the time and costs for their protection.

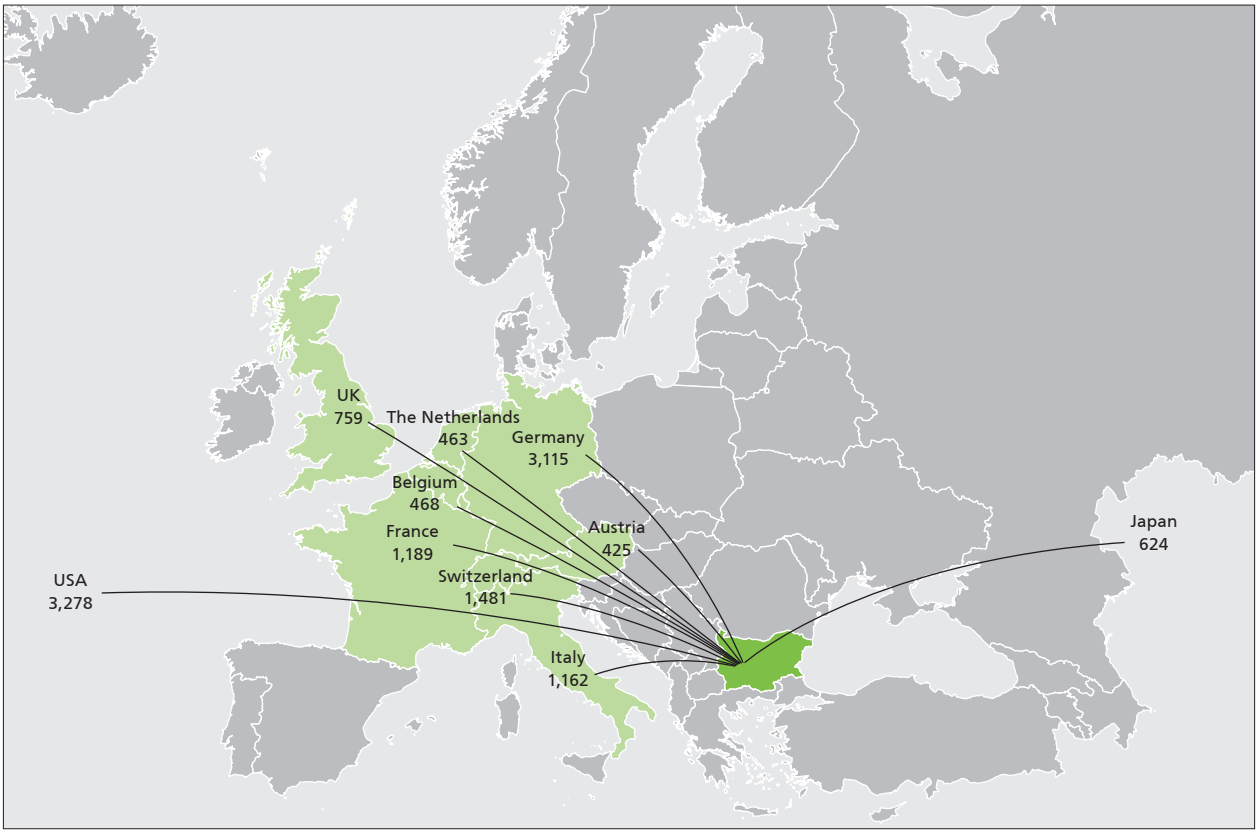
Albeit with certain fluctuations, **the upward trend in foreign patent activity on the territory of the country**

Figure 16. NUMBER OF PATENTS ISSUED FOR INVENTIONS IN BULGARIA



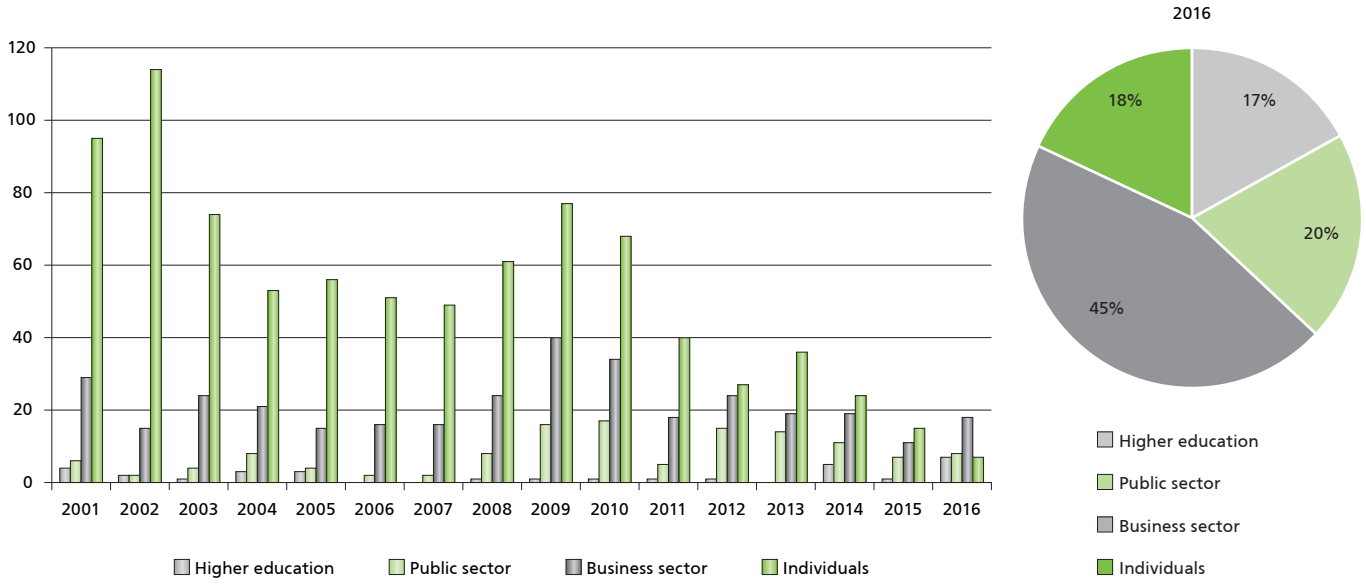
Source: Based on data from the PORB Official Bulletin.

Figure 17. TOP 10 OF THE PATENTS ISSUED TO FOREIGN HOLDERS EFFECTIVE ON THE TERRITORY OF BULGARIA, 2007 – 2016 (NUMBER)



Source: Based on data from the PORB Official Bulletin.

Figure 18. INSTITUTIONAL STRUCTURE OF THE PATENT ACTIVITIES OF BULGARIAN PATENT HOLDERS IN BULGARIA, 2001 – 2016 (NUMBER)



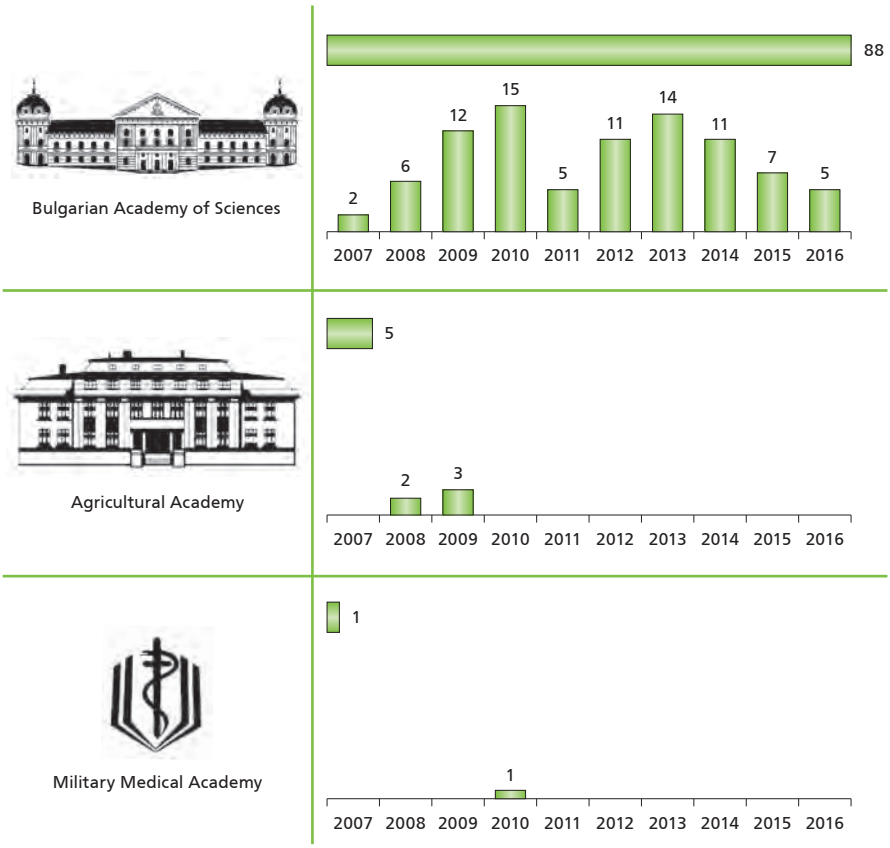
Source: Based on data from the PORB Official Bulletin.

continues (1,840 patents in 2016); it should be noted that **95.3 % of the patents of foreign patent holders were issued by the European Patent Office (EPO)** and are effective on the territory of Bulgaria as a Community member. **The protection of objects of intellectual property through the EPO is not yet practiced by Bulgarian inventors**. There have been only 13 European patents registered by the business sector since 2001 (or less than 4 % of all company patents for the period). As for the other sectors, such a practice is missing.

Germany remains the European leader in generating technological innovation almost equalling the patent activity of the USA (more than 3,000 patents for the past ten years), followed by Switzerland (1,481 patents), France (1,189 patents) and Italy (1,162 patents). Japan is also a traditional top-ten performer.

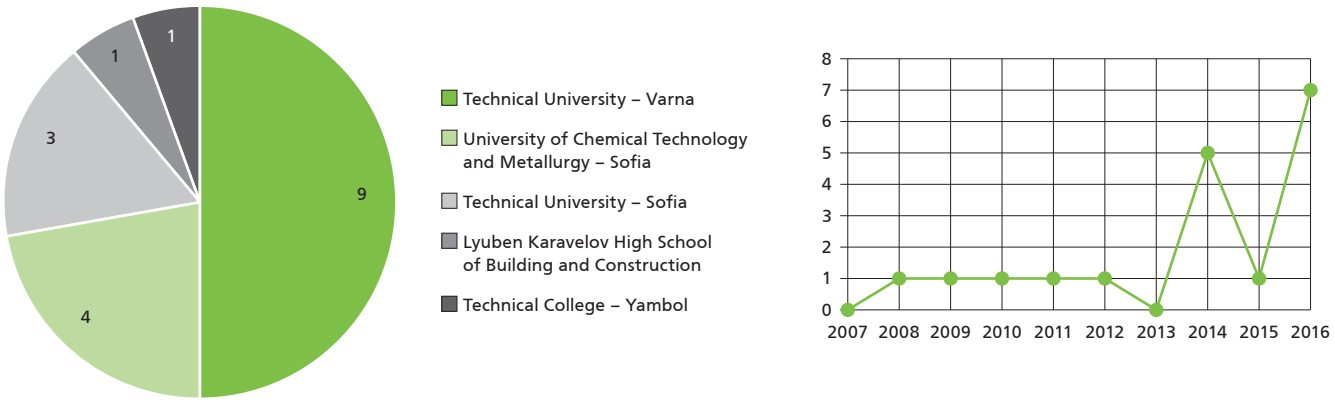
Significant changes are observed in the institutional structure of the patent activity in the country, mostly in terms of reduction of the

Figure 19. PATENT ACTIVITIES OF ACADEMIC INSTITUTIONS IN BULGARIA, 2007 – 2016 (NUMBER)



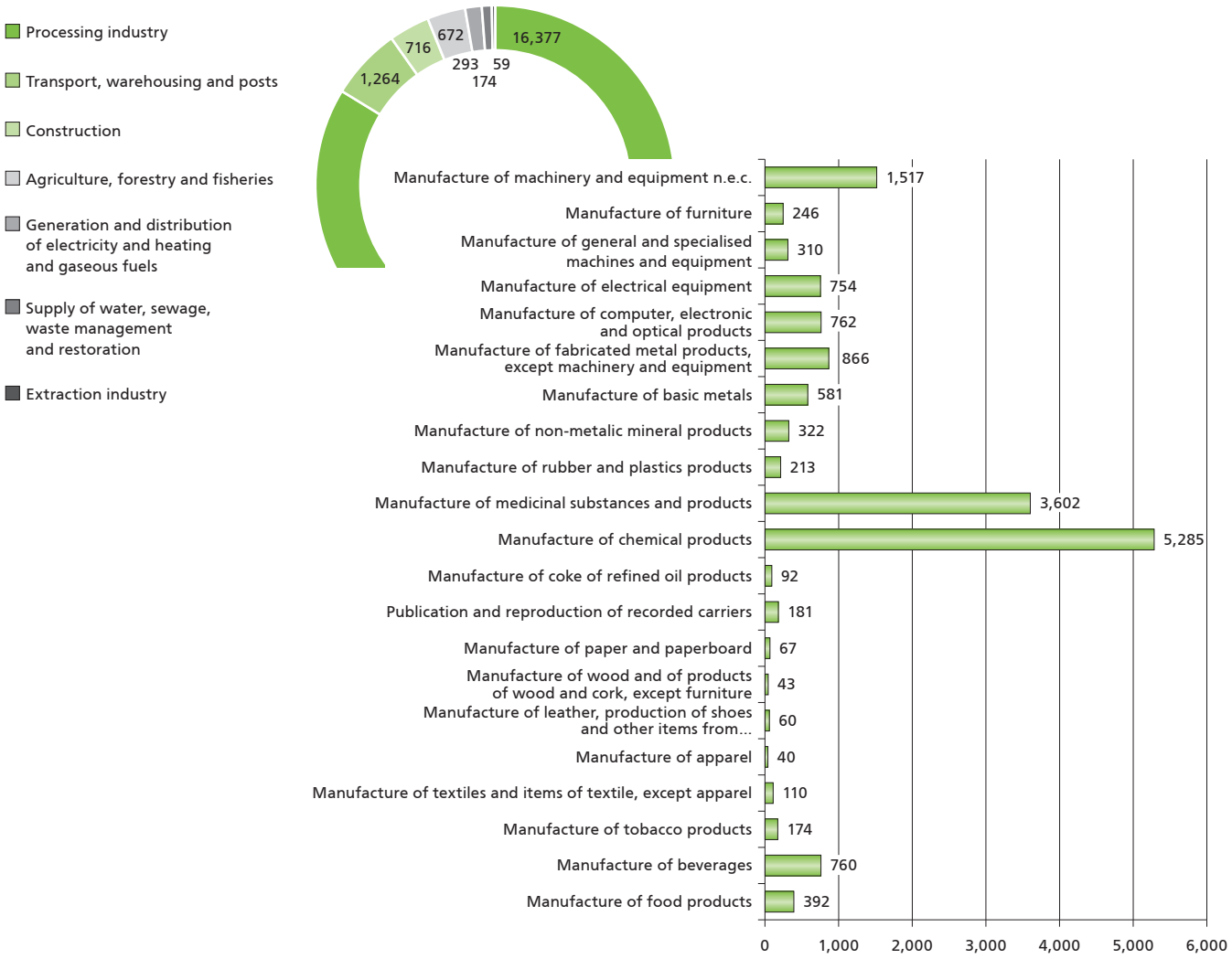
Source: Based on data from the PORB Official Bulletin.

Figure 20. PATENT ACTIVITIES OF THE HIGHER EDUCATION SECTOR ON THE TERRITORY OF BULGARIA, 2007 – 2016



Source: Based on data from the PORB Official Bulletin.

Figure 21. SHARE OF SECTORS IN THE PATENT ACTIVITIES IN BULGARIA, 2007 – 2016, NUMBER



Source: Based on data from the PORB Official Bulletin.

share of individuals and increase of the share the public sector, businesses and higher education. The relative share of individuals decreased almost five times from 86 % in 2002 to 18 % in 2016. Unfortunately, however, **fewer patents by individuals is not made up by an increase in the number of patents in the other sectors**. After the two peak periods – 2001 – 2003 and, to a lesser extent, 2008 – 2010 – **individual inventors who have no institutional affiliation and who decide to go down the long path of patenting and investing their own funds are disappearing in Bulgaria** – they start looking for opportunities outside the country or lose interest in such an exercise.

Table 1. COMPANIES REGISTERED IN BULGARIA WITH THREE OR MORE PATENS EFFECTIVE ON THE TERRITORY OF THE COUNTRY, 2007 – 2016

	Company patent holder	Number of patents
1	Hyundai Heavy Industries Co AD, Sofia	23
2	Sopharma AD, Sofia	21
3	VMZ AD, Sopot	11
4	Non-Ferrous Metals Company AD, Plovdiv	4
5	AVM-AGRO OOD, Plovdiv	3
6	Euroconsult OOD, Plovdiv	3
7	Mauer Locking Systems OOD, Varna	3
8	Mechatronica AD, Gabrovo	3
9	Promaks-99 OOD, Sofia	3
10	Sparky Eltos AD, Lovech	3
11	Laktina OOD, Bankya	3

Source: Based on data from the PORB Official Bulletin.

In practice, while the patent activities of the government sector (including higher education because the technical and technological higher educational institutions – patent holders are state-owned) and businesses remain relatively the same, it is the upward and downward trends in patenting by individuals which drive the national trends in the area as a whole.

In 2016, the Bulgarian Academy of Sciences added five new patents[18] to its collection of 88 patents for the period 2007 – 2016. For the past ten years, its most active bodies have been the Institute of Management and System Research (22 patents), the Institute of Metal Science (12 patents) and the Institute of Mechanics (10 patents), which contribute 50 % of the overall patent activity of the Academy since Bulgaria's joining the EU. These are also the scientific organisations where research activities are held systematically and there is a sustainable intensity with respect to the results achieved in almost every year of the period under review.

In 2016, the institutes of the Agricultural Academy focused their efforts primarily on new types of plants and new animal breeds.

The patent activities of the Military Medical Academy remain less than modest. There have been no patent activities at the Medical Universities in Pleven, Plovdiv, Sofia and Varna, despite the country's achievements in medicine with respect to scientific publications, references and the H Index (See section *Scientific product*). It should be noted here that the means used for treatment are subject to patenting while the methods of treatment are not.

2016 was a good year for the higher education sector with a total of 7 patents – an unrivalled achievement in the period after 2000. The main contribution to this result was that of the **Technical University – Varna with five patents issued** (or a total of nine patents over the past ten years). Additionally, one patent each was awarded to the University of Chemical Technology and Metallurgy (with a total of 4 patents for the period) and the Technical University – Sofia (with a total of 3 patents for the period).

The greatest share of overall patent activities has been registered in the sectors manufacture of chemical products and manufacture of medicinal substances and products – a little above 46 % of all patents effective on territory of the country for the past ten years and 55 % of the patents in Processing Industry.

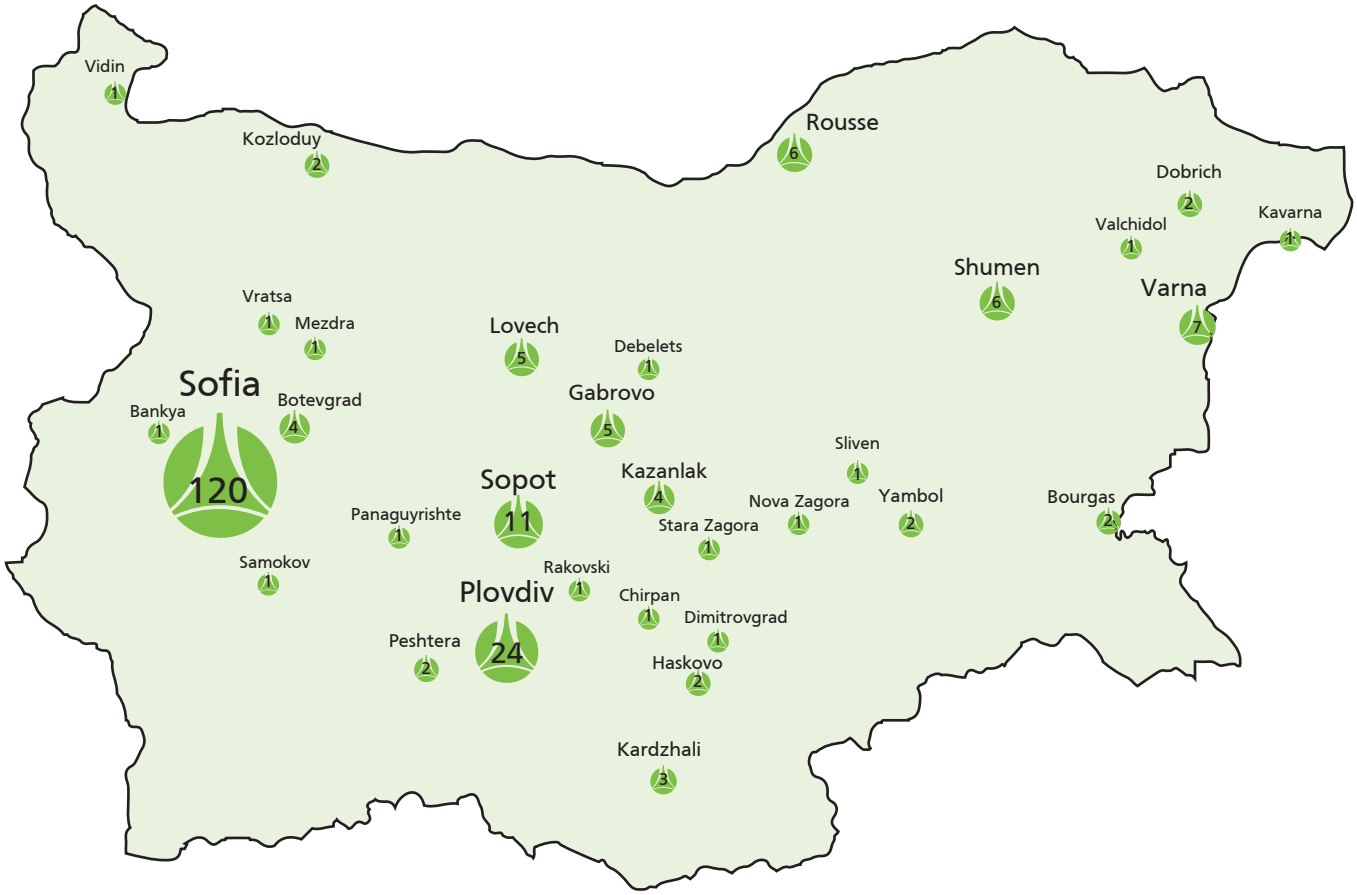
As for the Bulgarian patent holders, first come the sectors manufacture of electrical equipment (122 patents) **and metal products** (102 patents). Outside processing, the greatest number of protected inventions are in the sectors of transport, warehousing and posts (53 patents) and construction (41 patents).

The territorial distribution of the "business" patents issued in the country is highly uneven. Apart from the capital city – which has the greatest concentration of businesses – the **Southwest planning region may be deemed a patent-free zone**.

[18] In 2016, a patent was issued by the PORB to each of the Institutes of Metal Science, Solid State Physics, Physical Chemistry, System Engineering and Robotics, and Information and Communication Technologies. The R&D activities of the Institute of Information and Communication Technologies was presented in detail in the report *Innovation.bg 2016*.

The South Central Region has the most even distribution of patent-protected inventions followed by the parts of the North Central Region and the Northeast Region gravitating respectively around Gabrovo and Varna.

FIGURE 22. TERRITORIAL DISTRIBUTION OF PATENT ACTIVITY OF BUSINESSES, 2007 – 2016 (NUMBER)



Source: Based on data from the PORB Official Bulletin.

BOX 2. UTILITY MODELS AS THE PREFERRED MEANS OF PROTECTION OF TECHNICAL SOLUTIONS BY BULGARIAN INVENTORS

In the period 2007 – 2016, PORB registered a total of 1,492 utility models. Despite the annual fluctuations, **the interest of creators in the so called "small inventions" has grown over time** resulting in a doubling of the number of utility models registered annually – from 107 registrations in 2007 to 217 certificates issued in 2016.

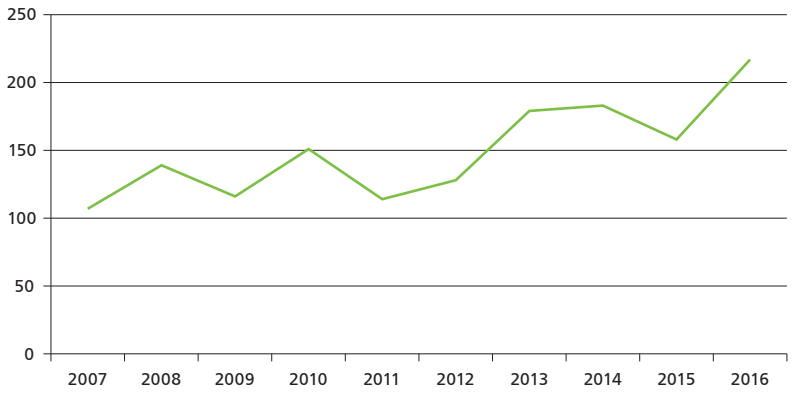
A factor for the high growth is primarily the amendments to the Patents and Registration of Utility Models Act which entered into force at the end of 2006. Their purpose was to turn utility models into an attractive form of protection of technical solutions through a series of measures such as:

- Reducing the duration of the procedure for their registration and simplifying it;
- Lowering the novelty criterion;
- Introducing lower requirements with regard to the so called "inventive step" in comparison to that for inventions.

Along with this, **the registration of a utility model requires less financing from the applicant in comparison to the procedure to patent inventions**.

Box 2. UTILITY MODELS AS THE PREFERRED MEANS OF PROTECTION OF TECHNICAL SOLUTIONS BY BULGARIAN INVENTORS (CONTINUED)

Figure 23. UTILITY MODELS REGISTERED ON THE TERRITORY OF BULGARIA, 2007-2016 (NUMBER)



Source: Based on data from the PORB Official Bulletin.

Unlike patents, **close to 95 % of the utility models registered are held by Bulgarian entities** – individually or jointly with foreign partners. The low activity of foreign applicants is the result of the fact that utility models are not equally popular as a form of protection in all national legislations. Some countries do not provide for such a form of rights protection for technical solutions and thus their citizens and businesses are not aware of this option.

Along with this, utility models are usually considered a less stable form of protection. In Bulgaria as well, 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 existence of these grounds for registration may always be challenged and, respectively, the rights arising from the registration may be lost.

Foreign holders come from 24 countries. There are almost equal shares of foreign applicants from Russia (17 %), Turkey (16 %) and the Czech Republic (15 %), followed by Germany (6 %) and Slovakia (5 %).

An interesting aspect is the procedure for filing applications, which allows for two options – as per national regime based on an application to PORB or as per the international regime under the Patent Cooperation Treaty. The data show that more than 2/3 of the applicants have chosen the first option. Thus, since the application under the Patent Cooperation Treaty is cheaper for registration in foreign countries, it is logical to assume that the prevailing applications under the national regime are related to a specific interest in Bulgaria as a commercial destination and not just an intention to realise a technical solution in a large number of countries, including Bulgaria.

The greatest interest in the registration of utility models over the period under review was that of the business sector with 781 registrations, followed by individuals who registered 525 utility models individually or in groups. Over the ten-year period, the activity of individuals has declined similarly to the situation with patents.

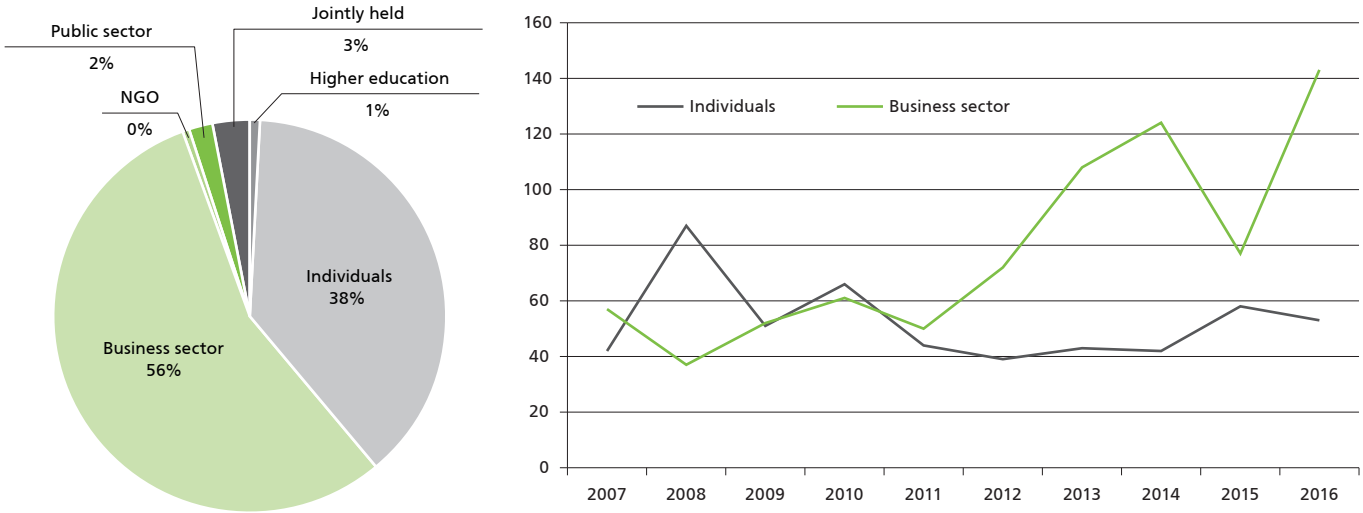
The leader among academic institutions in terms of the number of utility models is the Bulgarian Academy of Sciences with 20 registrations, followed by the Agricultural Academy (5) and the Military Medical Academy (1). In the public sector, there are also the National Science Fund and the National Centre for Radiobiology and Radiation Protection within the Ministry of Healthcare with 1 utility model each.

Four higher education institutions hold utility models – Technical University Varna (6), Rousse University (4), Higher School of Transport (3) and the University of Chemical Technology and Metallurgy (1). As with patents, the activity of higher schools is relatively low, which, to a large extent, is due to the lack of a strategic vision about development, entrepreneurial culture and understanding of the significance of intellectual capital. The Ministry of

Box 2. UTILITY MODELS AS THE PREFERRED MEANS OF PROTECTION OF TECHNICAL SOLUTIONS BY BULGARIAN INVENTORS (CONTINUED)

Education and Science introduced a requirement for academic and university bodies to adopt internal intellectual property regulations applying to the implementation of OP Science and Education for Smart Growth. The requirement, however, has been implemented formally in most cases, without these organisations taking targeted and specific measures in this regard.

Figure 24. STRUCTURE AND DYNAMICS OF THE REGISTRATION OF UTILITY MODELS, 2007 – 2016 (% AND NUMBER)



Source: Based on data from the PORB Official Bulletin.

A total of 49 utility models are held jointly by Bulgarian entities and their number has been constantly growing over the period. The main reason is the shared risk in joint applications and the better opportunities for finding markets for the technical solution.

Source: Applied Research and Communications Fund, 2017.

Research product

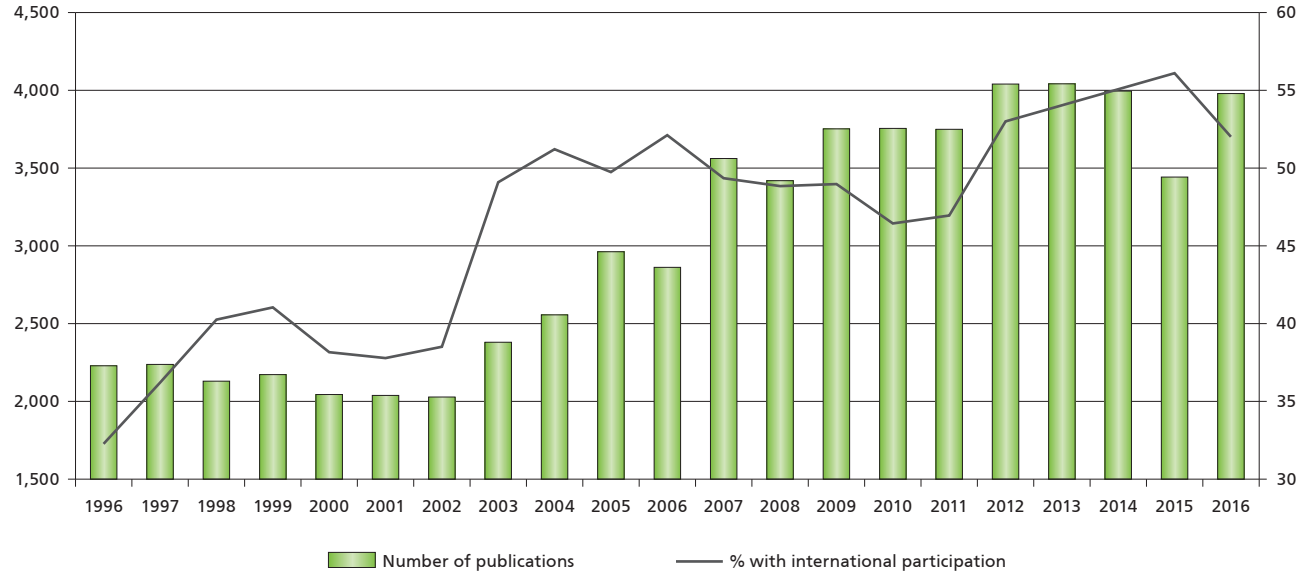
New scientific knowledge is an important condition for enhanced innovation activity in the country. The analysis of the dynamics and structure of the process reveals the potential of Bulgaria to successfully fit in the global scientific networks, its comparative advantages in various fields of knowledge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

In 2016, there was a **resurgence in the publication activity of Bulgarian scientists in the Scopus database** following the one-year decline of this indicator in 2015 – up to 3,978 scientific publications reaching the level of the peak 2012 – 2014 period. **The increase is by 15 % on an annual basis and it is the most significant one for Bulgaria since 2007**, when growth reached a little over 24 %.

Given this background, **the country maintains relatively stable positions with respect to the international, European and regional scientific community**. The comparative data show that the slight move forward by a position – up to the 22nd place – among EU-28 is accompanied by a decline of two positions to the 53rd place on the international stage. The regional ranking for Bulgaria does not change as regards the overall number of documents, while it has swapped its ranking for citation per document and the H Index.

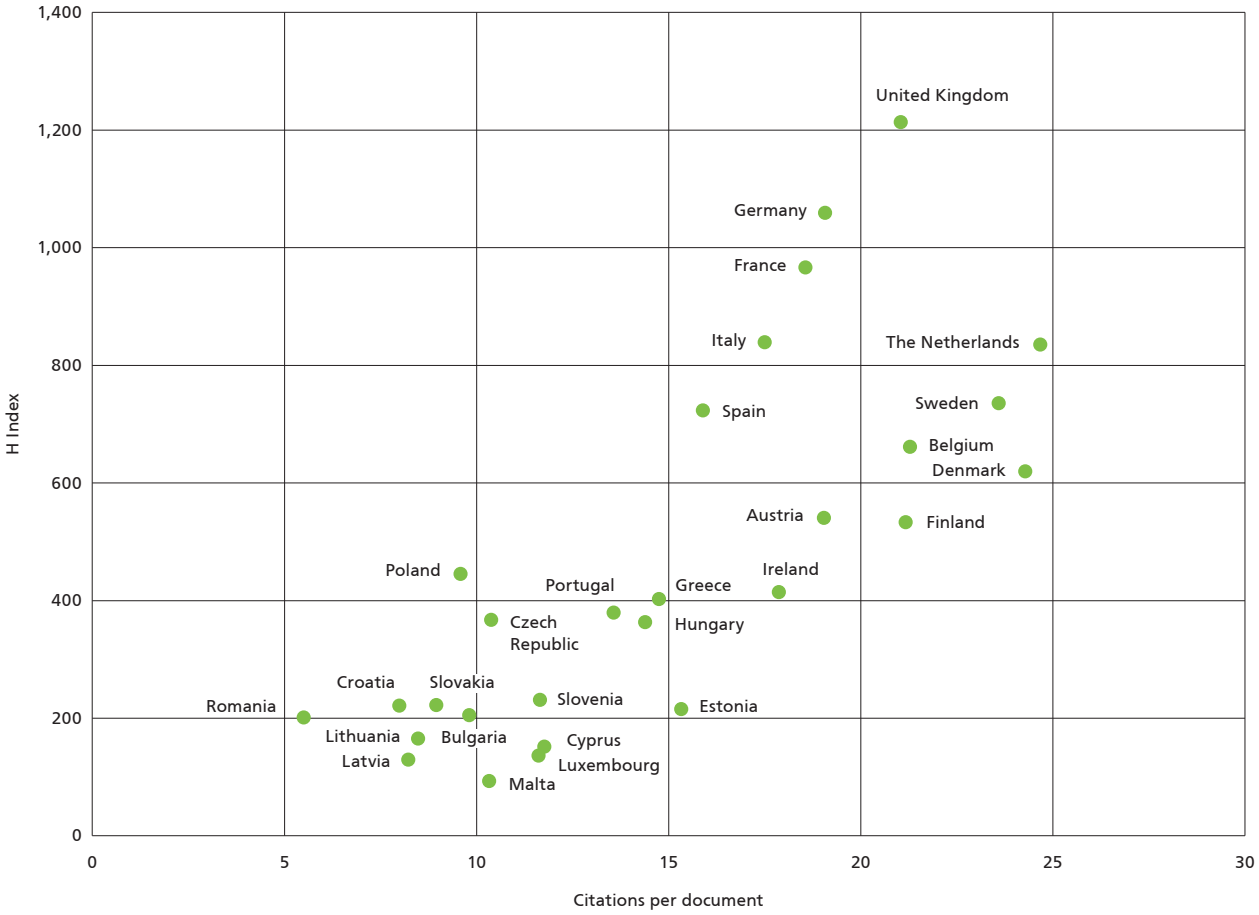
According to 2016 data only, Bulgaria ranks 60th in the world in terms of the total number of publications in the Scopus database in the group of Vietnam, Morocco and Bangladesh, which are immediately before Bulgaria. **Bulgaria's positioning in the Balkans also seems unfavourable**. The comparison of the national numbers of scientific publications and the numbers of citations per R&D expert for 2016 allows for an analysis of the publication activities in the countries from the Balkans. Three categories emerge in view of the results of the respective scientific communities in

Figure 25. PUBLICATION ACTIVITY IN THE SCOPUS DATABASE, BULGARIA, 1996 – 2016



Source: SCImago. (2007). SJR – SCImago Journal & Country Rank. Retrieved August 23, 2017, from http://www.scimagojr.com

Figure 26. H INDEX AND CITATIONS PER DOCUMENT IN THE SCOPUS DATABASE, EU-28, 1996 – 2016



Source: SCImago. (2007). SJR – SCImago Journal & Country Rank. Retrieved August 23, 2017, from http://www.scimagojr.com

Table 2. POSITION OF BULGARIA IN THE GLOBAL SCIENTIFIC COMMUNITY PRESENTED IN SCOPUS, 1996 – 2016

Bulgaria		Number of documents 64,425	Citations per document 9.81	H Index 205
Rank in the group	All countries in SCOPUS (239 countries)	53	152	51
	European Union (28 Member States)	22	22	22
	Eastern Europe (24 countries)	10	7	10

Source: SCImago. (2007). SJR – SCImago Journal & Country Rank. Retrieved August 23, 2017, from http://www.scimagojr.com

terms of number, significance and impact of the publications made. Croatia and Serbia have the best results in each analysed benchmark, followed by Romania, Bosnia and Herzegovina, and Slovenia. **Bulgaria is last but one in the region, after Montenegro and before Macedonia**. After ten years in the EU and constant reforms of the national scientific and innovation system as a whole, and its individual institutions in particular, Bulgaria is in the company of countries which, in the period 1991 – 2001, suffered the most serious military conflict in the new European history, are still far away from full EU membership (if this can be used as an indication of reforms, harmonised legislation and guarantees for the rule of law) and still cannot make full use of the European framework financing for science, technology and innovation.[19]

Figure 27. PUBLICATION ACTIVITY OF THE WESTERN BALKAN COUNTRIES, NUMBER OF CITABLE DOCUMENTS PER PERSON ENGAGED IN R&D*

* The data used for number of documents, number of citable documents and number of citations are for 2016. The date for R&D staff are for 2014. The data for Macedonia are based on the number of persons engaged in science and technology for 2015. There are no data for Albania and Kosovo.

Source: SCImago. (2007). SJR — SCImago Journal & Country Rank. Retrieved August 23, 2017, from http://www.scimagojr.com; Eurostat, 2017.

The prospects for Bulgaria's participation in the regional, and therefore international scientific community are also poor. **There is a continuing decline in the share of the publications of Bulgarian scientists in the regional and international research output**. This also holds true for research areas where Bulgaria is specialised and which determine the scientific profile of the country – physics and astronomy (25 % of all publications), medicine (20 %), engineering science (15 %).

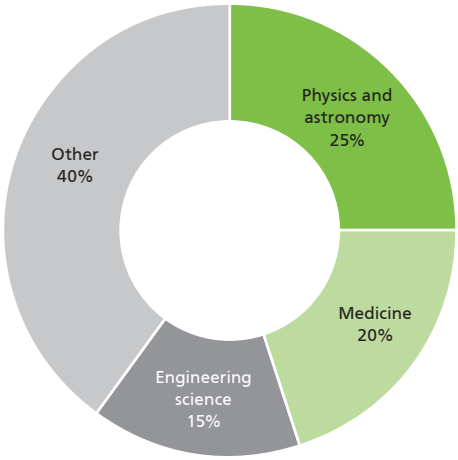
Bulgaria has the strongest results in physics and astronomy. In terms of the number of scientific publications, the country ranks 45th globally and 20th in the EU. However, after 2007, despite temporary fluctuations, Bulgaria's share in the global and regional scientific output has been on the decline constantly,

[19] Such results should come as no surprise given the methods and mechanisms applied in the management of scientific institutions in Bulgaria. A case in point is the Agricultural Academy – in 2017 alone, the Academy, which is a second-level budget spending unit within the Ministry of Agriculture, Food and Forestry, changed three presidents (Prof. Totka Trifonova until February, Prof. Ivan Pachev until July and Prof. Vasil Nikolov until the publication time of this report) or a total of six presidents for the past six years; this is in addition to the intention of subsuming the Agricultural Academy into the Bulgarian Academy of Sciences and thus undermining its independence and standing.

from 0.4 % globally and 3.46 % in the region for 2007 (a peak year for Bulgaria) to respectively 0.28 % and 2.09 % in 2016 when there was a slight increase in comparison to the previous year.

The same trend, but even stronger on a regional scale, is observed in **medicine** (55th globally and 22nd in the EU, an identical positioning as with engineering science). The slow-down has been taking place since 1996 from a baseline of 6.74 % and reaching 2.45 % in 2016, or a drop of more than 36 %. Medicine is not an isolated case – with few exceptions, the decline is almost as pronounced in all 27 areas of science.

Figure 28. BREAKDOWN OF BULGARIAN RESEARCH PUBLICATIONS BY FIELD, 1996 – 2016



Source: SCImago. (2007). SJR — SCImago Journal & Country Rank. Retrieved August 23, 2017, from http://www.scimagojr.com

Entrepreneurship

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.

In 2016, for a second year in a row, Bulgaria was included in the **Global Entrepreneurship Monitor** (GEM),[20] the study of the dynamics of entrepreneurial ecosystems on the largest scale. GEM 2016 covers 64 countries, 25 of them in Europe. The study assesses the **social and individual attitudes to entrepreneurship, the entrepreneurial activity at its various stages, and the framework conditions of the entrepreneurial ecosystem** viewed as a dynamic interaction among the entrepreneurial attitudes, abilities and aspirations of individuals, which determine the distribution of resources in the process of creating and developing new endeavours.[21]

The two-year period in which Bulgaria has been part of the comparative analysis is too short to expect substantial changes or trend-setting. There have been changes in certain indicators but, at this stage, they only confirm the country's disappointing positions at the bottom of both the European and the global rankings.

Although with lower values than 2015, the respondents' assessment of the high status of a successful entrepreneur and entrepreneurship as a good choice of career development remains at levels which are little above the European average. Still, **the share of latent entrepreneurs (intending to start their own business within three years) remains low** – a mere 7.09 % of the population aged 18-64 which is well below the European average of 11.86 % and the countries with the highest entrepreneurial spirit – Poland (20.83 %), Latvia (18.94 %), Croatia (18.17 %). The highest result is that of Macedonia – 24.85 %.

The intentions to develop entrepreneurial activities are typically lowest in the countries with a high innovation-based economic growth, a category most European countries belong to (an average of 15 %). A high standard of living and security of the population reduce the motivation to start one's own business. Although, as it transpires from the data further, the relatively low entrepreneurial activity in these countries is of the highest degree of innovativeness (measured as the level of novelty and complexity according to the sectoral structure of entrepreneurship) and social impact (from the point of view of jobs created).

In terms of comparison, in countries with a factor-based growth an average of 30 % of the population aged 18 to 64 indicate an intention for entrepreneurial activity. In the countries whose growth is based on an increase in efficiency (as is the case with Bulgaria according to the methodology of the World Economic Forum), this share is 26 %. Therefore, **in the group of countries with a similar economic situation and sources of growth, Bulgaria is distanced from the average levels by almost 20 points**.

In 2016, the profile of the typical Bulgarian entrepreneur shifted slightly in terms of age (25-34 year olds) but preserved **its low motivation index – a mere 1.1 % of the new businesses were created on the basis of new growth opportunities or aimed to improve the entrepreneur's financial situation**. In most cases, the decision to start one's own business is dictated by external circumstances and the need to provide for the family. Similar levels of the motivation index in Europe are present in Greece (1.1 %) and Slovakia (1 %).

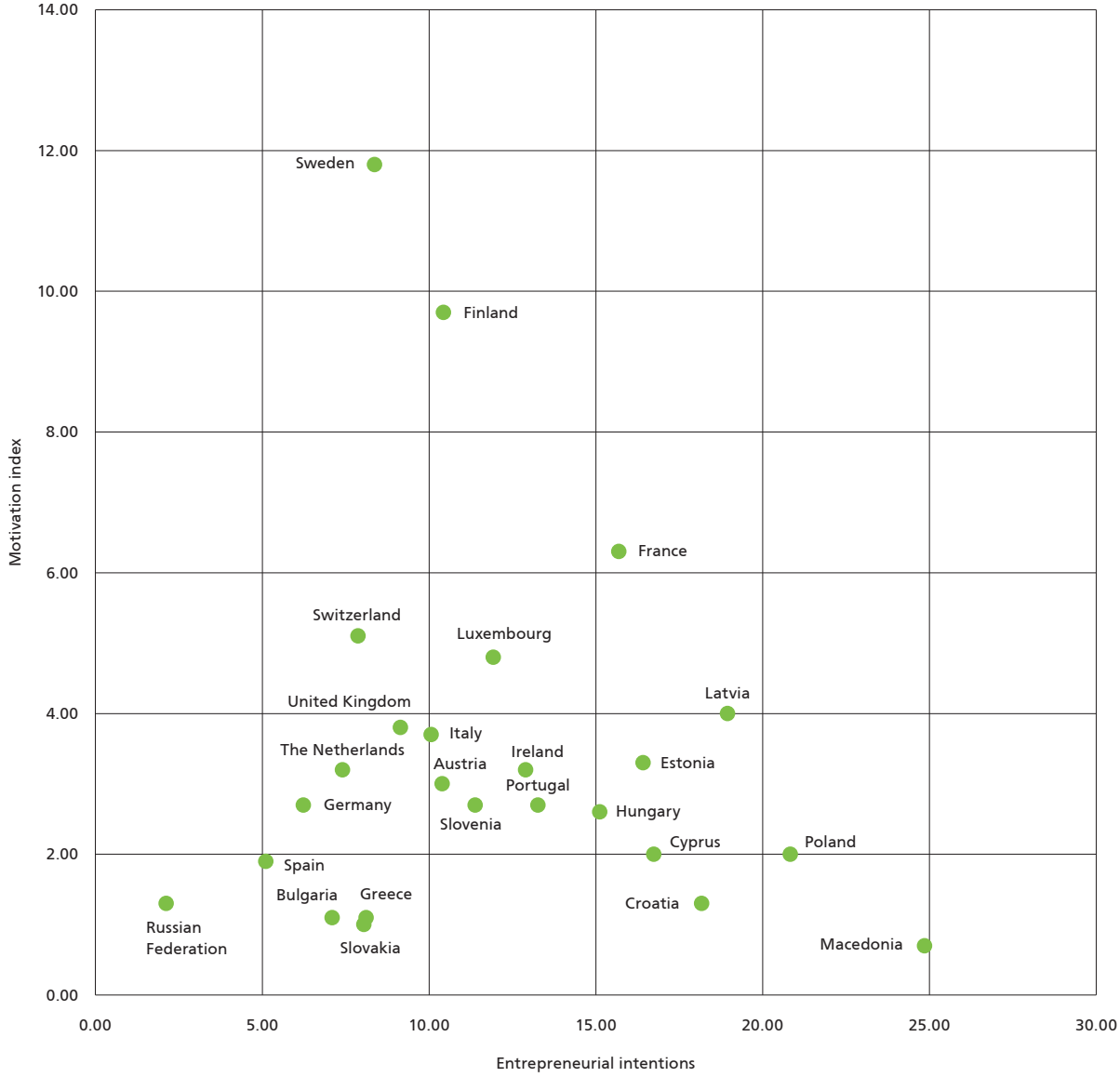
The two extremes of the European scale are occupied by Macedonia with the highest entrepreneurial attitudes of almost 25 % (albeit with the lowest motivation index of 0.7 % and one of the lowest levels of innovativeness), and Sweden where the population with the highest entrepreneurial intentions is among the least (a little over 8 %) but has a record-high motivation index of 11.8 % (compared to an average 3.4 % for Europe) and a significant level of innovativeness. **Bulgaria combines low entrepreneurial activity with a weak innovation potential and expected social impact**:

- A little over 17 % of the entrepreneurs who started their own

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

[21] 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

Figure 29. PROFILE OF ENTREPRENEURIAL ACTIVITY, EUROPE, 2016



Source: The 2016 Global Entrepreneurship Monitor (GEM).

business in the past three years indicate that the services and products they offer are a novelty (at least) for some of the consumers and competitors – the lowest level in Europe (assuming that Macedonia with 15.5 % and Russia with 5.4 % are "off the scale") and far from the average levels in Europe of more than 28 %.

- The differences in terms of the expectations to create jobs are also considerable – 13.4 % of the entrepreneurs intend to expand their business and create 6 and more jobs in the next 5 years. Bulgaria is followed by Greece and Spain with 9.7 % and Austria with 13 % given an average for Europe of almost 22 %. Close to 70 % of those who started a new business in Bulgaria do not envisage to create new jobs – a relative share which places the country first in Europe and 6th globally.

As a result, **Bulgaria's entrepreneurial potential remains locked in low-tech activities,** even more so in 2016 than in 2015. The share of new enterprises in wholesale/retail has grown by ten percentage points at the expense of sectors such as ICT, transport, mining. The biggest growth, despite the very low baseline, is typical of the professional services and agriculture.

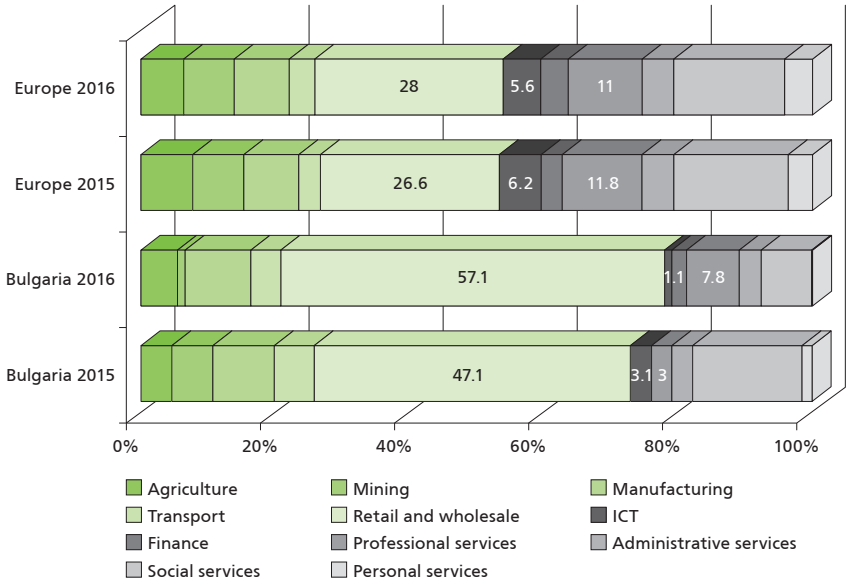
Entrepreneurial employee activity in Bulgarian companies is completely in line with the general trend. **The staff who demonstrate initiative and creative thinking in their work**

and commit to ideas for new products, organisational and marketing improvements in the companies where they work are less than 1 %. The result in Bulgaria is almost identical to that of Russia (0.7 %), followed by 1.4 % in Macedonia and Greece. Leaders in this regard are Austria (7.3 %), Luxembourg (7.3 %) and the United Kingdom (7 %).

Bulgaria's low values in this indicator is probably the reason why it has not been included in the special report on entrepreneurial employee activity. According to this report, which complements the regional profiles of entrepreneurial activity, the European countries together with the USA, Canada and Australia (the countries with an economic growth based on innovation) demonstrate much higher levels of entrepreneurship at the workplace in which the staff, rather than develop their own new products and services independently, initiate and implement such within the organisations their work for. Together with the creation of new enterprises, entrepreneurial employee activity forms the **overall entrepreneurial activity** of each country. **With a result of 22.46 % for this indicator** (16.16 % of the population aged 18-64 who have started either as entrepreneurs or as owners of a new business plus another share of 6.3 % of entrepreneurial staff) **Estonia is the European leader**. **Bulgaria is at the bottom with entrepreneurial activities of a mere 5.74** % (4.84 % and 0.9 % for the individual indicators).

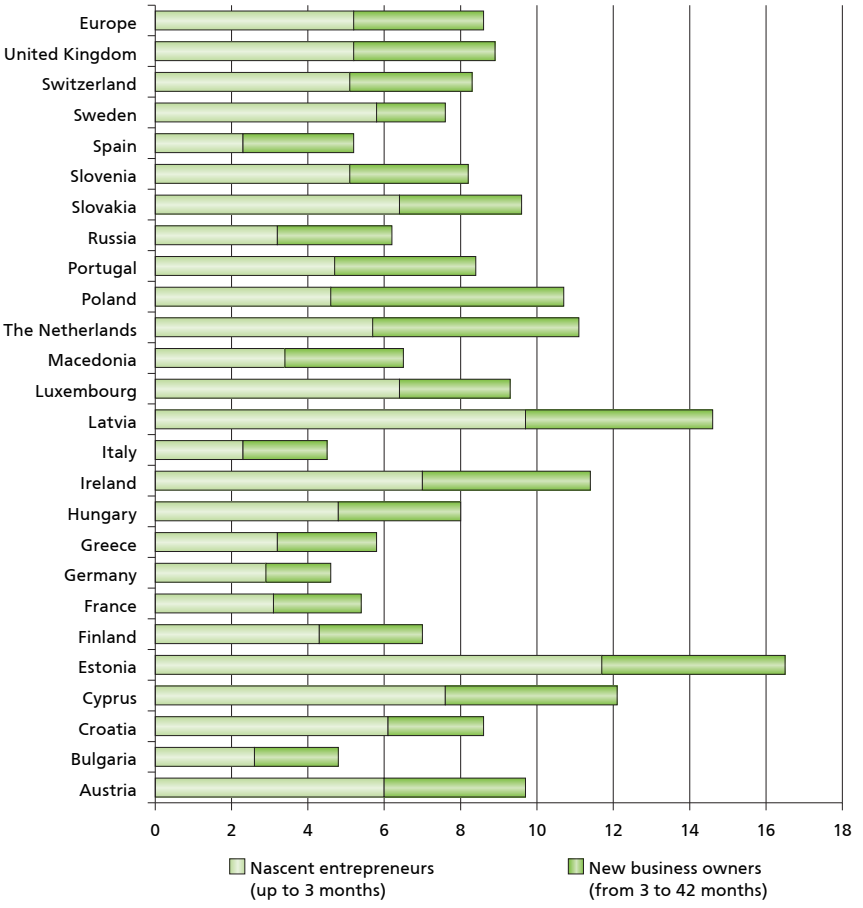
On the other hand, **Bulgaria tops the European ranking when it comes to female entrepreneurship** as it has the highest results for the ratio of female to male entrepreneurs with the number of women with a new business being 80 % of the level for men (together with Russia 83 % and Spain with 81 %). The average for Europe is 59 %.

Figure 30. SECTORAL STRUCTURE OF ENTREPRENEURIAL ACTIVITY, 2016, %



Source: The 2016 Global Entrepreneurship Monitor (GEM).

Figure 31. ENTREPRENEURIAL ACTIVITY AT AN EARLY STAGE, 2016, %



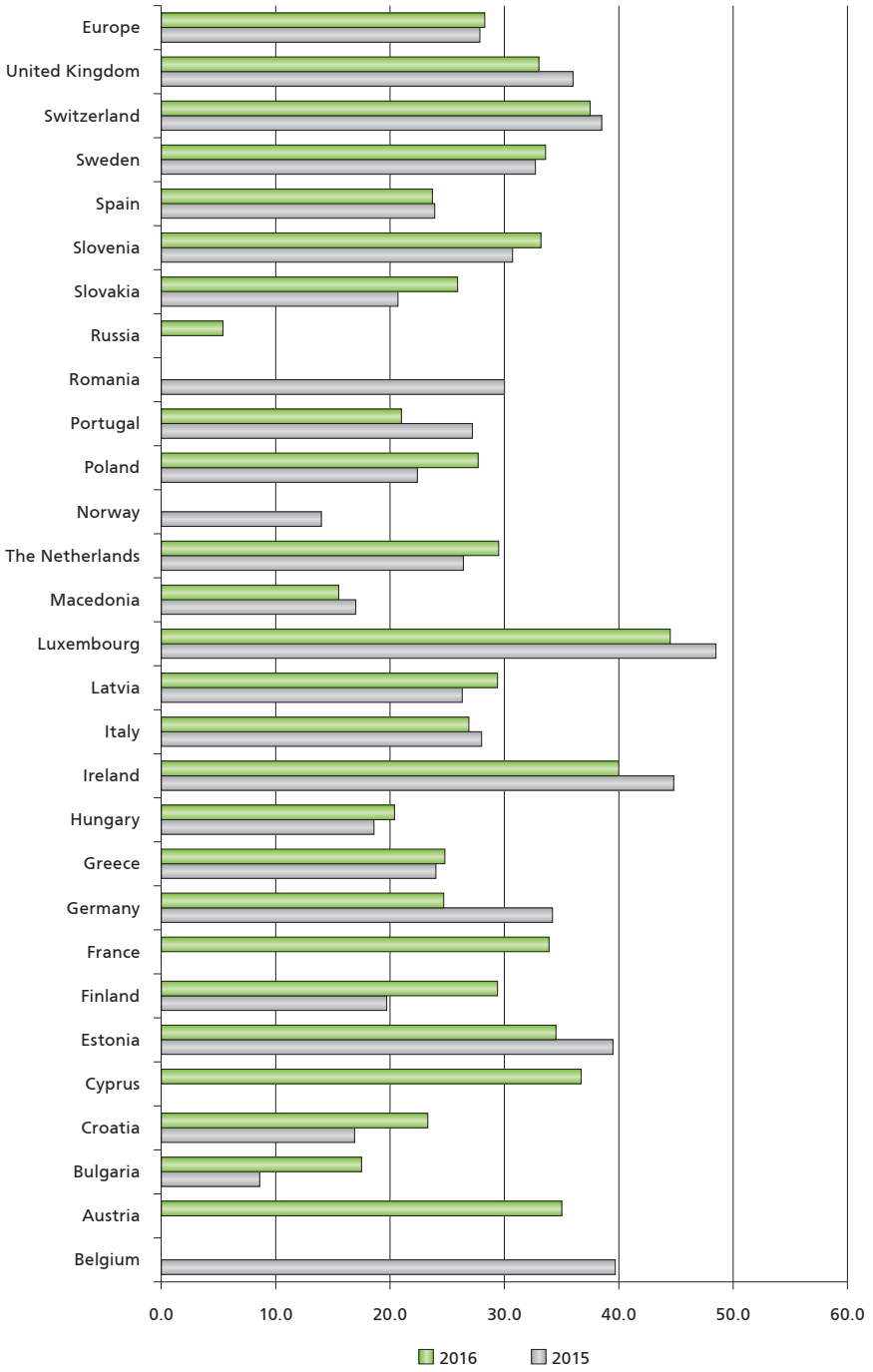
Source: The 2016 Global Entrepreneurship Monitor (GEM).

Bulgaria's scores on the framework conditions indicators diverge widely, ranging from very high values for factors such as physical infrastructure and services (with the highest average for all 65 countries), tax environment and accessible sources of financing, to very low for government policy and entrepreneurship education (with the lowest average for all 65 countries). **Bulgaria comes last, or 65th, in the international ranking in terms of relevance of the government policy in the area of entrepreneurship and 60th in terms of government programmes in support of entrepreneurship**, which demonstrates the insufficient role and impact of the government institutions in the entrepreneurial ecosystem.

As shown by the data about Bulgaria's progress in 2016 in the implementation of the principles of the Small Business Act – a European SME support initiative[22] – **the assessment of the progress achieved is lowest for entrepreneurship**, which envisages measures to create "an environment in which entrepreneurs and family businesses can thrive and entrepreneurship is rewarded." The change achieved is insignificant and the performance of the country is worsening. Added to poor performance in terms of skills and innovation, this points to an **exceptionally low innovation potential of the SME sector in Bulgaria**.

Similarly to the results from the Global Entrepreneurship Monitor, in the EC study the relatively high results for Bulgaria in terms of entrepreneurial intentions are not matched by corresponding levels of entrepreneurial activity. The measures laid down in the National Action Plan **Entrepreneurship 2020 – Bulgaria** to include entrepreneurship in the curricula at all educational levels, to stimulate the practical training of pupils and students, develop university entrepreneurship centres and the wide range of competitions and awards for young entrepreneurs are a step in the right direction. However, the expected results are not immediate and need to be supported by sustainable policies towards the other factors of the entrepreneurial environment in view

Figure 32. LEVEL OF INNOVATIVENESS OF ENTREPRENEURIAL ACTIVITIES, 2016, %

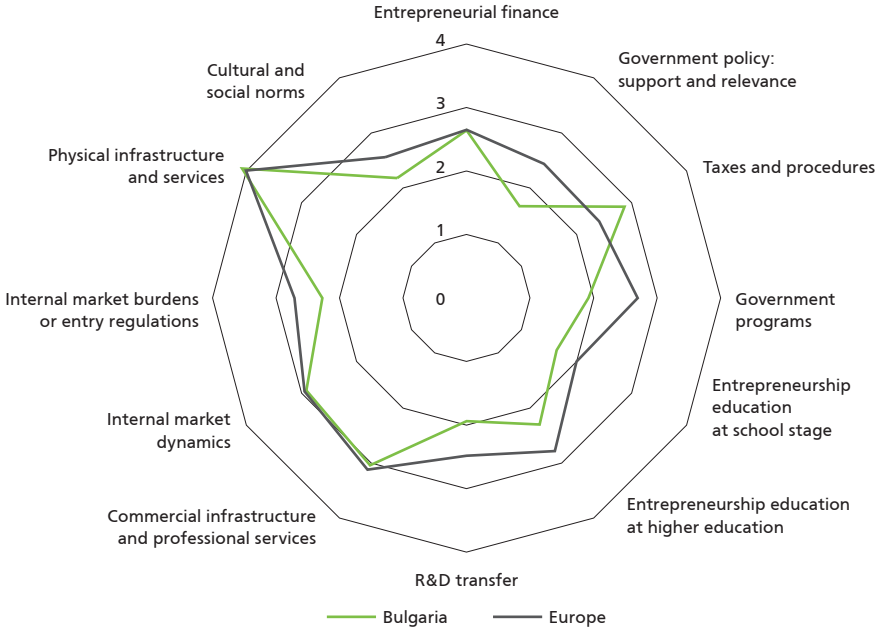


Source: The 2016 Global Entrepreneurship Monitor (GEM).

[22] 2016 SBA Fact Sheet, Bulgaria; Annual Report on European SMEs 2015/2016, SME recovery continues, SME Performance Review 2015/2016, Contract number: EASME/COSME/2015/012, FINAL REPORT, November 2016, http://ec.europa.eu/growth/smes/business-friendly-environment/performance-review-2016_en

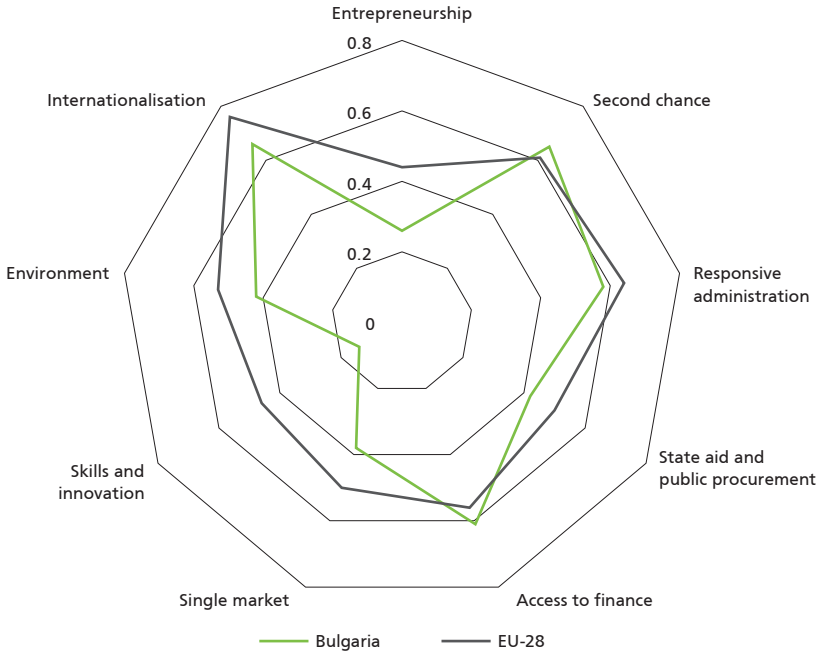
of the needs of the different groups of entrepreneurs – social or profit-oriented; situated in high or low-tech activities; representatives of traditional family businesses or new fast-growing industries; young or experienced entrepreneurs; serial entrepreneurs.

Figure 33. FRAMEWORK CONDITIONS OF THE ENTREPRENEURIAL ECOSYSTEM, 2016



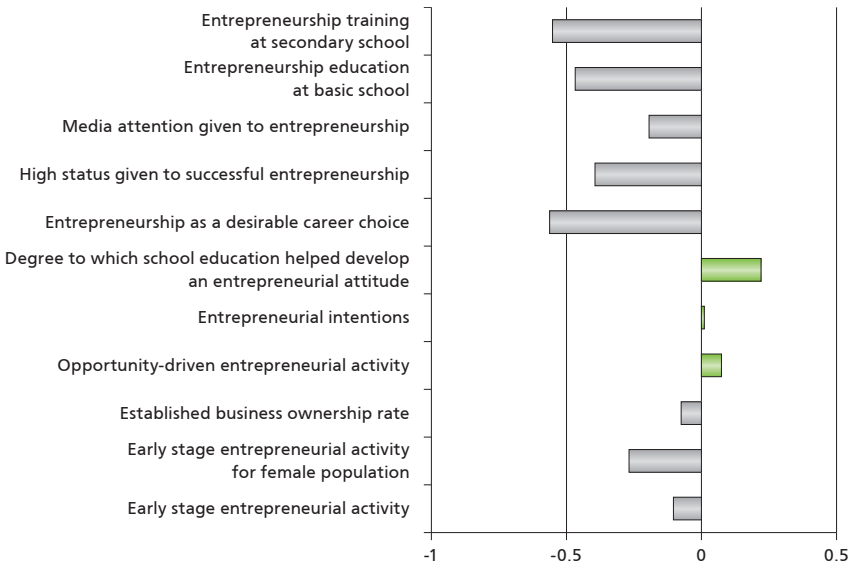
Source: The 2016 Global Entrepreneurship Monitor (GEM).

Figure 34. PROFILE OF BULGARIA, THE SMALL BUSINESS ACT 2016



Source: 2016 SBA Fact Sheet, Bulgaria, http://ec.europa.eu/growth/smes/business-friendly-environment/performance-review-2016_en

Figure 35. BULGARIA'S PROGRESS IN ENTREPRENEURSHIP, 2008 – 2016, EU AVERAGE = 0



Source: 2016 SBA Fact Sheet, Bulgaria, http://ec.europa.eu/growth/smes/business-friendly-environment/performance-review-2016_en

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

In 2016, for the first time in the past seventeen years, **the R&D costs declined** in absolute amount. The drop was significant – by close to 14 % which, given the growing GDP (1.06 in comparison to the current prices indicator of 2015), is accompanied by an even more abrupt decline in their share of almost 19 %. The data about the sources of financing for R&D indicate the main reason for that, namely that the greatest decline is observed in funding from abroad (close to 33 %), which includes mainly foreign company resources. In fact, after 2014 and 2015 when projects started in the 2007 – 2013 period were finalised (and, respectively, funds used), there was a calming-down as a result of the delay in the procedures to approve the new programme documents and "unlock" the new project financing schemes.

The main drawback of **financing R&D in Bulgaria primarily with funds from abroad** is that it makes it impossible to achieve sustainability (under the influence of external factors outside the control of the Bulgarian government) and targeted action (due to the priority financing of projects determined at the European rather than the national level) in the area of new technologies and innovation which are said to lie at the foundation of the national and company competitiveness.

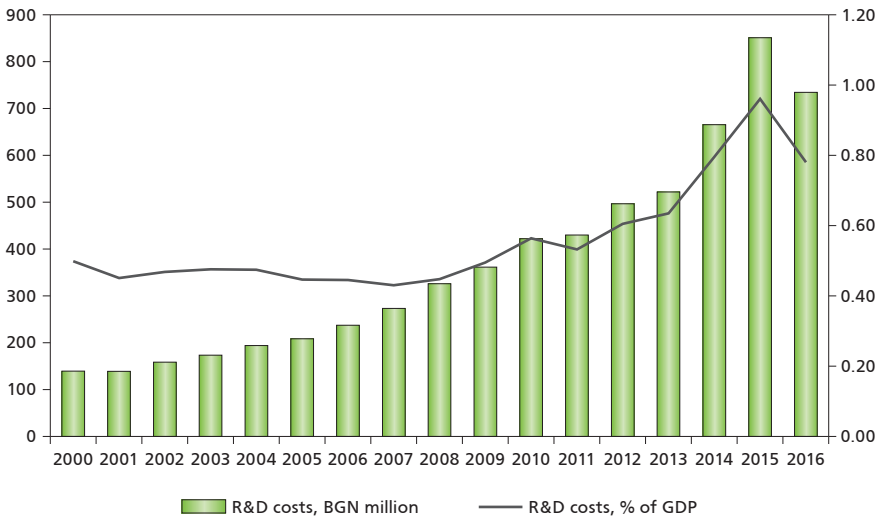
The reduction in R&D spending is a fact in all sectors; it is most significant in higher education. **Enterprises are the only sector which, in 2016, continued to invest increasing resources in innovation**. The public sector reduced, for yet another year, the resources for R&D and innovation. The decline in this indicator raises serious doubts whether Bulgaria will be able to achieve its ambitious, as it is, goal of a 1.5 % share of GDP for R&D costs.

In 2016, the main participants in the national innovation system remain confined to their respective groups. Enterprises contract R&D work to the public research institutions (Bulgarian Academy of Sciences and Agricultural Academy) and (mostly) the public universities amounting respectively to at a mere 1 % and 3 % of their R&D budgets. The financial flows in the other direction are even more limited. The situation is similar with regard to the government sector – 85 % of the budget of the academic institutions remains at their disposal, another 10 % are channelled to higher schools, most of which are also publicly funded.

The greatest diversification in terms of the sources of financing is in higher schools followed by enterprises. The latter get some serious financial resources from abroad which are largely allocated competitively. Unlike them, the R&D units of the public sector are financed primarily from the state budget, which is mainly institutional financing.

The only planning region in Bulgaria to have an increase in R&D costs for 2016 was the Northeast (by almost 45 %). Against the backdrop of the decline in R&D costs in the other

FIGURE 36. R&D SPENDING IN BULGARIA, 2000 – 2016

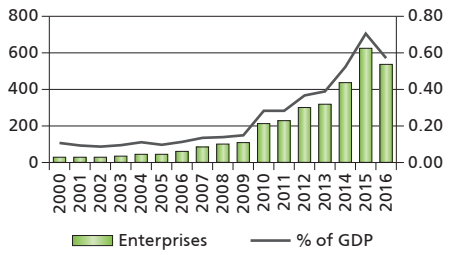


Source: NSI, 2017.

Box 3. CURRENT STATE AND DYNAMICS OF INVESTMENT IN R&D IN BULGARIA BY SECTOR

BUSINESS SECTOR

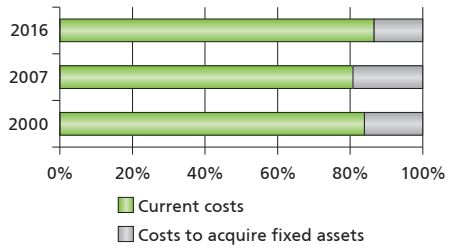
Dynamics of R&D costs, BGN million



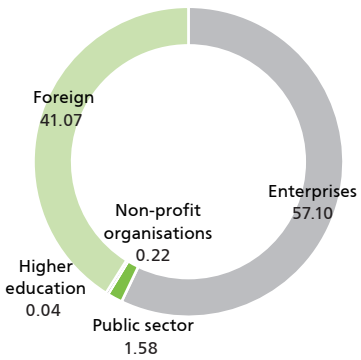
-13.81%
Decline in funds absorption
in comparison to the previous year

+5.74%
Growth in sources of financing
in comparison to the previous year

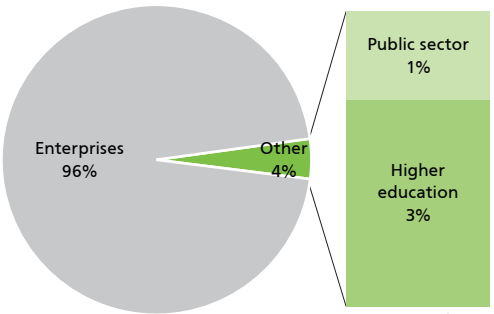
R&D costs by types



R&D costs by source of financing



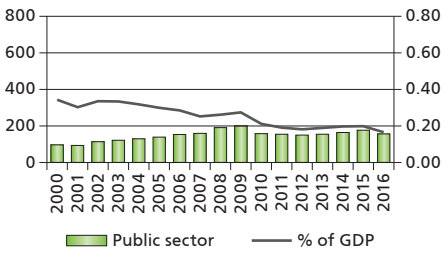
R&D costs by sectors of investment



70.07%
for technical sciences

PUBLIC SECTOR

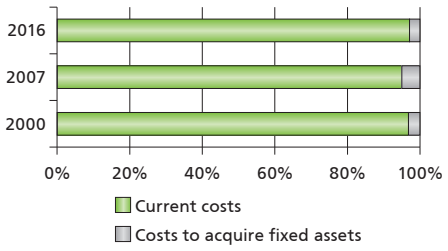
Dynamics of R&D costs, BGN million



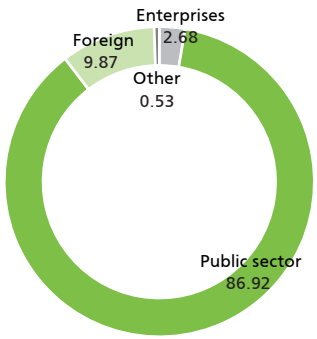
-11.56%
Decline in funds absorption
in comparison to the previous year

-7.32%
Decline in sources of financing
in comparison to the previous year

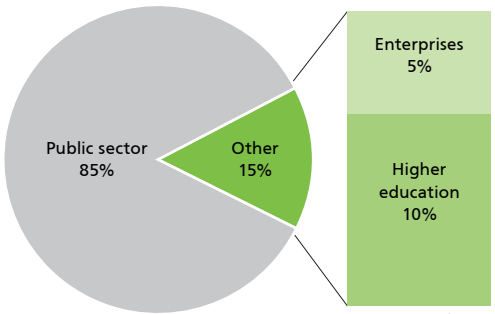
R&D costs by types



R&D costs by source of financing



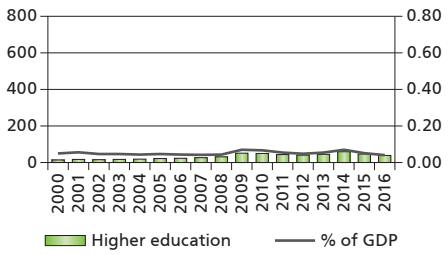
R&D costs by sectors of investment



45.67%
for natural sciences

HIGHER EDUCATION

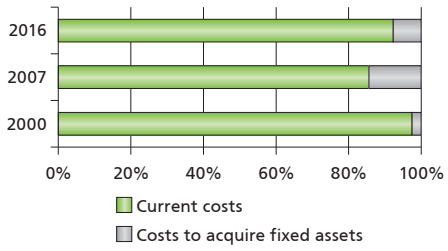
Dynamics of R&D costs, BGN million



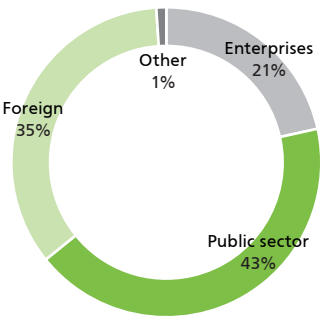
-16.20%
Decline in funds absorption
in comparison to the previous year

-32.54%
Decline in sources of financing
in comparison to the previous year

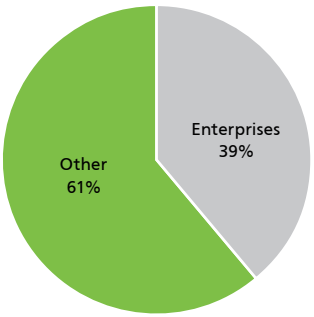
R&D costs by types



R&D costs by source of financing



R&D costs by sectors of investment



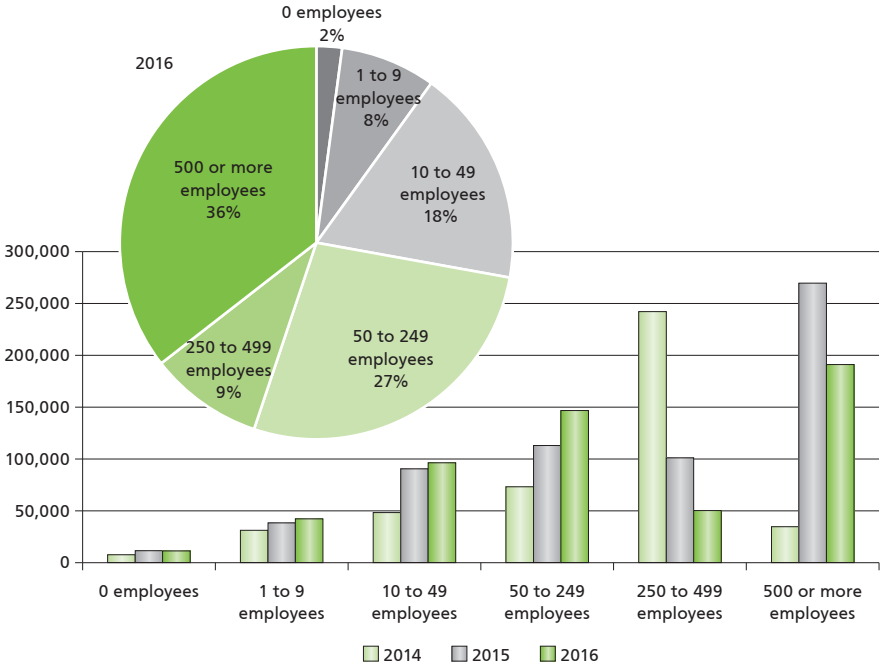
38.84%
for technical sciences

Source: NSI, 2017.

planning regions, seen to the greatest extent in the Southwest and North-central regions (respectively by 19 % and 18 %), the Northeast region managed to almost double its share in the regional structure in this indicator. For the second year in a row, the Southwest region loses its importance in the regional allocation of R&D costs. This trend, viewed as a factor to balance out the country's regional structure in terms of new technologies and innovation, theoretically has a positive impact. However, taking into account the fact that it is not the result of a deliberate national policy of regional development and implementation of the strategy for smart specialisation, the effect is rather dubious.

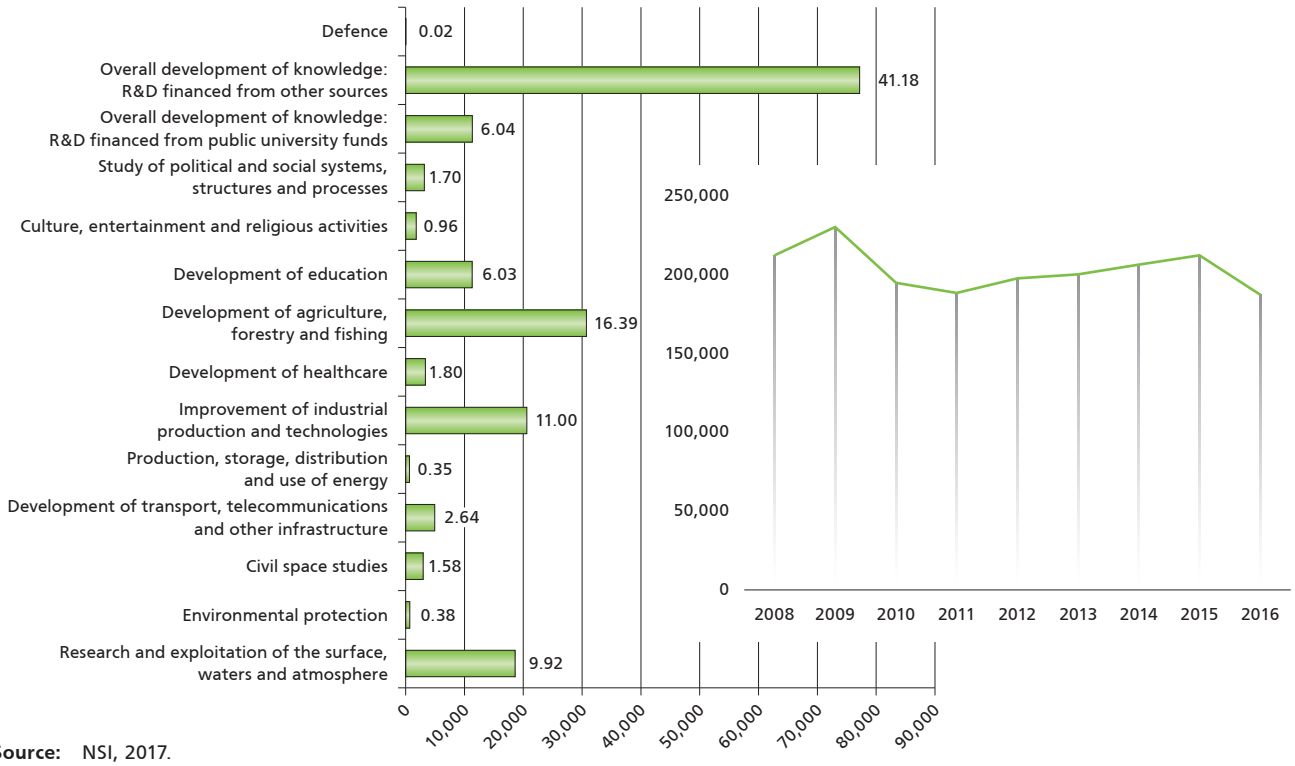
The decline in financing for R&D has almost no impact on SME budgets for innovation. **In 2016, SMEs again reported higher financing for innovations**. The situation with large enterprises is quite the opposite, especially in those ranging from 250-499 employees where the decline over three years is close to 80 % in comparison to the peak year 2014.

Figure 37. R&D SPENDING BY ENTERPRISES, BY ENTERPRISE SIZE, 2014 – 2016, BGN THOUSAND



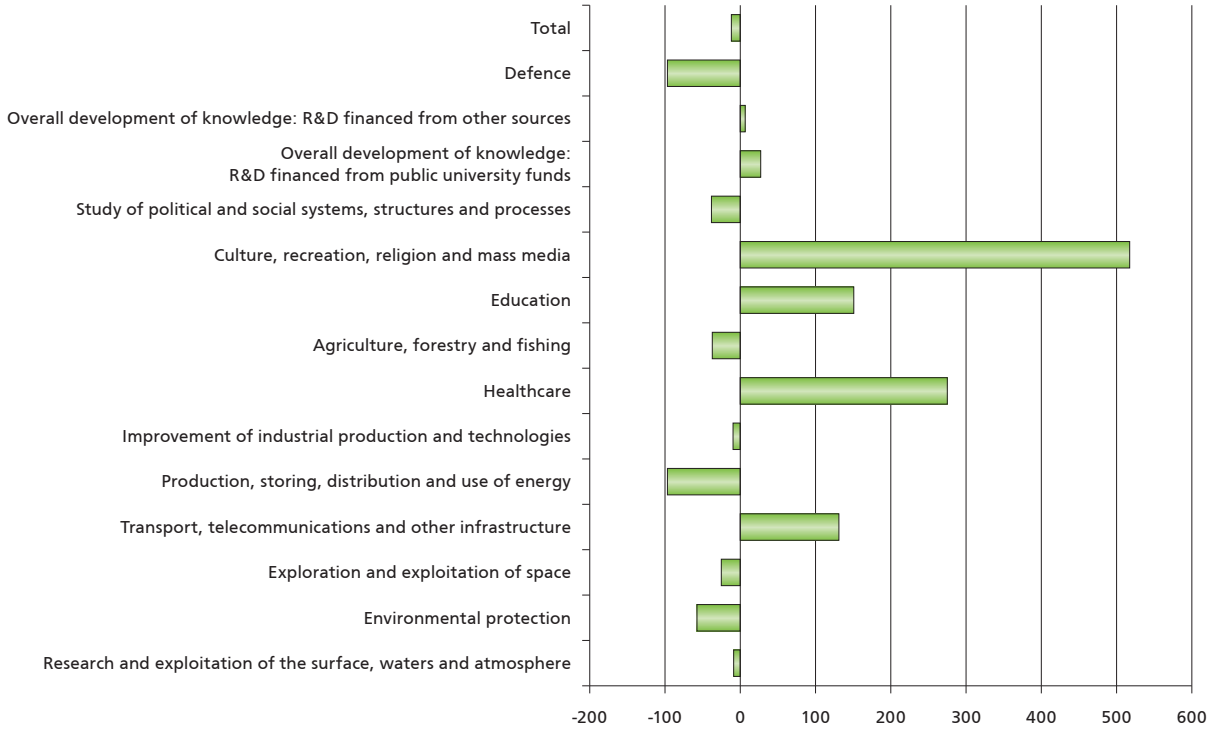
Source: NSI, 2017.

Figure 38. PUBLIC SPENDING ON R&D BY SOCIAL-ECONOMIC OBJECTIVE, 2016, %; 2008 – 2016, BGN THOUSAND



Source: NSI, 2017.

Figure 39. PUBLIC SPENDING ON R&D BY SOCIAL-ECONOMIC OBJECTIVE, GROWTH FOR THE PERIOD 2008 – 2016, %



Source: NSI, 2017.

Government budget spending on R&D encompass the R&D work carried out both in and out of the country. The annual membership contributions to the budget of international scientific organisations and the payments related to the participation of the Republic of Bulgaria in bilateral and multilateral R&D programmes are also considered government budget costs for R&D.

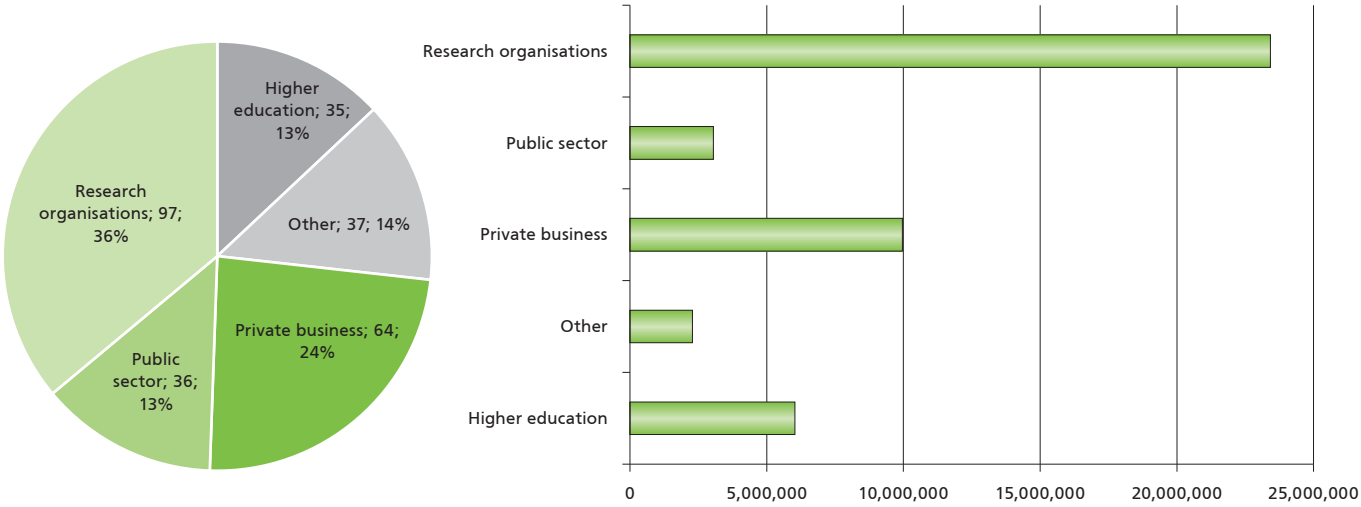
The four-year trend of slow growth in the public financing of R&D came to an end in 2016. **Along with the decline in the state's share in the structure of costs for R&D, there is now a decline in absolute amount** – to a little above BGN 187 million which is the lowest level for the past nine years. As regard the sectoral profile of enterprises, predictably the greatest contribution to R&D costs is that of the highly diversified group of enterprises in the processing industry which invested a total of BGN 185.8 million in innovations in 2016, or 35 % of the entire budget for the enterprises sector. Almost equal – 32 %, or BGN 171.7 million – is the share of the enterprises engaged in "creating and disseminating information and artistic products; telecommunications," which is largely due to the development of information technologies (including computer programming) and telecommunications. Third, with a significant share of 28 %, come the enterprises in the subsector "professional activities and research."

There is a decline in all areas of use of budget funds, most drastically (85 %) in defence, together with transport and telecommunication (49 %) and energy (40 %). There is a minimum increase in the budget funds of 5 % on an annual basis solely in the general university funds for research. Within the nine-year period, the areas of defence and energy have been the largest losers in the allocation of budget funds for science. The greatest increase in comparison to the 2008 baseline has been in culture, recreation, religion and mass media, in healthcare and in education.

Bulgaria in the EU framework programmes

As of July 2017, 279 organisations in Bulgaria had taken part in EU framework programmes and received financing totalling EUR 46.57 million. Of them, 53 are SMEs with a contribution of EUR 7.81 million. Bulgarian organisations and persons applied with 2,809 projects with a success rate of 9.6 % – significantly lower than the EU 28 average of 13.3 %. Based on that, Bulgaria ranks 20th in terms of number of financed projects and 24th in terms of the EU funding provided. The top 5 main partners of Bulgarian organisations in the joint implementation of R&D projects include Germany (401), Spain (355), UK (329), Italy (304) and France (230).

Figure 40. SHARE OF VARIOUS SECTORS IN THE FUNDING BY HORIZON 2020, NUMBER OF PROJECTS AND AMOUNT RECEIVED, EUR



Source: European Union Open Data Portal, last updated 22 December 2016.

The greatest number of EU funded projects is that of R&D organisations[23] (36 %), followed by the business sector (24 %). Higher schools have equal positions with the public sector and NGOs, which make up almost the entire category "Other."

A leader among the Bulgarian research organisations is the Bulgarian Academy of Sciences. Seventeen BAS institutes received EU funding of EUR 7,880,479.65 for 42 projects under Horizon 2020. The largest number of projects have the ICT Institute (6), the Institute of Nuclear Research and Nuclear Energy (6) and the Institute of Oceanology (4). As for the funding received (EUR 1,966,337), the leader is the Institute of Molecular Biology.

A special case is the Centre for Plant Systematic Biology and Biotechnology in Plovdiv set up under the PlantaSYST projects with funding of EUR 7,350,000. **Although it was created with the participation of the Bulgarian Academy of Sciences** (through the Institute of Molecular Biology and Biotechnology and the Institute of Microbiology) **and the Agricultural Academy** (through the Maritsa Vegetable Varieties Institute, Plovdiv) **which are public bodies, the new Centre is privately owned**. This is not the first case of **outflow of technological know-how from the public to the private sector** to allow for unhampered decision-making in private interest and distribution of dividends from the use of the research infrastructure created with public funds. The other **channels to privatise science** include spin-offs between the BAS/public higher schools and the private sector which are also registered as private property[24] and the registration of patents by individuals as inventions created in state-owned labs. Such practices are the direct result of the lack of understanding about the significance and competitive potential of science at the national level which naturally leads to a lack of a strategic vision about the development of public institutes and their R&D capacity. Failing to institutionalise the results of R&D activities entails their ineffective and unsustainable use and diminishes their effect in resolving public problems.

In the higher education sector, 15 higher schools received funding under Horizon 2020. **First with 12 projects and EUR 2,585,081.21 comes Sofia University**, followed by the Medical University, Varna (EUR 935,791.25), Technical University, Sofia (EUR 682,500) and Plovdiv University (EUR 116,812.49) with three projects each.

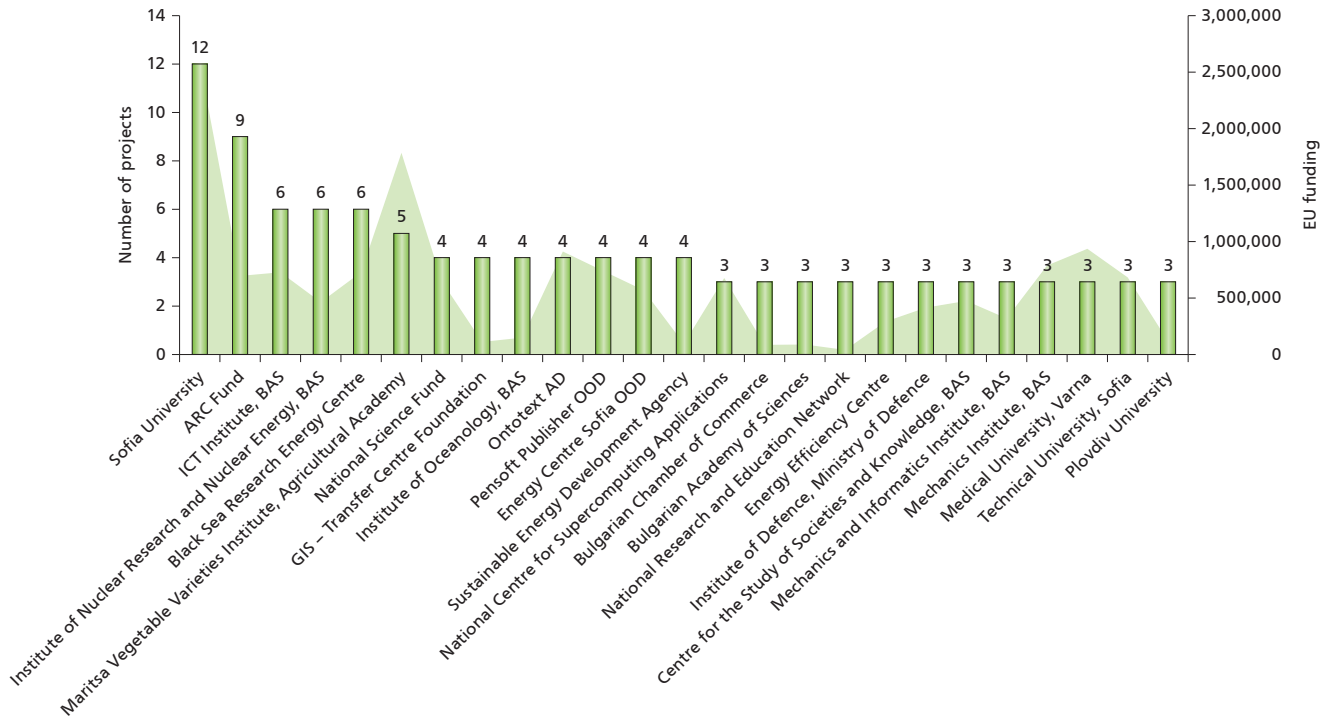
In the national ranking of number of projects funded under Horizon 2020 **ARC Fund comes immediately after BAS and Sofia University with 9 projects**. ARC Fund is a non-profit institution, registered as a research organisation in the Research Activity Register at the Ministry of Education and Science and is a leader in the research of innovation potential, technological transfer and information society.

In 2017, **Bulgaria performed well in the SME Instrument** in comparison

[23] The sector includes units of the Bulgarian Academy of Sciences, the Academy of Agriculture, the Military Medical Academy and NGOs registered in the Scientific Activity Register of the Republic of Bulgaria.

[24] See further *Innovation.bg 2010*, p. 41; *Innovation.bg 2012*, p. 38.

Figure 41. BENEFICIARIES UNDER HORIZON 2020 WITH 3 OR MORE PROJECTS, NUMBER OF PROJECTS AND FUNDING RECEIVED, EUR



Source: European Union Open Data Portal, last updated 22 December 2016.

Table 3. BULGARIA'S PERFORMANCE IN THE SME INSTRUMENT

	Enterprise	Total budget (EUR)	EU funding (EUR)	Year	Phase	Priority area
1	Cores EOOD	71,429	50,000	2015	1	Boosting the potential of small businesses for eco-innovation and a sustainable supply of raw materials.
2	Comac Medical Ltd	71,429	50,000	2015	1	Clinical research for the validation of biomarkers and/or diagnostic medical devices.
3	SCA Development Ltd	71,429	50,000	2015	1	Stimulating the innovation potential of SMEs for a low carbon energy system.
4	Bulteh 2000 Ltd	71,429	50,000	2016	1	Resource-efficient eco-innovative food production and processing.
5	Biodit Global Technology	71,429	50,000	2017	1	Small business innovation research for Transport and Smart Cities Mobility.
6	Ionitech Ltd	71,429	50,000	2017	1	Accelerating the uptake of nanotechnologies advanced materials or advanced manufacturing and processing technologies by SMEs.
7	EnduroSat AD	2,030,138	1,206,588	2017	2	Open Disruptive Innovation
	Total	**2,458,712**	**1,506,588**			

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

to previous periods. The number of projects almost doubled and the funding received by Bulgarian companies grew many times as a result of a project awarded in the second phase of the programme. Still, because of the increase in the programme budget and the heightened competition among companies, Bulgaria dropped a place in comparison to its 2016 ranking to being 27th out of 37 countries entitled to take part.

The countries with the largest number of successful projects and total amount of funding – Spain, Italy, UK, Germany, France and the Netherlands – preserved their leading positions from the previous year. These are also the countries which cover all 13 priority areas in which companies have had the possibility to apply so far.

For the next period 2018 – 2020, the EC is changing some of the rules for participation in the SME instrument as follows:

- Increase in the programme budget

An increase in financing is planned for each of the three years until the end of the programme period. The annual budget will be allocated equally among the four annual sessions.

2018	Phase 1	EUR 48,219,000 (an increase by 45 % in comparison to 2017)
	Phase 2	EUR 419,505,300 (an increase by 10.6 % in comparison to 2017)
2019	Phase 1	EUR 54,159,000
	Phase 2	EUR 471,183,300
2020	Phase 1	EUR 58,774,000
	Phase 2	EUR 511,333,800

- The priority areas are removed

The EC will not set priority areas to restrict the interest of enterprises in applying. It is expected that the two changes (higher budgets and no fixed thematic areas) will significantly boost the competition among enterprises, which is already high.

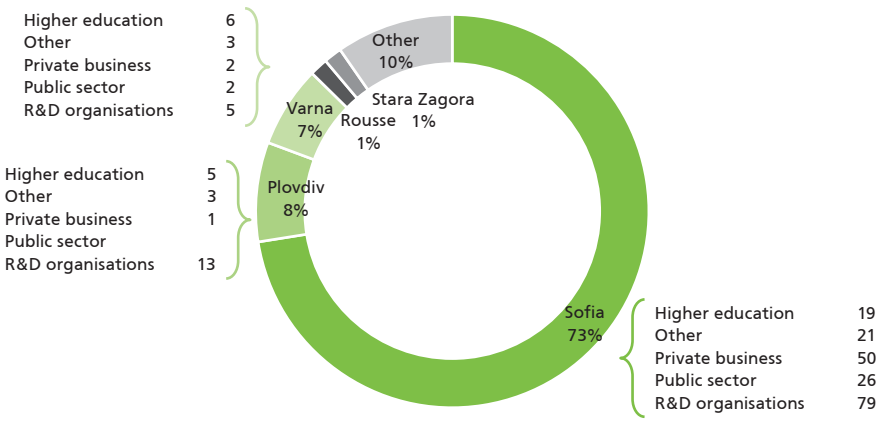
- Changes in the project evaluation methodology

Instead of the equal weights allocated to three criteria – excellence, impact and quality and efficiency of the implementation – the greatest number of points will be given to impact (50 %). The other points will be distributed equally to excellence and quality and efficiency of the implementation. In this way, the **focus shifts from priority areas to impact** – within the European (or global) market and with regard to end consumers or communities.

- New assessment procedure

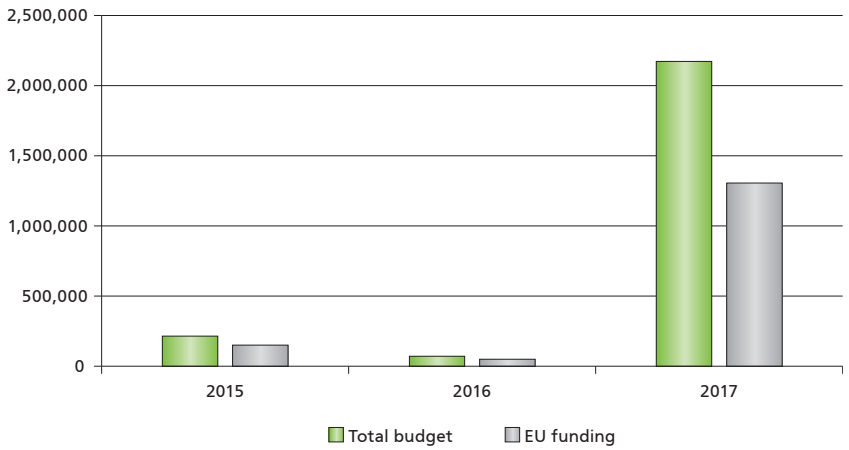
With the increase in the significance of the results and the impact of project implementation, the assessment procedure is also changing

Figure 42. GEOGRAPHICAL CONCENTRATION OF PROJECTS FUNDED BY HORIZON 2020



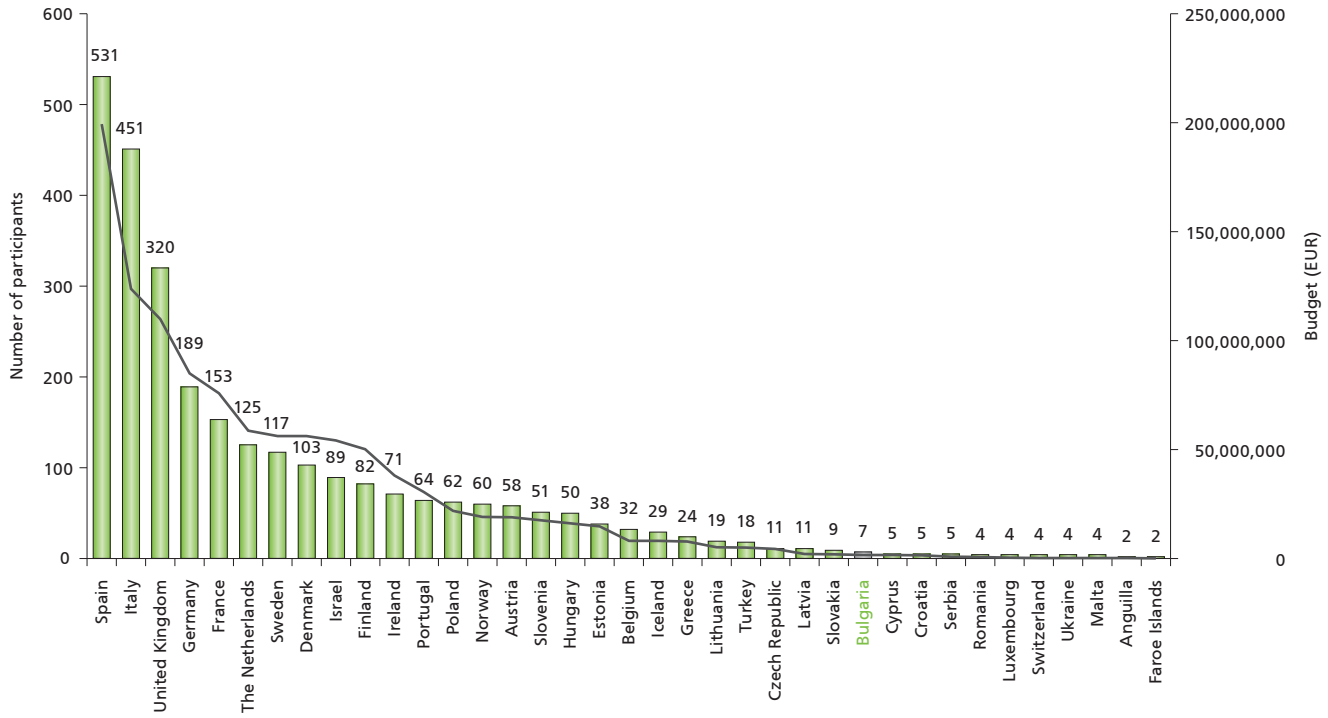
Source: European Union Open Data Portal, last updated 22 December 2016.

Figure 43. FUNDING FOR BULGARIAN ENTERPRISES FROM THE SME INSTRUMENT, EUR



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

Figure 44. NUMBER OF PARTICIPANTS AND ALLOCATION OF THE SME INSTRUMENT BUDGET

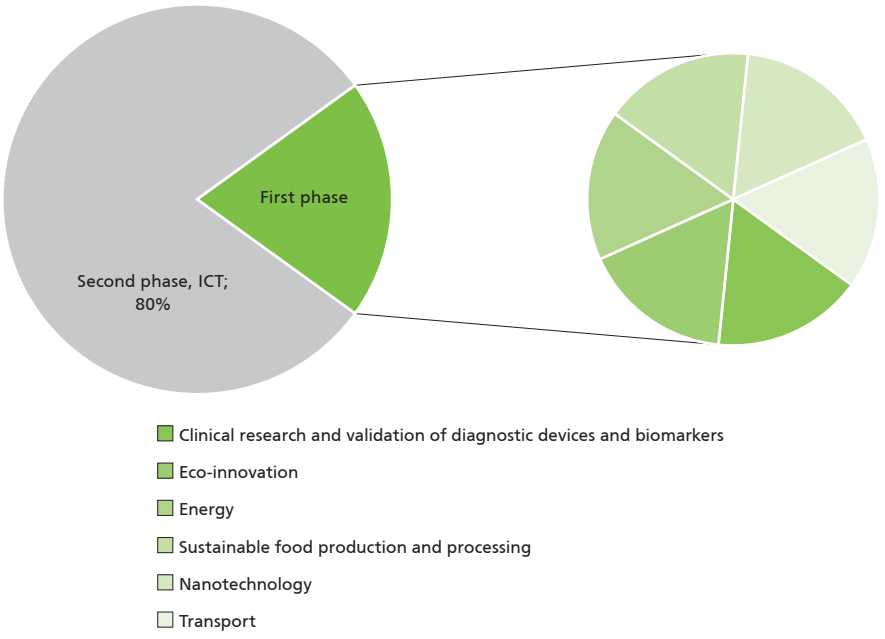


Source: https://sme.easme-web.eu/

which will affect primarily on those applying in Phase 2. Two stages are introduced: 1) an overall assessment as per the three criteria at the first stage, which will end with an expert report; and 2) an in-person interview in Brussels when the project team will be evaluated. It is believed that entrepreneurs will thus gain more experience which will be useful to them in procedures for financing of their future projects through venture capital funds.

COSME is another important EC instrument encouraging the competitiveness and innovation potential of SMEs by providing capital and debt financing, improving the business environment and entrepreneurship. During the current programming period, 65 countries from all over the world have participants in projects funded by the programme. **Bulgaria ranks 15th with 25 participants** (SMEs, NGOs, public administration) and a total funding received so far of EUR 3,077,929.45. Bulgarian organisations coordinate 5 of the projects in which the country is involved.

Figure 45. THEMATIC BREAKDOWN OF THE BULGARIAN PROJECTS FUNDED FROM THE SME INSTRUMENT



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

Box 4. THE FIRST BULGARIAN COMPANY FUNDED IN PHASE 2 OF THE SME INSTRUMENT

EnduroSat is a start-up specialised in satellite engineering which develops services and products in the area of space technology. The company has been engaged in R&D activities for about 2.5 years. EnduroSat creates communication infrastructure and provides accompanying training so that start-ups may focus directly on the applications, services and analysis for the purposes of industry. The goal is to build a network of interconnected satellites in orbit.

"We are working in the segment of the so-called nanosatellites or CubeSat, which is a niche product. This is the only fast developing segment in the satellite market today. The reason is that nanosatellites are small enough to be launched as a secondary payload on carrier rockets. The launch price is many times smaller than that of 'standard' space missions," said the company.

EnduroSat is the first Bulgarian enterprise to be awarded financing under Phase 2 of the SME Instrument of Horizon 2020 for its InnoSpaceComm project. The project aims to launch a new generation of satellite communication modules and connect directly European SMEs, the industry and academia through educational resources. The communication modules will create new opportunities for many start-ups giving them access to a data transmission satellite infrastructure at an affordable price.

Mr. Raycho Raychev and his team applied directly under Phase 3 and were successful at their third attempt. EnduroSat wrote and edited repeatedly their project proposal. "We identified the SME Instrument as a tool to obtain support in the realisation of the next generation of communication satellite modules designed and built in Bulgaria. Through the InnoSpaceComm project, we will take the next step in our development – from a start-up to a growing company with a market share of more than 15 % of the European market," Raychev concludes.

Source: Applied Research and Communications Fund, 2017.

Figure 46. THEMATIC BREAKDOWN OF THE BULGARIAN PROJECTS FUNDED UNDER COSME

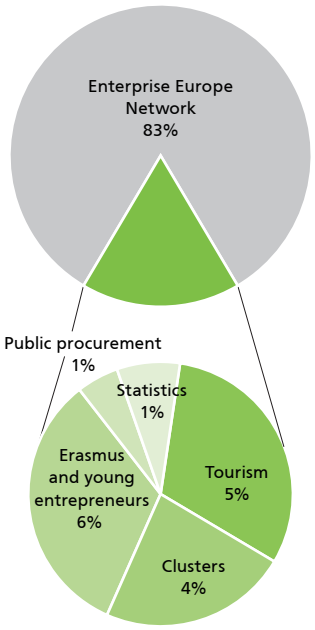
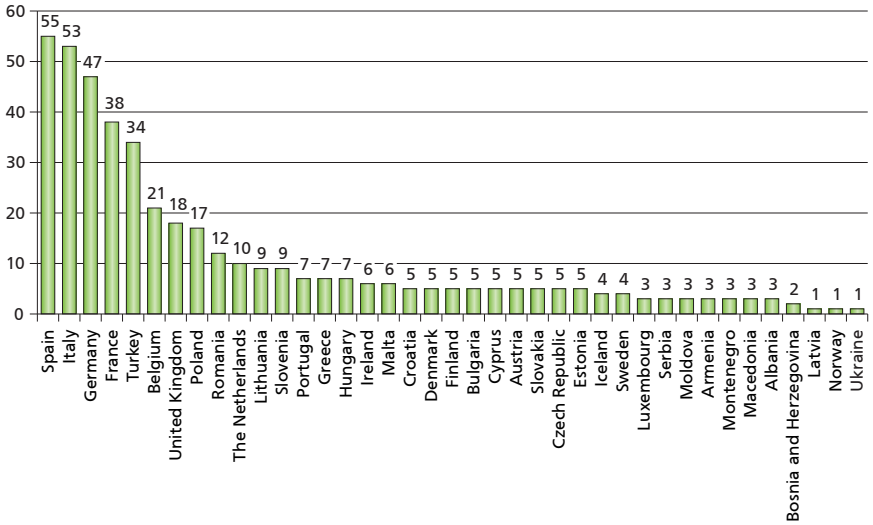
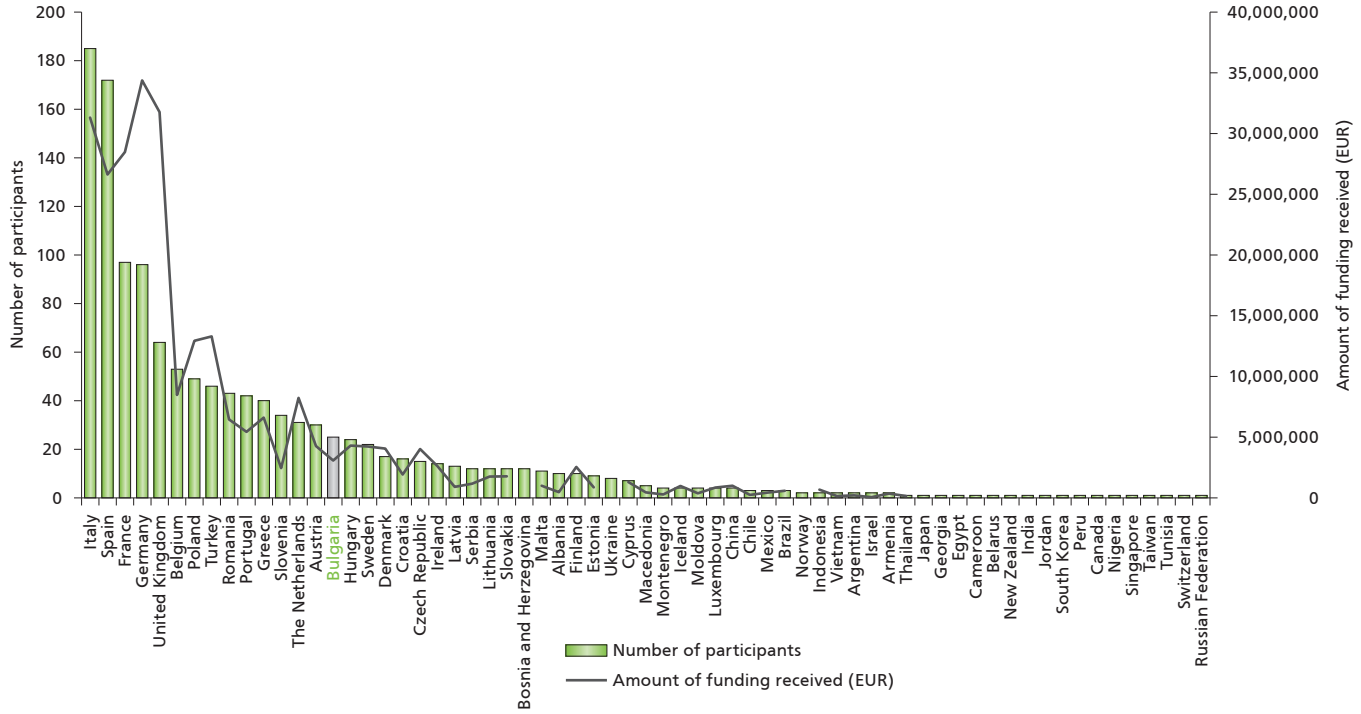


Figure 47. NUMBER OF COSME-FUNDED PROJECTS BY COORDINATOR NATIONALITY



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

Figure 48. NUMBER OF PARTICIPANTS AND FUNDING RECEIVED FROM COSME



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

Human Capital for Innovation

Staff engaged with 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 characterizes the country's specialisation in sectors with a high level of innovation activities.

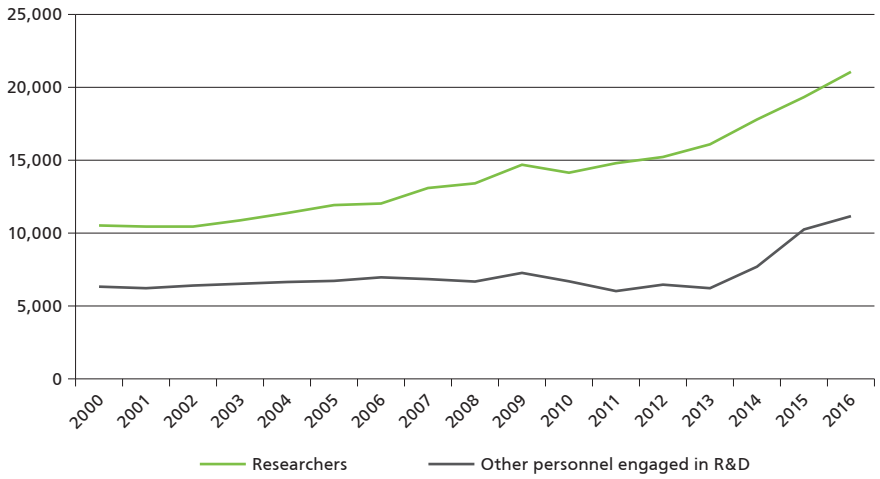
Of the two resource streams fuelling the innovation system – financing and R&D staff – the latter is more conservative and does not mirror the significant drop in R&D costs in 2016. Since 2001 (excluding the post-crisis 2010 and 2011), **the number of people engaged in R&D has been growing constantly**; it almost doubled compared to its 2000 level and increased 1.6 times in comparison to Bulgaria's first year of EU membership.

However, the discrepancies between R&D personnel and financing end here. Structural changes confirm the conclusions reached in the previous section:

- **The business sector preserves its active role** in R&D and innovation;
- **The public sector, and to a lesser degree higher education, suffer a marked drop** in positioning in these areas.

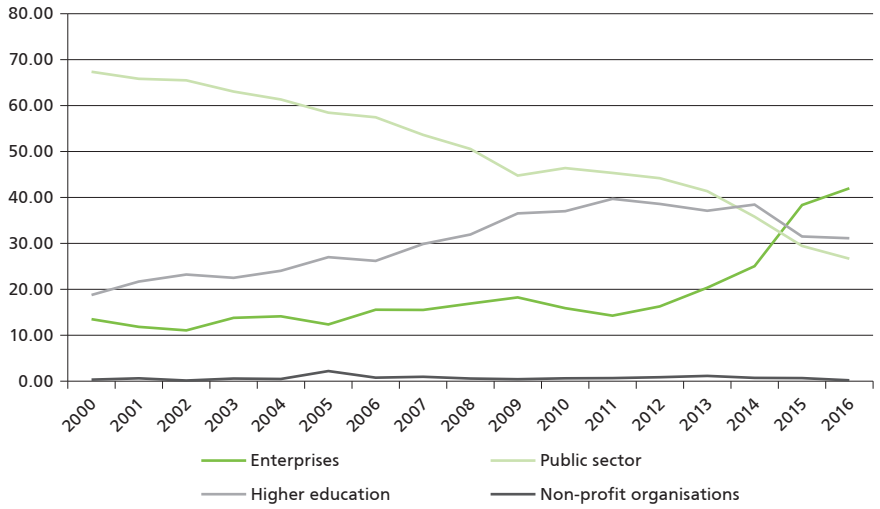
The structure of R&D personnel in the business sector reflects the distribution of enterprises by size: **the largest share of 37 % of R&D staff is in large enterprises** with more than 250 employees, followed by medium-sized (50-249 employees) and small (10-49 employees) enterprises. In those, the shares of R&D personnel are respectively 27 % and 22 %. Micro enterprises have a share of 14 % of R&D personnel, including 3 % for those who are self-employed. There is a lasting trend of an increase in R&D personnel in all categories of enterprises. For the past ten years, the increase in the large enterprises has been more than 5 times, and for all other categories it has been between 4 and 6 times.

Figure 49. DYNAMICS OF THE NUMBERS OF R&D STAFF



Source: NSI, 2017.

Figure 50. SHARES OF VARIOUS SECTORS IN OVERALL R&D STAFF, %



Source: NSI, 2017.

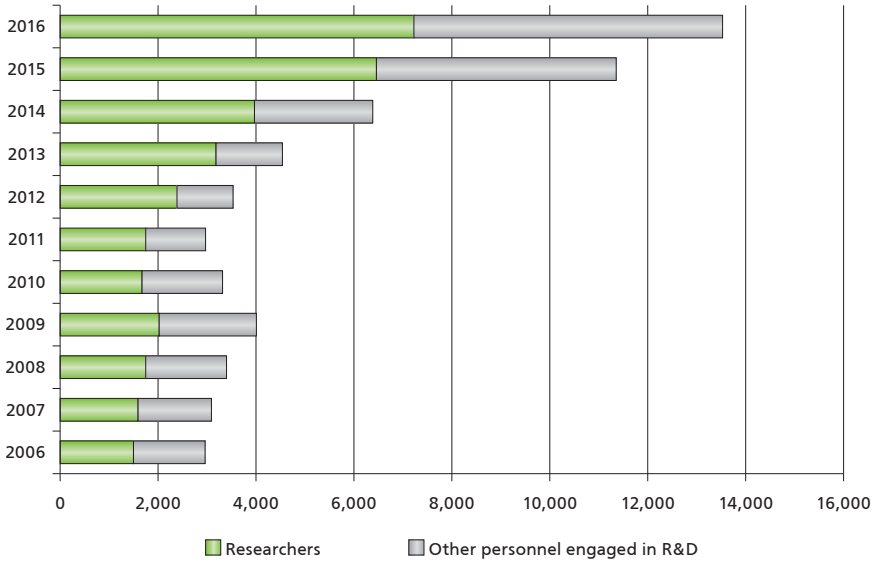
The benefit enterprises receive as a result of their growing commitment to R&D and innovation is two-fold – along with the development of new technological solutions from their R&D work, they optimise production processes and increase labour productivity as an indirect effect of

successfully implemented process innovations.[25]

After the peak year 2013 when the share of researchers in the total R&D personnel was the highest (72.15 %), in 2016 there was a decline of the indicator to the 2007 levels of 65 %. The main reason for the **increase in the number of technical personnel and a reduction in researchers** is related to the stronger performance of the enterprises sector in the innovation system and the outflow of R&D personnel from academic and university bodies in the country.

As the **interest of the enterprises sector is in the technical sciences**, the greatest increase in R&D personnel is in these areas – in 2015 and 2016, 40 % of that personnel was engaged in the technical sciences. Natural sciences are significantly farther behind with 19 %, followed by the medical sciences (15 %), the social sciences (11 %) and humanities (8 %). The least attractive (see the reasons for this discussed in the Research Product section) are the agricultural sciences with 7 % of the R&D personnel in the country.

Figure 51. DYNAMICS OF THE NUMBER OF R&D PERSONNEL IN THE ENTERPRISES SECTOR



Source: NSI, 2017.

R&D in the public sector and higher schools remains unattractive to young people. In 2016, only 15 % of the R&D personnel in public research units (which mostly consist of the bodies in the Bulgarian Academy of Sciences and the Agricultural Academy) were aged up to 35. In higher education, their share reached 21 %, which does not seem promising when it comes to generational change and getting young people into science. On average, the share of each of the following age categories is about 26 %. The category of those aged 65 and more amounts to a little more than 5 % of the R&D personnel of the academic institutions in the country and there has been a lasting upward trend since 2010. Their share in university faculty remains about 4 %.

Box 5. EMPLOYMENT IN THE ICT SECTOR

ICT are horizontal technologies which ensure progress in all other areas of economic and social life. As such, they still one of the most attractive sectors for professional development and career, including young and highly qualified people. An additional incentive is provided by the numerous policies and financial instruments at the European and national levels.

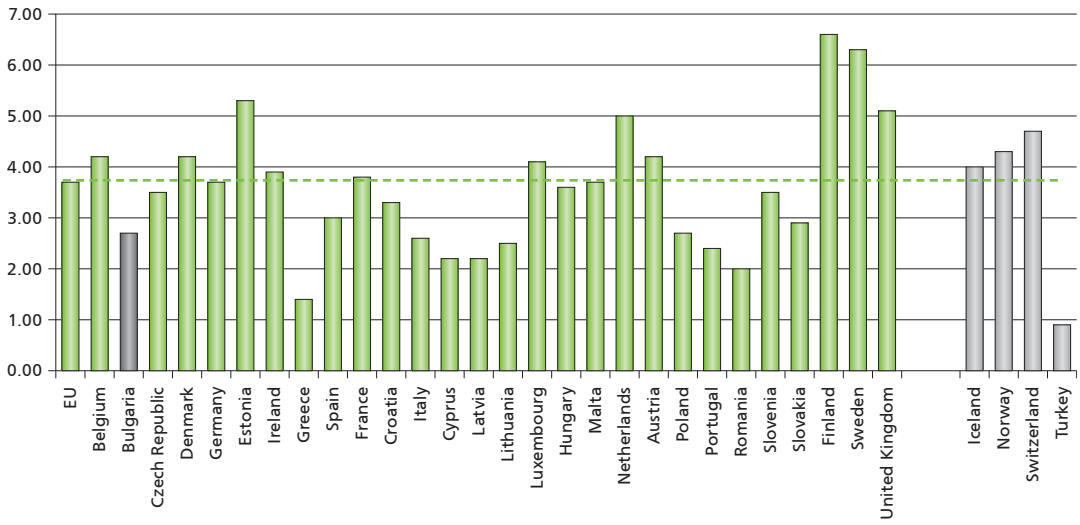
In 2016, more than 8.2 million were employed in the ICT industry across Europe (or 3.7 % of the overall employment in the EU), which is an increase of almost 30 % in comparison to 2011.

In 2016, there were 80,900 ICT experts in Bulgaria, which was 2.7 % of the overall employment in the country. The change during the five-year period is positive in terms of both the number of people employed and the share in national employment (50 % for both). As for the growth in the number of ICT experts, Bulgaria comes in sixth in the EU after Portugal (65 %), Estonia (64 %), France (58 %), Hungary (55 %) and Germany (54 %). In terms of the growth in the share in the overall employment, the country is fourth after Portugal (171 %), Estonia (156 %) and France (152 %).

[25] *Industrial Scientists and Engineers Don't Just Do R&D*, The NBER Digest, National Bureau of Economic Research, September 2017. See also the results of the survey of the management practices of innovative Bulgarian companies in the section *Gross Innovation Product*.

Box 5. EMPLOYMENT IN THE ICT SECTOR (CONTINUED)

Figure 52. SHARE OF ICT EXPERTS IN ALL EMPLOYED, 2016, %



Source: Eurostat, 2017.

There is a strong link between ICT and the development of the innovation potential, which is evidenced by the countries at top positions in the ranking where there is a tie between the European innovation leaders Finland and Sweden.

Third comes in Estonia which is known for its affinity to open innovation and the development of e-society. Three of the four main priorities of the country in this area as it assumed the presidency of the Council of the EU for the second half of 2017 have been: open and innovative European economy, safe and secure Europe, digital Europe and free movement of data. This is the result of the country's overall policy after the democratic changes:

- Estonia is a country of a mere 1,315,944 people (2016) who understood quickly that they could not afford an expanded public administration and police structures;
- The right to internet use is enshrined in the country's Constitution as a fundamental right of Estonian citizens;
- The territory of the entire country is covered by public wireless access points which are largely free of charge;
- Voting via the internet is provided in the country;
- More than 700 public services are provided online;
- Electronic health record;
- Electronic school (eKool, or e-school)
- Almost 100 % of bank transactions are done online;
- The Tiger Leap programme is implemented with the help of a government-supported investment organisation named Tiger Leap Foundation with three main priorities – computerisation and internet connectivity of schools, development of educational software, and computer training for teachers;
- Programme Work in Estonia (www.workinestonia.com) in which Estonia is looking for IT specialists from abroad;
- Electronic company registration with a record 18 minutes for a registration;
- Electronic resident of Estonia (https://e-resident.gov.ee/), or the new digital nation, allows business registration and management from anywhere around as an Estonian resident.

ICT are mostly male territory with 83.3 % of those employed in the sector in 2016 being male (given 54 %, or almost a complete balance, in the European economy as a whole). **In Bulgaria, the ICT sector has the best balance in terms of gender equality** in the EU with a slight predominance of men of only 69.8 %. At the other extreme of the spectrum is Slovakia (90.8 % of male employees which is ahead of Turkey which has 90.1 %).

Box 5. EMPLOYMENT IN THE ICT SECTOR (CONTINUED)

In 2016, almost 65 % of those employed in the ICT industry in Bulgaria had a higher education (given an EU average of 61.8 %), which was double the rate in the economy as a whole (32.4 %). Almost half of the ICT specialists (47.4 %) are aged under 35 given a share of young people employed in the country of 27.2 %.

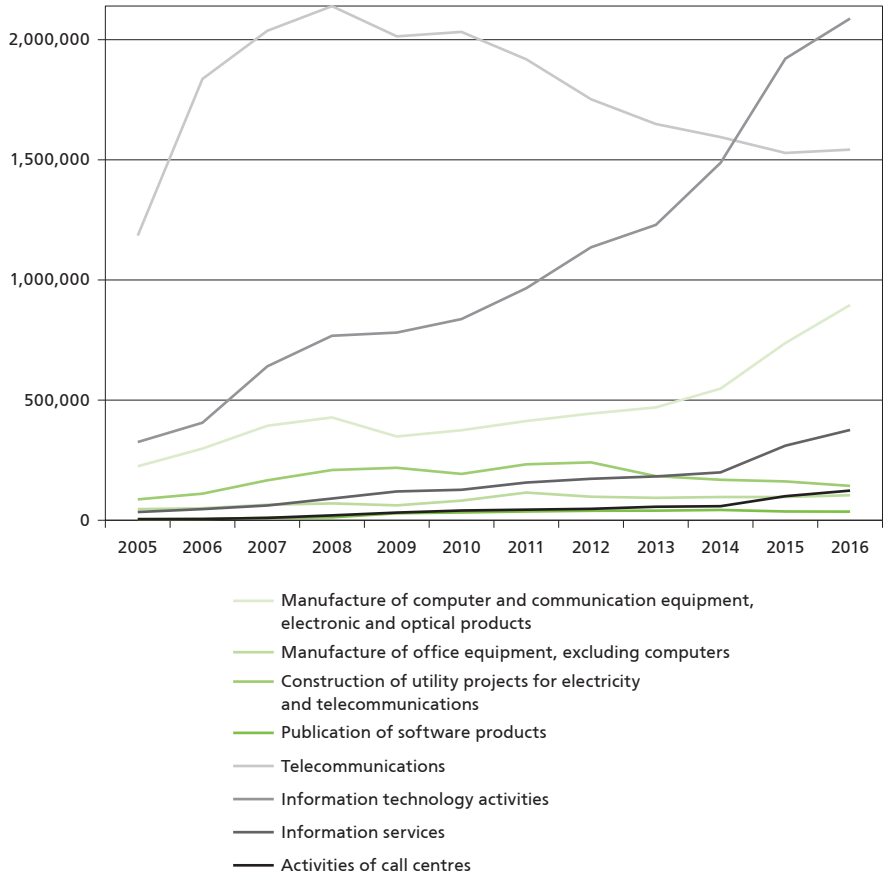
The greatest shortage of personnel with ICT competencies is in the Czech Republic where 66 % of the companies have such difficulties. The same holds true for 39 % of the Bulgarian companies, which is a little below the European average of 41 %.

Source: Eurostat, 2017.

Information and Communication Technologies

The ICT sector continued its turbulent development and, in 2016, it provided 4 % **of the jobs, 4 % of the revenue and 9.3 % of the added value in the economy**. For the first time in 2016, the **revenue in the sector exceeded BGN 10 billion.** These results were achieved by **2.4 % of the companies and 3.6 % of the assets** in them.[26] Between 2005 and 2010, the revenue of telecommunication companies accounted for more than 50 % of the total amount. In 2016, they were under 30 % with a downward trend in the coming years due both to European regulations and the transition from voice services to internet-based services via telephones and the falling prices for mobile internet. In 2015, for the first time the revenue of the companies in the subsector "Other information technology activities" was higher than the revenue in "Telecommunications." The hectic search for talent in the sector increased personnel costs 3 times from the average to a level of 11.2 % of **the overall amount for the economy.**

Figure 53. DYNAMICS OF THE REVENUE IN THE ICT SECTOR, EUR THOUSAND (2005 – 2016)



Source: BvD Amadeus.

The sector has become attractive not only to labour migrants from less developed countries such as Ukraine, Moldova, Russia and Macedonia but also from Italy and the Netherlands. The ICT sector alone employs more migrants from the European Union than the overall number of refugees in Bulgaria. In some companies, the share of foreigners is as high as 30 % (in Sitel, for example). A large part of those employed in the sector have been through the first acquisitions, mergers, take-overs, outsourcing, expansive corporate growth, home office, work in global virtual teams, they have managed multinational teams. Unlike the times of privatisation in other sectors when the intensity of innovation was much lower, now almost everyone has seen or taken an active part in some innovative process. This leads to **early stage access to new technologies**, to **internalisation of the codified know-how in foreign companies**, to a **rich experience and familiarisation with a broad range of potential clients**, which is an excellent prerequisite for the **successful development of entrepreneurship attitudes among those employed in the ICT sector**. Through its contact with other sectors – e.g., human resource management, education, finance and banks, transport and logistics – the ICT sector is disseminating process, organisation and marketing innovation. Thus, for example, through the development of specialised modules for a connection between the electronic systems of courier companies (Econt) and electronic trade platforms (Magento) entrepreneurs and companies from all sectors can easily have an online store with an integrated payment and delivery system created by a person with good computer skills but not necessarily a developer/web designer. The application designed by Datecs turning smartphones (Blackberry and iPhone)

[26] According to BvD Amadeus.

into a mobile payment terminal has revolutionised retail sales in the US, thus boosting the effectiveness of chain stores.

The **most important feature of the sector, however, is still its role of an "anchor" for talent who are not only well paid but also have the sense of being at the "centre" of global events.** The R&D work of companies such as VMware, Visteon, SAP, Melexis, Datecs, Progress (formerly Telerik), Interconsult, Software Group Bulgaria, Chaos, Endurosat, Ontotext, Software AG and others gives confidence to hundreds of software engineers in Bulgaria that they are part of the global technological innovation.

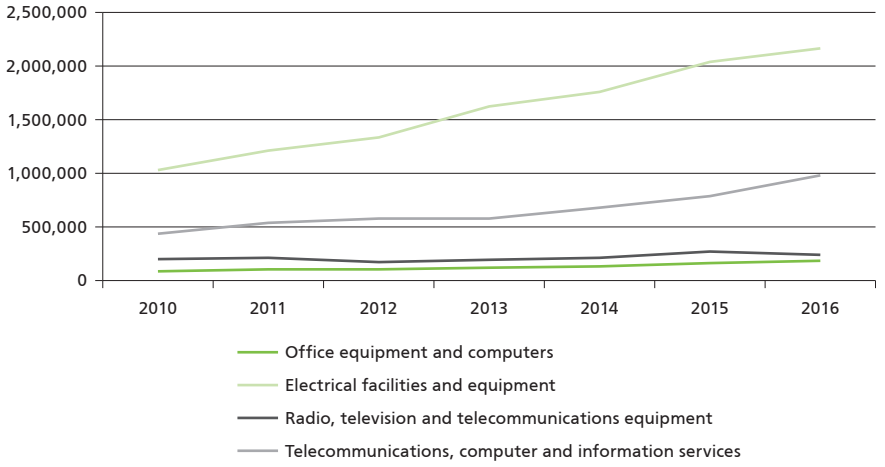
Learning through export in the ICT sector (including electric facilities and equipment) **proves to be one of the most effective and the share of the sector in the overall exports rose from 10 % in 2015 to 14 % in 2016**. The growth is attributed primarily to the increase in exports of automotive equipment as well as greater outsourcing of business services. This trend is expected to continue in the coming years.

The share of exports in the overall revenue in the sector was 54 % in 2016 compared to 36 % in 2010. If this share is recalculated to exclude electronics (electrical facilities and equipment), there is again growth albeit smaller – from 19.5 % in 2010 to 26.5 % in 2016. The domestic consumption of ICT services is stable standing at BGN 5 billion for the period 2010 – 2016 but is showing signs of stagnation.

Bulgarian enterprises are lagging significantly behind the average European values in almost all e-business indicators monitored by the European Commission. The use of cloud services is among the lowest in the EU (5 %) and so is the overall digital intensity (with a high result for only 7 % of the enterprises) and online sales (5.39 % given an EU average of 17.8 %). Bulgaria has one of the greatest shares of enterprises with low digital intensity – 63.7 %; Romania is the only country with a lower result of 66 %.

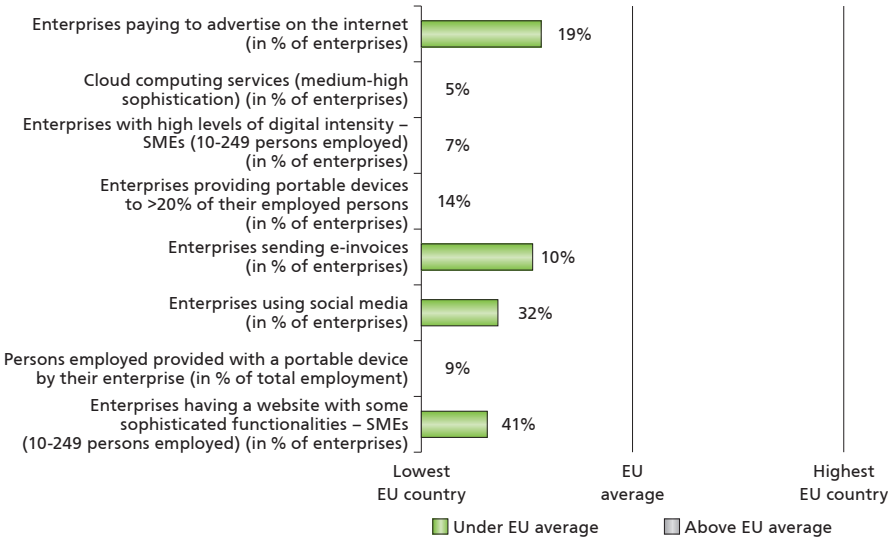
The use of specialised enterprise resource planning (ERP) software (24.9 %) is below the European average (35.6 %) but is better than Estonia, Romania, Poland, Hungary, Latvia and even the United Kingdom. As for customer relationship management software, the situation is worse – only 13.3 % have such a software (or a module in an ERP product) compared to the European average of 20.9 %. Although more than half of the enterprises have a website (50.7 %), we are again lagging behind Europe in this indicator – 77 % with only Romania behind us with 42.4 %.

Figure 54. DYNAMICS OF ICT EXPORTS, EUR THOUSAND (2010 – 2016)



Source: Comext/Eurostat and payment balance, Bulgarian National Bank.

Figure 55. COUNTRY PROFILE FOR BULGARIA, E-BUSINESS INDICATORS



Source: European Digital Scoreboard.

All these **negative signals about the development of e-business in Bulgaria**, and hence the **limited internal demand for ICT services**, are explained by the typical **positioning of the Bulgarian enterprises in the international value added chains**. The sales and customer relationship management are handled by the European (or other) owners of the enterprises or they are very limited (when it comes to resource extracting enterprises) and, respectively, there is no business need for such a software. When a parent company needs to follow more quickly and accurately what is happening with its subsidiary in Bulgaria, prepare reports and so on, it implements an ERP software or more specific products or electronic supply chain management – 17.6 % compared to the EU average of 16.8 % or uses access and personnel tracking radio frequency identification (RFID). With regard to this indicator, Bulgaria is among the leading countries in Europe. The average value is 10 % with only Austria and Finland with better results.

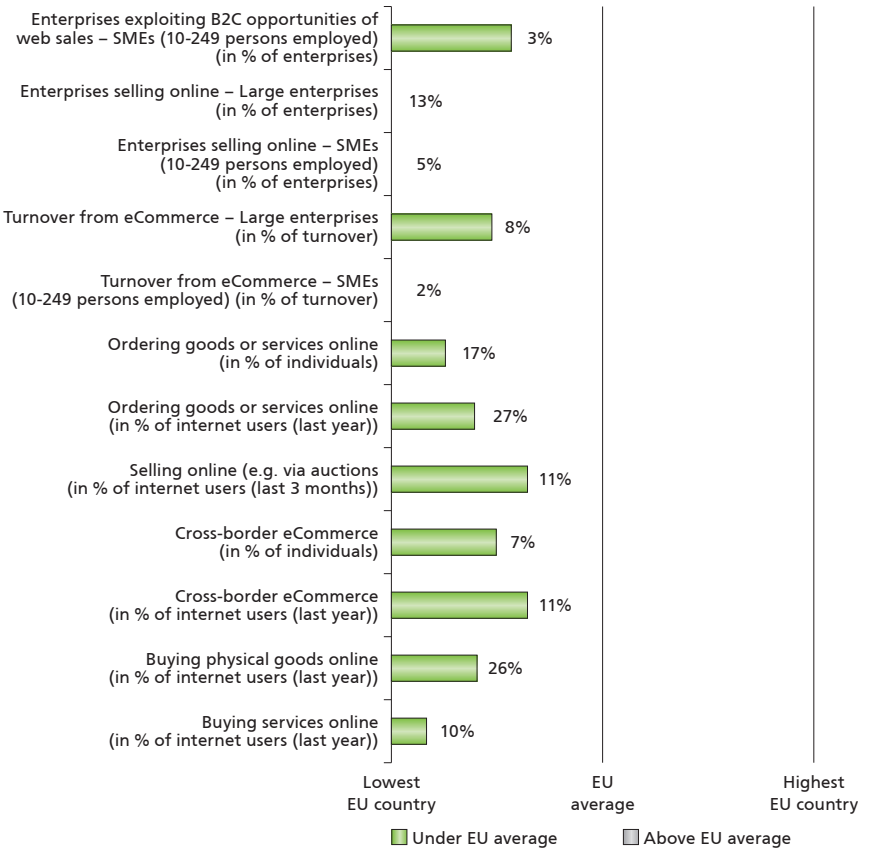
Bulgaria is an unconditional leader with regard to RFID products with 9.25 % compared to the European average of 3.85 %. Bulgaria specialises in **low-tech niches** where it is important to get to **effective labelling, packaging, warehousing and logistics of ready products,** which would be very slow and expensive without the technology, even with the low prices in Bulgaria. Very often, the overall systems come directly from the parent companies so this is yet another reason for the limited internal demand for ICT services. In-depth interviews with participants in the RFID market have indicated a serious stagnation after the first deals which propelled the country to the top ranks.

Because of the same type of positioning in the international value added chain, Bulgaria has the lowest share of revenue of enterprises generated online – under 4 % compared to the EU average of 16.4 % and one of the lowest shares of B2C website functionalities – 3 % given an EU average of 7.19 %.

Internal demand for ICT services may also be stimulated by users seeking options for online shopping and sophisticated additional services related to the selection of products, personalisation, delivery tracking, return options and others. Certain market niches are entirely dominated by internet platforms with detailed information and online orders. In the B2C segment, these are the used cars market, residential area leasing, real estate sales, job applications (in the segment of highly-qualified, highly-paid work and/or management positions). In the B2B segment, this is, for example, the order of spare vehicle parts by repair shops. In other spheres, even though traditional shopping remains dominant, the online users' behaviour has a high impact on the price and market strategies of companies. In practice, when purchasing electronic and/or domestic appliances, each user with internet access compares the product features and prices online. To a lesser degree, the same holds true for the selection of loans, car insurance, vacations, information about healthy food or healthcare.

Unfortunately, Bulgaria cannot benefit from this opportunity because the **population has low levels of digital skills and scarce experience with online shopping**. A mere 17 % of Bulgarian citizens shopped online in 2016 and only 6.3 % shopped for services online. It is online services which require more complex ICT sys-

Figure 56. COUNTRY PROFILE FOR BULGARIA, E-COMMERCE INDICATORS

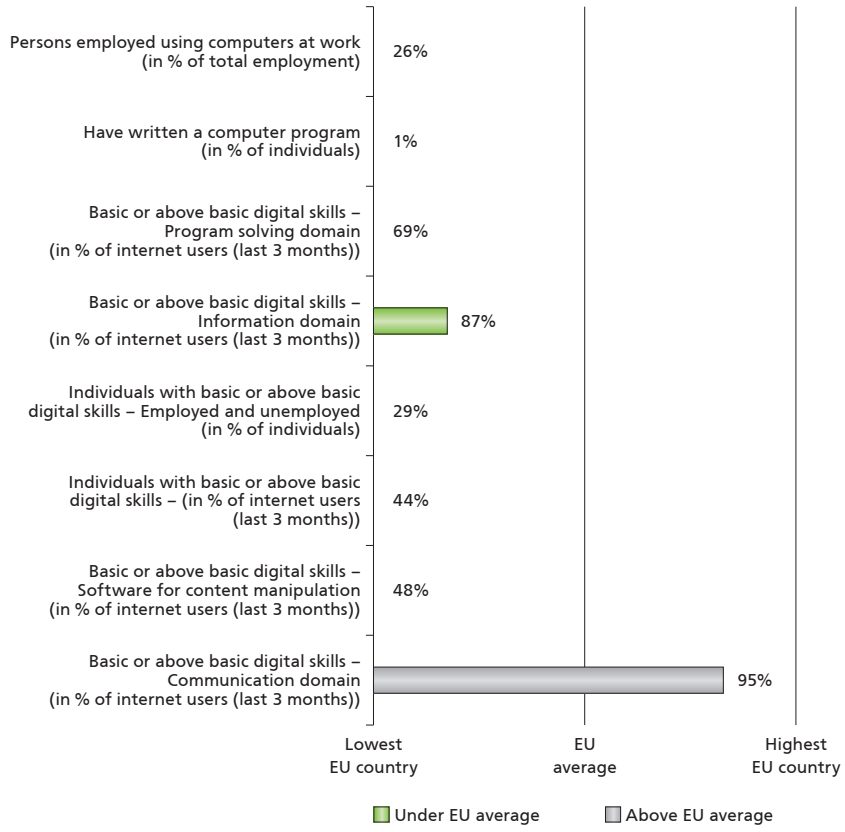


Source: European Digital Scoreboard.

tems and their increased use would result in an increased internal demand. Creating an online store for physical goods without additional services is generally very easy; almost as easy as maintaining a blog and a social media account, regardless of the fact that the levels of digital skills in Bulgaria are very low, at lease according to the European Digital Scoreboard.

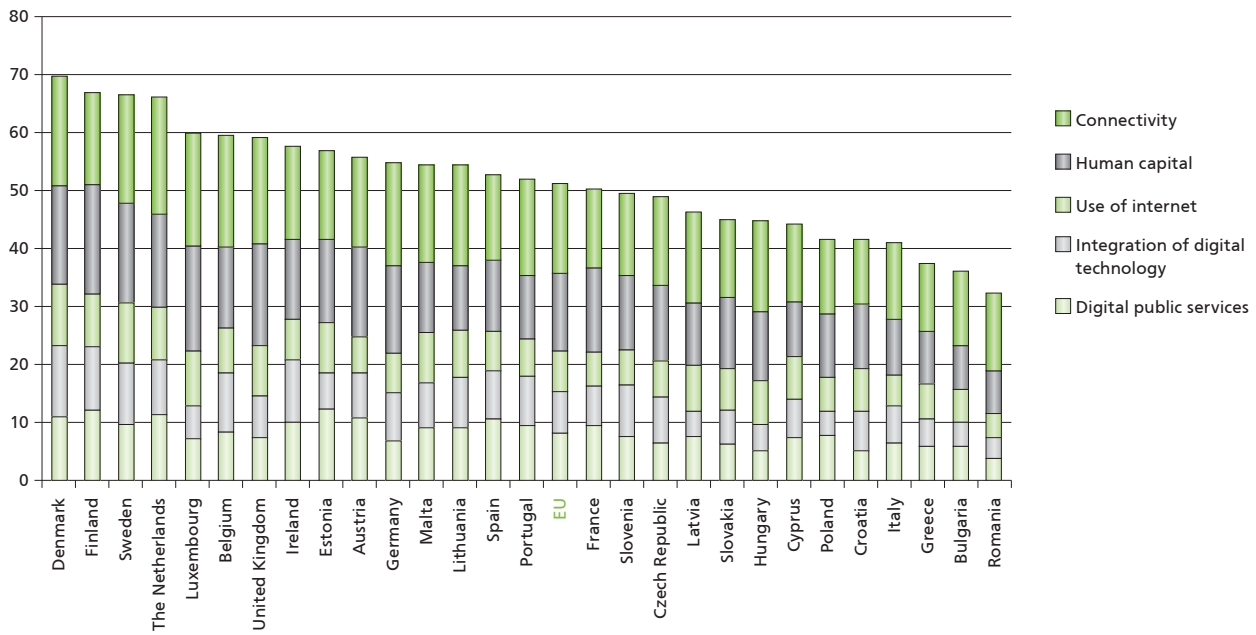
The use of computers at the workplace is the lowest among EU member states – 26 %, almost half the European average of 50.2 %. Similar is the share of those who use content processing software (text, picture, video) – 26.3 % of internet users have such skills given an EU average of 48.7 %. In Bulgaria, digital skills are not acquired at school/university (only 20 % of the workforce have acquired some skills, albeit at a low level). In the leading countries (Scandinavian states), the share is 40 %. A mere 1 % of the people claim that they have written code – most probably, in addition to programmers these are graduates of math schools

Figure 57. COUNTRY PROFILE FOR BULGARIA, KEY DIGITAL SKILLS



Source: European Digital Scoreboard.

Figure 58. DIGITAL ECONOMY AND SOCIETY INDEX (2017)



Source: European Digital Scoreboard.

and those who were students in the 1980s when programming was part of the formal curriculum although not all schools had computers.

To respond to those significant deficiencies and lagging behind in the workforce's skills in Bulgaria given the ever greater demand for IT specialists in the country and the tendencies to look for such specialists abroad through a Blue Card, the **government approved changes to the curriculum for the 3rd and the 4th grades to come into effect respectively from 2018/2019 and 2019/2020 according to which all children will study computer modelling,** which is supposed to teach the kids the **foundations of algorithmic thinking and visual programming**. An issue with the curriculum is the requirement for the courses to be headed by primary school teachers who are not prepared at all and it is highly unlikely that the IT teachers in higher grades will earn in a year additional qualifications for primary school teachers to be able to teach the subject. At the same time, in the past 4-5 years, many companies and NGO initiatives have sprung up in larger cities in Bulgaria (for example, Coder Dojo which was started in 2014 by ARC Fund and was later taken up and popularised by the Digital National Coalition) which offer training and fun for children of different ages with programming of robots, controllers, computers and mobile applications. These courses are taken very well by the children, including children at a disadvantage, which suggests that the experiment with computer modelling might be successful if effective training is provided to the teachers along with ready e-content and methodological guidance. Pioneers in this respect were Robopartans (for robots), Telerik's Children's Academy (for programming) and the team of Assoc. Prof. Galya Momcheva from Varna Free University (with the platform Scratch); currently, the largest player in the marker is the Software University (with Micro:bit). Such activities will improve the students' creativity and entrepreneurship and contribute to the long-term competitiveness of human resources in Bulgaria.

The European Commission has created a composite index to measure the progress of member states as regards the digital economy and information society. Bulgaria's results in this index show serious deficiencies in human resources, use of internet, integration of digital technology and digital services provided by the public administration. Unfortunately, the good positioning in certain indicators is not enough for the country to be at an average European level in another indicator but connectivity.

Yet, **there is an indicator which allows for optimism**. This is the **use of internet and applications via mobile phones – at 62 % Bulgaria is above the European average of 57.7 % for 2016**. As regards the indicator of mobile broadband internet, Bulgaria is better placed than Austria, France, Germany, Belgium, Greece and others. A number of Bulgarian

Box 6. NATIONAL PROGRAMME IT CAREER TRAINING

The IT Career Training programme was developed in partnership between the Ministry of Education and Science, the Bulgarian Association of Software Companies, Bulgarian Association of Information Technologies, ICT Cluster, the Bulgarian Outsourcing Association and SoftUni. The programme provides financial, organisational and logistical support to students in their tenth year in secondary school acquiring the professional qualification "applied programmer." The course includes 900 hours of training spread over three academic years. Over nine hundred students out of 1,200 applicants have enrolled in the programme's first cycle, which will take place in five regional centres – Sofia, Plovdiv, Bourgas, Rousse and Pravets. In November 2017, 250 students already started their training in Sofia. Each centre has been established in partnership between a secondary school and a university. For the 2017/2018 academic year these are:

1. The Technical School Electronic Systems in Sofia and Sofia Technical University.
2. The High School of Mathematics in Plovdiv and Plovdiv University.
3. The Vocational High School of Electrical Engineering and Electronics in Bourgas and Assen Zlatarov University, Bourgas.
4. The Vocational High School of Electrical Engineering and Electronics in Rousse and Rousse University.
5. The Vocational School of Computer Technology and Systems in Pravets and Sofia Technical University.

The programme covers room, board and transport costs for students who do not live in the cities where the training is delivered. At the end of 2017, the programme's budget is BGN 300,000 but it is expected to rise in 2018, possibly through funding from European structural funds. Given good intermediary results, the programme is expected to be extended in 2018 or 2019 to other cities where there is demand for such experts, such as Varna, Veliko Tarnovo, Blagoevgrad and Gabrovo. SoftUni provides shorter free of charge courses to young people and even teachers in 34 smaller towns not covered by the national programme.

Source: Applied Research and Communications Fund, 2017.

companies develop new products and services based on mobile technologies, test them in Bulgaria and then seek markets abroad. Such is the case with Sirma Mobile and the SMS parking project in South America, Tickey Mobile Solutions (recipient of the 2016 Innovative Enterprise of the Year Award of ARC Fund) with a project for contactless payment for tickets and use of public transport/metro/ferryboat in Bulgaria, Canada and the United Kingdom. Given the trend of having all appliances and devices connected to the internet and managed via mobile phones, **Bulgaria is in a very good position to be an early adopter and tester of complex solutions**. Such models have already been applied in Bulgaria (Vivacom transitioned to Huwaei and then its engineers helped other telecoms to implement the technology) and Moldova (Orange experimented with the transition to a next generation of networks there to avoid risking in France). Also, mobile projects usually require smaller teams than the conventional network projects based on computers and servers, which is an additional benefit to smaller companies in Bulgaria.

The market in mobile applications in Bulgaria is very dynamic and shows that companies from all sectors are experimenting with different innovations. In terms of shopping via mobile apps, the most popular ones in both main markets are OLX (with more than 1 million installations for Android) and eMag (between 100,000 and 500,000 installations for Android). In addition to direct orders, some companies are using mobile apps as a marketing tool – for example, the famous game of Queens juices simulating the opening of a juice cap with a message of luck. The game can be done in a day if the pieces of luck have already been inserted from the actual caps and there have been from 500,000 and 1,000,000 downloads for Android only, which makes it a very effective marketing

Figure 59. MOST POPULAR MOBILE APPS IN THE FINANCIAL SPHERE AS OF 1 NOVEMBER 2017

iPhone

#	Free		Paid	
1	Bulbank Mobile UniCredit Bank Bulgaria pc...	=	Cryptocurrency Exchange R... Ruslan Timchenko	=
2	DSK Smart DSK Bank PLC	=	HomeBudget with Sync Anishu	=
3	ePay.bg EPAY AD	=	iCurrency Pad Sollico	=
4	My Fibank First Investment Bank AD	▲ 3	MoneyBook - finance with fi... noidentity	=
5	Trader.bg Avus Capital	=	iXpenselt FYI mobileware	=
6	Raiffeisen ONLINE Raiffeisenbank (Bulgaria) EAD	▲ 2	MoneyWiz 2 - Personal Fina... SilverWiz	=
7	BankOn Mobile Societe Generale Expressb...	▼ 3	Next for iPhone - Track your ... noidentity	=
8	PayPal Cash Wallet: Send M... PayPal	▼ 2	Trip Cost Per Person Plamen Todorov	=
9	m-Postbank Deutsche Postbank	▲ 3	BUDGT - monthly finances, ... S. Flückiger	=
10	UBBMobile United Bulgarian Bank	=	Saver ~ Control your Expens... Alex Solonsky	=

Android

#	Free		Paid	
1	Bulbank mobile UniCredit Bul...	=	My Budget Book OneTwoApps	=
2	DSK Smart DSK Bank	=	Daily Expenses... Michel Carvajal	=
3	credissimo - na... Credissimo	=	Sparkasse+ Star Finanz	=
4	IQ Option brok... IQ Option	=	CASHFLOW - T... Torn Screen	=
5	Raiffeisen ONLI... Raiffeisenban...	▲ 1	Money Manage... Realbyte	=
6	Eidoo Eidoo Sagl	▼ 1	Monefy Pro - M... MonefyApp	▲ 1
7	ePay.bg EPAY AD	=	Pro Credit Card... Julien MILLAU	▼ 1
8	My Fibank First Investme...	▲ 2	CWMoney EX ... CWMoney	▲ 4
9	Monese Monese	▼ 1	Our Budget Bo... Mavi Software	▲ 2
10	Trader.bg - For... Trading 212	▲ 2	Home Budget ... Anishu	▼ 1

Source: AppAnnie.

tool compared to the potential costs for billboards or TV commercials. Even banks such as DSK are using the same approach with a numerology app to advertise themselves to potential and current customers. Worth mention is the chaotic investing and experimenting with mobile apps by companies which have been quite conservative on the web, TV and print advertising.

The tendency for mobile phones to turn not only into internet access devices but also becoming a key tool for managing the time and behaviour of individuals at work, study or at home has not been lost on banks and financial institutions. Although it is possible for users of online banking services to use them via the phone browser, people who are not using bespoke apps are more of an exception and the data are indicative of the respective market shares. Such indicators will be gaining ever more importance for the analysis of consumer behaviour than, for example, the statistics of the Bulgarian National Bank about the number of bank clients/accounts.

Social media are also an important tool of marketing innovation for companies all over the world and, in particular, Bulgaria. In Bulgaria, 31.7 % of companies use social media for work purposes, while this share in the EU is 44.6 %. Only 9.42 % of companies use more than one media. The most popular one is Facebook, followed by Instagram and Twitter. The most famous top 20 Bulgarian brands[27] which have their own Facebook profiles have an average of 340,000 followers, approximately 44,000 average monthly interactions via three posts every day. Even though it is widely known that video is more popular, Facebook page administrators often post photos (46 %) or a link (43 %) and only share videos in 11 % of the cases. They are probably optimising time and money because it is much more difficult to make a quality video than a photo or an existing publication from the corporate website or a media publication.

Samsung Bulgaria has the largest number of fans – approximately 500,000 – which demonstrates that a good mobile app can easily attract more clients and it is easy for the company to get the client's attention via a mobile app. Depending on their target group, the companies choose to be more active on Facebook (if the target group is in Bulgaria) or Twitter (if the target group is in the USA or around the world) – an example is Enhancv which has more than 8,000 clients paying monthly for the development of a new CV. Enhancv is an innovative company which has demonstrated how to create a "blue ocean" market out of a seemingly unsellable service because everyone in Europe is using the Europass CV form and Microsoft Word offers numerous free CV templates. **Enhancv was the fastest growing Bulgarian brand on Twitter in September 2017.**

Social media are a valuable marketing tool for many small entrepreneurs who sell on Facebook and without which they would not have a market. Some of them use PayPal to receive payments from abroad and, sometimes, Bulgaria. To give approximately 12,000 small entrepreneurs the opportunity for a quick way to expand their business or create new jobs, the Bulgarian institutions should pursue reforms in the regulations of cash registers and mobile/virtual payment terminals and make it possible for mobile phones to become not only a means of payment but also a means to accept payment similarly to the case in the USA with the payment terminals of Apple and Blackberry. In Bulgaria, most banks are still conservative with regard to providing a classical payment terminal which could change its location.

[27] Data from SocialBakers for September 2017.

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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.

ARC FUND

Applied Research and Communications Fund
5 Alexander Zhendov Street, Sofia 1113
tel.: +359 (2) 973 3000 ■ fax: +359 (2) 973 3588
www.arcfund.net