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Economic Resilience through Innovation

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CONTENTS

LIST OF ABBREVIATIONS

AA	Agricultural Academy
BAS	Bulgarian Academy of Sciences
BEAIT	Bulgarian Employers' Association of Innovative Technologies
COSME	Competitiveness of Enterprises and Small and Medium-sized Enterprises
CRM	customer relationship management
EC	European Commission
EIS	European Innovation Scoreboard
EPO	European Patent Office
ERP	enterprise resource planning
EU	European Union
GDP	gross domestic product
GEM	Global Entrepreneurship Monitor
ICT	information and communications technologies
IMD	Institute for Management Development
INA	survey of the innovation activity of enterprises
IP	intellectual property
NCEA	National Classification of Economic Activities
NCPR	North Central Planning Region
NEPR	North East Planning Region
NGO	non-governmental organisation
NSI	National Statistics Institute
NWPR	North West Planning Region
OP	operational programme
OPIC	Operational Program Innovation and Competitiveness
OPSESG	Operational Programme Science and Education for Smart Growth
PORB	Patent Office of Republic of Bulgaria
R&D	research and development
SCM	supply chain management
SCPR	South Central Planning Region
SEPR	South East Planning Region
SIR	SCImago Institutions Rankings
SME	small and medium-sized enterprise
STEM	science, technology, engineering and mathematics
SWPR	South West Planning Region
USA	United States of America

INDEX OF TABLES

INDEX OF FIGURES

INDEX OF BOXES

EXECUTIVE SUMMARY

Finding opportunities in a crisis – this is how a number of Bulgarian companies reacted during the year of Covid-19. The need to optimise production, provide a safe working environment and create new products in response to changes in demand has led companies to implement new business models, improve their product portfolio, and launch innovations in the workplace.

In the last year, about 58% of companies have implemented some kind of innovation and just over 30% of those who had refrained from innovation plan to start a similar project next year. According to the data from the survey of innovation activity of enterprises in Bulgaria INA-5, which the Applied Research and Communications Fund has been conducting since 2004, if all intentions are realised 70.4% of enterprises will innovate in 2020 – 2021, which corresponds with the findings from the previous crisis for the period after 2008.

Innovative Bulgarian companies are actually benefiting internationally from the crises. This finding has an important implication for policy – the Bulgarian government must be able to recognise such trends and support them in order to strengthen their positive effect on the country's economy. Instead, the government is transforming funds intended to support innovation under the Operational Programme Innovation and Competitiveness into "support for all". In the medium term, such solutions may hinder the advancement of innovative companies in the country, whose growth could have a favourable effect on the economy through larger and higher paid employment.

The crisis has affected both the manufacturing sector and the services sector. **The education system in Bulgaria has undergone a shocking change** with the outbreak of the Covid-19 pandemic in March 2020 and the forced transition to online learning of all educational institutions. This unanticipated development drew public attention to the much-discussed lag in the introduction of methods of teaching and learning appropriate for the digital age. Now the challenge facing the education system is to build on this change, to support and stimulate it in order to develop true digitalisation of the edu-

cational process, which would require a profound change in the quality and type of educational content.

In 2020, the second programming period of Bulgaria's full membership in the EU will come to its end. According to many of the indicators of the European Innovation Scoreboard, however, Bulgaria has not made progress. The country remains in the group of modest innovators, despite the goal of increasing R&D spending as a share of GDP to the level of 1.5% by 2020 and moving to the group of moderate innovators.

In 2019, **patent activity in Bulgaria reached another ten-year peak** (181 patents of Bulgarian individuals and legal entities), almost equalling the achievement of 183 patents in 1999 and ahead of 134 patents issued in 2009. The number of foreign patents amounted to 2,624, almost all of which (99.63%) were issued by the European Patent Office (EPO) and have effect on the territory of Bulgaria as well. Within the surveyed period, with few exceptions, **individual patent holders remain leaders in the institutional structure of patent activity** in Bulgaria. For 2019, their share was 40%, and for the last 20 years – 57%. Despite the growth of patents issued to business and the Bulgarian Academy of Sciences (BAS) (the lead public sector institution in this regard), the role of individuals remains key; moreover, it has grown again in the last four years.

Utility models remain the preferred means of protecting the results of inventive activity. They are used as a way to ensure monopoly rights over the so-called small inventions. However, they are also an option to avoid the cumbersome, more expensive and time-consuming patenting procedure (in cases, of course, where the invention meets the conditions for doing so). The number of certificates issued for utility models on the territory of the country for the period 2007 – 2019 amounted to 2,377, **with the business sector in the lead with 1335 utility models, followed by individuals with 833**.

In 2019, Bulgaria ranked 61st in the world in scientific production with a total of 6,022 publications, of which 5,752 scientific articles, reports and abstracts. The country ranked 178th in terms of the number of citations per publication. The comparative positions of Bulgaria for 2019 in the world ranking are inferior to the indicators for the period 1996 – 2019 when the country ranked 55th for publication activity and 164th in the number of citations per publication. However, the H-index, which assesses both the productivity and relevance of publications, puts Bulgaria in the 54th position out of a total of 231 countries.

Scientific organisations in the country register a growing number of publications in the Scopus database. For the second year in a row, there is double-digit growth in publication activity on an annual basis – 13% for 2019 after the increase by 20% for 2018. This affects the share of publications with Bulgarian participation in the world (0.18%) and regional rankings, respectively 0.64% within the EU-28, and 2.25% among East European countries. **Within the EU-28, Bulgaria is 22nd in terms of total publication activity** both for the entire surveyed period (1996 – 2019) and for the last year. Within Eastern Europe, **Bulgaria manages only just 13th place (ahead only of North Macedonia) with a little under 29 scientific articles, reports and abstracts per 1,000 people engaged in science and technology.** Leaders are Slovenia (106) and the Czechia (91), which have three times higher publication productivity, followed by Romania (63).

The Covid pandemic has affected entrepreneurial activity. Major changes have taken place in terms of **access to finance, the structure of the portfolio of financial instruments and the main guidelines for their spending.** The government's financial measures were mainly aimed at overcoming the negative effects of the crisis, including in support of companies from the most affected economic sectors and the laid off employees, in some cases at the expense of initiatives for the promotion of innovation and entrepreneurship.

The closure of nurseries, kindergartens and schools, as well as work/learning from home, put **women's entrepreneurship** to a special test. Caring for the family, as well as the stronger involvement of parents in the learning process, limit the opportunities above all for women to develop and put into practice their ideas for entrepreneurial endeavours.

Social entrepreneurship in its various forms and manifestations is becoming more necessary than ever. It is a response to the critical need for quick solutions in unprecedented new conditions; provides support for unemployed people or families on the verge of poverty; provides technological solutions to emerging problems, many of which are related to the digitalisation of business processes and social life.

In 2019, R&D expenditures amounted to BGN 1,002 million, or 0.84% of GDP. **Investment in the research sector in the country continues to grow steadily** both in absolute terms (21% increase on an annual basis) and as a share of GDP (11% increase on an annual basis). After the decline in 2016 and 2017, all R&D sectors improved. However, Bulgaria remains far from its national target of 1.5% R&D expenditure as a share of GDP by 2020, set at the beginning of the programming period in 2014.

For another year, business has the largest contribution to research and development activity in the country with a total budget for 2019 of BGN 673 million, or 0.56% of GDP. The increase on an annual basis is 13%, which is within the normal change for the sector in recent years. In fact, 2019 became peak year in the modern history of the country in terms of business investment in R&D. However, the total volume of R&D investments in the country remains many times smaller than the investments of an average global company.

In 2019, **Bulgaria ranks among the fastest growing business hubs in Europe with growth in high-tech employment** higher than the average levels for the continent. The index Geography of Europe's Brain Business Jobs 2020 of the European Centre for Entrepreneurship and Policy Reform compares 31 European countries by concentration of high-tech jobs. **Compared to the base year 2014, Bulgaria is in 8th position with a 28.6% increase in the number of jobs in knowledge-intensive businesses** per 1,000 people of the working age population of the country. Of the 39,400 new jobs 73% are in ICT, 12% are in the creative industries, 8% in the technology sector and 7% in the services.

Moreover, **Bulgaria is ahead only of Romania, Malta and Cyprus in terms of the share of R&D employees in relation to the working age population of the country**. The growth of R&D staff on an annual basis used to be 11%, but was reduced to 2% in 2019 – a result of the reduction of researchers in the higher education sector, offset by growth in non-profit organisations and businesses. This corresponds with the findings of the **World Talent Ranking** of the Institute for Management Development (IMD, Switzerland) where

Bulgaria falls into the group of the 10 most backward countries in the field of talent development and capitalisation on this basis. The country has dropped 3 positions compared to 2019 and ranks 55th out of a total of 63 countries included in the survey.

The information and communication technology sector is growing every year by all indicators – number of companies, number of employees, share of exports, share of GDP. In 2020, of the top 100 of companies by employment 21 are in ICT and provide 21% of employment in the largest companies. There is rapid blurring of the boundaries and convergence between ICT and other sectors (finance, insurance, retail, security, entertainment, education). The digital transformation of the various sectors has led to a significant change in the source of added value and this is increasingly related to the introduction of new digital technologies. Healthcare, however, is not among the successful sectors in this respect. Bulgaria continues to lag behind global trends in e-health, which will have a long-term negative impact.

INTRODUCTION

The ***Innovation.bg*** **report provides an annual assessment of the innovation potential of the Bulgarian economy in Europe** and of the status and opportunities of the Bulgarian innovation system. It makes recommendations for improving public policy on innovation in Bulgaria and in the EU drawing on the latest theoretical and empirical research and taking into account the specific economic, political, cultural and institutional framework within which the country's innovation system is developing. Over the last 16 years *Innovation.bg* has made a number of concrete proposals for improving the innovation policy and practice in the country, which have been supported by the government, business, the scientific community and the European Commission. However, there has been no breakthrough in national innovation policy so far and it still remains almost entirely dependent on EU instruments and funding.

Membership in the EU has led to the development and implementation of the country's first comprehensive innovation strategy – the Innovation Strategy for Smart Specialisation 2014 – 2020. Extending it in the future and achieving sustainable economic growth through innovation requires scaling up private sector efforts and overcoming the serious **institutional weaknesses in the development and implementation of public policies in this area**.

Innovation.bg 2020 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;
- investment and financing of innovation;
- human capital for innovation;
- information and communication technologies.

The leading theme of *Innovation.bg* 2020 is the strategic framework of the European Commission for the programming period 2021 – 2027 with its priorities and measures for a more innovative and green European economy.

The report focuses on the policy of the Bulgarian government for supporting competitive business in the context of growing challenges on the global stage.

Innovation policy of the European Union and Bulgaria on the eve of the programming period 2021 – 2027

European policy in the field of science and innovation – prospects and priorities

The strategic framework of the European Union has been extremely dynamic over the last year. The launch of the annual cycle of the **European Semester**,[1] the instrument for coordinating economic policies in the EU for 2020, coincided with the launch of the **European Green Deal**.[2] This prompted the integration of the UN sustainable development goals[3] and the environmental dimensions of the **Annual Sustainable Growth Strategy (ASGS)**[4] into the analysis of progress, challenges and opportunities for member states, and later in the recommendations for national programming documents.

The European Green Deal is seen as Europe's new growth strategy aimed at **building a modern, resource-efficient and competitive economy that does not jeopardise the protection, conservation and growth of the old continent's natural capital.** The European Green Deal prioritises two dimensions of growth: a **green and digital transformation of the European economy** on the agenda.

In order to achieve the ambitious goals of the Deal, actions at different levels and in a wide range of areas are needed:

- attracting European, national and private funding, with **Horizon Europe** having the leading role[5];
- synergy between Horizon Europe and other EU programmes;

[1] The European Semester.

[2] The European Green Deal, Brussels, 11.12.2019.COM(2019) 640 final.

[3] 17 Goals to Transform Our World.

[4] Annual Sustainable Growth Strategy 2020, COM/2019/650 final.

[5] Horizon Europe.

- **horizontal missions**[6] to conduct ambitious research by bringing together a wide range of stakeholders;
- **partnerships**[7] between the European institutions, member states and business in order to create broad platforms for experimental development and testing of new technological solutions;
- **knowledge and innovation communities**[8] under the auspices of the European Institute of Innovation and Technology as a platform for co-operation between higher education institutions, research organisations and businesses;
- **thematic clusters**,[9] which cover the full range of global challenges through joint research and innovation in the field of health, culture, creativity and inclusive society, civil security, digitalisation, industrial and space technology, climate, energy and mobility, food, bioeconomy, natural resources, agriculture and environment.

The ASGS further develops these ideas into the concept of competitive sustainability, based on four fundamental principles: macroeconomic stability, social justice, a sustainable environment and productivity increase. The strategy reaffirms that in the next programming period **technological leadership and technological independence** will be among the European Union's main objectives. This is to be achieved not through a small number of leading sectors or enterprises, but **on the basis of widespread innovation and access to finance**, so that the existing gaps between technological levels within the European economy will be reduced to a minimum and higher productivity from a larger number of sectors and enterprises, including SMEs will be achieved. The Strategy focuses on another set of preconditions for the business environment, which – if ensured at the national level – can enable the achievement of the ambitious goals:

- good management;
- effective institutions;
- independent and efficient judicial systems;
- robust public administrations;
- solid anti-corruption regulations;
- efficient functioning of public procurement;
- effective insolvency frameworks;
- efficient tax systems.

Additional emphasis on creating an environment conducive to the introduction of innovation as a prerequisite for increasing productivity and ensuring the competitive sustainability of national economies is made in the **New Industrial Strategy for Europe**.[10] Specific initiatives include:

- intellectual property action plan;
- general and specific EU competition rules, including mergers and state aid;
- White Paper on overcoming the anti-competitive effects of foreign subsidies in the single market and on controlling foreign access to EU public procurement;
- regulations for environmentally friendly public procurement;
- action plan on vital raw materials, and others.

[6] Missions in Horizon Europe.

[7] European Partnerships under Horizon Europe: results of the structured consultation of Member States, Directorate-General for Research and Innovation, Unit A4 – Missions and Partnerships.

[8] Knowledge and Innovation Communities.

[9] Orientations towards the first Strategic Plan for Horizon Europe.

[10] A New Industrial Strategy for Europe, Brussels, 10.3.2020 z., COM(2020) 102 final.

The European Strategic Framework for the next programming period pays special attention to small and medium-sized enterprises (SMEs). The development of the sector is crucial for the achievement of the Community's economic and social objectives. The **strategy on the role of SMEs in a sustainable and digital Europe**[11] envisages the expansion of the network of digital innovation hubs in the member states, the creation of a fund for initial public offering for SMEs, dissemination of good practices for start-ups, and promotion of women's entrepreneurship. Taking into account the diversity of SMEs and the business models they apply, the strategy focuses on achieving three main goals:

- Capacity building for green and digital transformation.

The main challenges in this area are related to the insufficient and ineffective use of digital technologies by SMEs, difficulties in the protection of intellectual property, difficult access to funding for research and innovation, lack of qualified staff, including in new and niche specialties, and lack of digital skills.

- Reducing the regulatory burden and improving the business environment.

The main efforts will aim at eliminating over-regulation, digitalisation of public services and one-stop counters, optimising the public procurement framework, improving access to external markets and the European single market, introducing preventive restructuring and providing second chance for businesses in difficulty. The principles of "think small first" (taking into account the interests of SMEs in European and national policy-making), "one-off" (citizens and businesses provide data to the public administration only once) and "digital default" (reducing administrative burdens, making the provision of digital services a standard in the work of public administration), together with the introduction of the principle of "abolition of previous burdens when introducing new ones (one-in, one-out)".

- Providing more affordable financing through a combination of financial instruments.

Measures are envisaged to improve SMEs' access to external financing on better terms, to diversify financial sources to meet the needs of both start-ups and growing enterprises (for example by setting up an Initial Public Offering Fund), and further streamlining state aid rules for SMEs.

Box 1. THE ROLE OF THE ENTERPRISE EUROPE NETWORK DURING THE PROGRAMMING PERIOD 2021 – 2027

The 600 centres of the Enterprise Europe Network (EEN) for technology transfer provide tailored services to SMEs in more than 60 countries around the world. The Applied Research and Communications Fund and its consulting unit ARC Consulting EOOD have been coordinating a consortium of 12 EEN centres in the 6 planning regions of Bulgaria since 2008. In the programming period 2021 – 2027, the main focus of the network will be to help SMEs make the transition to sustainable development and digital transformation. The network will provide advice on investing in areas with resource-efficient and circular processes and infrastructure, digitalisation and business sustainability by finding relevant business and financial partners and promoting cooperation. The consultations on innovation management of SMEs, which were awarded the seal of excellence by the European Innovation Council, will be also strongly represented.

[11] An SME Strategy for a sustainable and digital Europe, Brussels, 10.3.2020, COM(2020) 103 final.

Box 1. THE ROLE OF THE ENTERPRISE EUROPE NETWORK DURING THE PROGRAMMING PERIOD 2021 – 2027 (CONTINUED)

In order to ensure the smooth provision of services and advice, exchange of experience and good practices throughout Europe, the EEN is envisaged to work closely with:

- **digital innovation hubs – nearly 240 throughout Europe;**
- **Startup Europe – a European Commission (EC) initiative to connect high-tech start-ups with accelerators,** corporate networks, universities and the media;
- **the European Institute of Innovation and Technology and its knowledge and innovation communities; and**
- **other structures, including national, regional and local authorities.**

Source: Applied Research and Communications Fund, 2020.

In this context, interventions in the fields of research, innovation, education and training are an important element of both general and specific recommendations to member states to meet the challenges and achieve the European Semester 2020 targets. The latter are crucial for ensuring productivity growth.

After March 2020, the procedures for the implementation of the annual cycle of the European Semester, as well as the interaction between the European Commission and the member states reflect the new global challenges related to the outbreak of the Covid epidemic. The core of the Commission's specific approach to meeting the 2020 targets is innovation and investment in human capital development, including through digitalisation and the necessary digital skills. The example of a number of European and global innovation leaders is similar, providing targeted support to innovative start-ups, high-tech and innovative companies and innovation infrastructure, so that they continue to operate in times of crisis. Innovate UK, part of the UK Research and Innovation[12] (the UK's National Funding Agency for Science and Innovation) and the German federal government[13] are just a few examples of direct financial support. There are also various examples of non-financial support,[14] including through pre-commercial public procurement to innovative businesses.

The actions of the Bulgarian government seemed to go in the opposite direction of the EU. The funding planned for regional innovation centres, innovation clusters and innovative business under OPIC[15] was redirected elsewhere, thus jeopardising the implementation of a number of innovation projects and contributing to the unpredictability of the environment for business innovation.

The innovation policy of Bulgaria – new players and new rules of the game

The Innovation Strategy for Smart Specialisation of Bulgaria 2014 – 2020 provides that Bulgaria's progress in the field of research, technology and innovation should be measured by the country's comparative positions in the European Innovation Scoreboard (EIS). The July 2020 EIS shows that Bulgaria remains in the group of modest innovators in the company of Romania only,

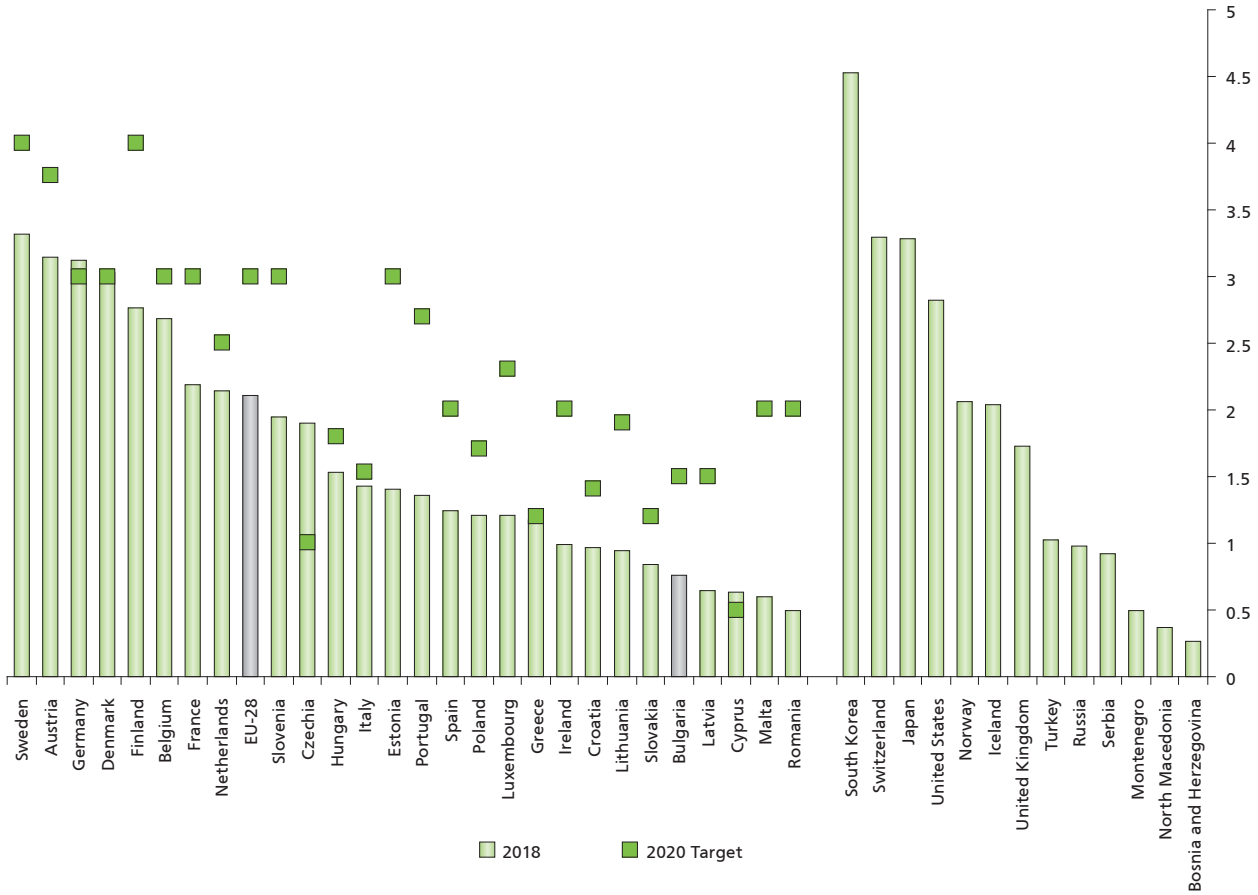
[12] Billion pound support package for innovative firms hit by coronavirus.

[13] Financing for start-ups, company growth, and innovations.

[14] Responding to COVID-19 with Science, Innovation, and Productive Development, April 25, 2020.

[15] Project BG16RFOP002-1.027 Creation and development of regional innovation centres.

Figure 1. R&D EXPENDITURE AS SHARE OF GDP – 2018 AND 2020 EU MEMBER STATES' TARGETS



* The data for Switzerland are for 2018. The data for Bosnia and Herzegovina are for 2014.

Source: Eurostat, 2020.

with an innovation index of 49 (no change compared to 2019) and indicators that show almost no positive development compared to the base year 2012. Thus, Bulgaria has failed to meet its national targets for moving to the higher category of moderate innovators and for achieving R&D expenditure level of 1.5% of GDP. In comparison, the average EU target is 3% and the level that the country has achieved at the end of the current programming period is just over 0.7% (a decline compared to 2015, when R&D expenditures amounted to 0.95% of GDP). The main missing component are public R&D expenditures, which are very insufficient. Such levels of funding are also indicative of a lack of administrative capacity for designing and implementing a national innovation policy.

The development of Bulgaria's strategic framework for science and innovation for the next programming period (2021 – 2027) needs to address the shortcomings identified so far and to take into account the recommendations of the European Commission made in the process of the European Semester 2020 and in previous years.[16] The main ones focus on the following:

[16] European Semester 2020: Assessing progress in structural reforms, preventing and correcting macroeconomic imbalances and the results of in-depth reviews in accordance with Regulation (EU) No. 1176/2011, Brussels, 26.2.2020, COM (2020) 150 final; European Semester 2020: country-specific recommendations, Brussels, 20.5.2020, COM (2020) 500 final; Council Recommendation on Bulgaria's National Reform Program 2020 containing the Council's Opinion on Bulgaria's Convergence Program 2020, Brussels, 20.5.2020, COM (2020) 502 final.

- underdeveloped linkages within the innovation system; low intensity of innovation dissemination between enterprises; limited knowledge of and reluctance to participate in technology transfer;
- low technological level of enterprises compared to the average levels by economic sectors – a problem that is reproduced and deepened by the public investment, which is far below the existing technological thresholds;
- widening of the technological gap between a small number of enterprises representing niche high-tech sectors, on the one hand, and the majority of enterprises employed in medium- and low-tech industries, on the other;
- slow penetration of digital technologies in enterprises and low level of digitalisation of business processes, accompanied by lack of digital skills and unwillingness to participate in and conduct trainings;
- low share of public investment in research and innovation; limited access to finance by SMEs; lack of diversification and complementarity of financial sources;
- serious challenges related to the development, attraction and retention of talents;
- fragmented innovation system and significant regional imbalances;
- an environment inadequate to the goals of digitalisation, including issues related to the quality of public services, cybersecurity, lack of open data, and inefficient public spending.

The state of the innovation system in Bulgaria requires decisive measures in order to overcome the lagging behind not only world innovation leaders, but also behind countries catching up with them, so that the country can achieve innovation-driven economic growth.

The start of the next programming period 2021 – 2027, together with the measures needed to tackle the consequences of the Covid crisis, are a good beginning. The strategic framework in the field of science, technology, innovation, education and support for SMEs for the next seven years is in the process of development, the effect of which is expected to be multiplied by the creation of a new player on the innovation scene – the **State Agency for Scientific Research and Innovation**,[17] a specialised body of the Council of Ministers tasked with strengthening the applied nature of scientific research and encouraging the dissemination of the innovation results through enhanced interaction with business. Specific strategic planning steps include the following:

National Reform Programme[18] **and Convergence Programme 2020 – 2023**[19]

The two documents are prepared by the Ministry of Finance as part of the annual cycle of the European Semester and in support of the implementation of Bulgaria's goals within the Europe 2020 strategy. Along with interventions in a number of other areas, commitments have been made to structural reforms in the areas of science and innovation. The establishment of the new State Agency and changes in research and innovation legislation are envisaged as

[17] Decree of the Council of Ministers No. 356 of 14 September 2020. In a number of its publications, the *Innovation.bg* report of the Applied Research and Communications Fund has proposed the creation of a single body for the implementation and coordination of policies in the field of research and innovation as a prerequisite for ensuring interaction between them and hence improving the innovation potential of the national economy.

[18] Europe 2020 National Reform Programme, Ministry of Finance, April, 2020.

[19] Convergence Programme 2020 – 2023, Ministry of Finance, April, 2020.

key mechanisms to promote synergies between science and business and the accelerated application of innovative developments in practice.

Innovation Strategy for Smart Specialisation 2021 – 2027 and National Strategy for SMEs in Bulgaria 2021 – 2027

Having these documents adopted is a pre-condition for member states to be eligible for allocation of European structural funding. In the forthcoming programming period, the measures envisaged in both strategies will be based on the same regional zoning of the country, despite some doubts in this regard, and will promote activities in the same priority areas with minimal changes in terms of subsectors and regional priorities.

Programme for Scientific Research, Innovation and Digitalisation for Economic Transformation

During the third programming period of Bulgaria as a full member of the EU, the country launched a new programme for science and innovation,[20] in addition to the existing programmes managed by the Ministry of Economy and the Ministry of Education and Science (through the Executive Agency of Operational Programme Science and Education for Smart Growth). The new programme is a stand-alone tool for funding research, innovation and digitalisation of public services and is expected to change the scope of the other two related programmes in terms of limiting their impact on the independent implementation of innovation projects by enterprises (in the case of the existing Operational Programme Innovation and Competitiveness at the Ministry of Economy) and interventions in the field of education (in the case of the existing Operational Programme Science and Education for Smart Growth at the Ministry of Education and Science). All closely related activities in applied science, intellectual property protection, technology transfer, joint implementation of research and innovation projects and other activities promoting the interaction between science and business will be in the remit of the new Programme for Scientific Research, Innovation and Digitalisation for Economic Transformation. The indicative budget of the Programme is envisaged to be EUR 883.29 million with the European Regional Development Fund as a source, of which BGN 19 million will be set aside for technical assistance.[21]

The funds will be distributed according to two main priorities: sustainable development of the Bulgarian scientific and innovation ecosystem, and digital transformation.

Digital transformation and industry 4.0

In response to EU priorities and global challenges, a series of documents have been developed by the Ministry of Transport, Information Technology and Communications[22] and the Ministry of Economy[23] which aim to improve the

[20] Decision of the Council of Ministers No. 495 of 21 July 2020 amending and supplementing Decision No. 196 of 2019 for approval of the Analysis of the Socio-Economic Development of Bulgaria 2007 – 2017 for determining the national priorities for the period 2021 – 2027 of the List of Policy Objectives to be supported during the 2021 – 2027 programming period and the list of programmes and lead development agencies.

[21] Decision of the Council of Ministers No. 496 of 21 July 2020 amending Decision № 335 of 2019 approving the indicative financial allocation of ESF+, ERDF and CF funds for the programming period 2021 – 2027 by policy and program objectives.

[22] Digital transformation.

[23] Industry 4.0.

business environment and increase the efficiency of public services, and to accelerate the uptake of information and communication technologies in the economy as a way of increasing the innovation and productivity of enterprises.

The preparation of these strategic documents is supposed to be based on an analysis of what has been achieved so far, including:

- Development of a National Strategy for Small and Medium Enterprises in Bulgaria 2021 – 2027;
- Interim evaluation of the implementation of the Innovation Strategy for Smart Specialisation 2014 – 2020;
- Review of public spending on science, technology and innovation, commissioned by the Ministry of Education and Science to the World Bank;
- Strategic evaluation of the emerging centres of excellence and centres of competence in Bulgaria, assigned to the Joint Research Centre at the European Commission.

Most of these documents, however, had not been ready by the time of the submission of the first draft of the partnership agreement with the European Commission and of the texts of the operational programmes at the end of 2020. The recommendations made in these documents should thus be taken into consideration in a subsequent updating of the agreement and operational programmes.

Despite improvements in the strategic framework and funding of the national innovation system, Bulgaria is still behind European innovation leaders. This is mostly the result of **lacking vision and focus at the policy level**, entailing a lack of national priorities and policies (developed independently and in advance of European ones), a drop in the share of public funding for R&D, gaps and faulty coordination in the national innovation system, and a failure to utilise the existing tools and capacity for innovation-driven development. Some of the measures for a more effective national innovation policy which *Innovation.bg* has identified over the past few years include:

1. Reassessing regulatory barriers to innovation and taking measures to overcome them

Changes could focus on:

- Amendment of the regulation of public procurement in order to have its provisions better reflect the specific nature of research and innovation.
- Regulating pre-commercial public procurement as a tool to promote the transfer of new technologies into practice, to increase business innovation, and address social challenges in an innovative and sustainable way. The main areas in which the pre-commercial public procurement model could be piloted are the priority areas for development in the next decade – digitalisation of the main sectors of the economy and the green economy.
- Companies should be incentivised to report their research and innovation activities in their annual financial statements. For this purpose, a favourable administrative environment needs to be created to facilitate the submission of reporting data and a system for control of their completeness and reliability. Neglecting this problem leads to underestimation of the innovative performance of the country and to the development of policies which do not reflect economic reality.

- Preparation of a set of regulatory initiatives on innovation, which would include initiatives to support research and innovation, and technology transfer, and to provide financial and tax incentives benefiting innovative businesses.

2. Unlocking the potential of human capital

People are the most important – and in the case of Bulgaria often the only – innovation capital; they are the sources of creativity and innovation. Closing the gaps in this area will require mobilisation and leadership for at least the next 20 years. Negative trends can be slowed down and reversed by way of the following measures:

- Ensuring European rates of the remuneration of researchers, including for the purpose of attracting talent from abroad, and introducing adequate mechanisms for evaluation of the results.
- Regulation and support for the implementation of the so-called third mission of higher education institutions – the transfer of research results to business.
- Support for the mobility of researchers, undergraduate and postgraduate students between research organisations, universities and business.
- Development of entrepreneurial attitudes among young people through the introduction of specialised tools to encourage creativity at every stage of the education system.

3. Increasing national public investment in research and innovation

A national system for financial support of innovation is de facto absent. The two funding instruments – the National Science Fund and the National Innovation Fund – are limited and are not integrated into a common budgetary framework for innovation support (including the budgets of universities, the Bulgarian Academy of Sciences and the Agricultural Academy).

The following emergency measures are required:

- Creation of a medium and long-term national financial framework to support research and innovation in order to ensure sustainability of the business environment and limit the risks for economic agents.
- The national public funding for science, innovation and technology transfer needs to be increased in absolute terms and as a share of GDP and approximated to European standards in this regard.
- Electronic management of financial flows for science and innovation needs to be introduced to all distribution channels, in order to reduce bureaucratic obstacles and increase spending transparency.

4. Finalise the development and apply a systematic approach to the innovation system

A balanced and sustainable approach is needed in the following areas:

- An improved administrative capacity of the planning regions so that they could become an equal partner to local government and innovative business. This would create opportunities to increase the attractiveness of local economies and develop regional competitive advantages. At

present, there is a tendency of deepening regional imbalances in terms of innovation potential, which hinders the increase of the competitiveness of the Bulgarian economy as a whole.

- Support for innovation infrastructure and units that provide business services in the field of research and innovation. This element of the system remains undervalued, and it can be extremely useful in promoting technology transfer and innovation. Support is needed to increase the capacity of existing technology transfer units and encourage their linkages with established international and European networks such as the Enterprise Europe Network.
- Introduction of differentiated support for business according to the specific characteristics and needs of the different groups of enterprises: newly established, rapidly developing, and those with established market positions.

5. Open data policy

The design of evidence-based policies depends to a large extent on the availability of and access to data. There has been progress in this area in Bulgaria and its momentum needs to be sustained. The use of data from the public and private sectors is key to improving the intervention tools and making them more precise. The policy of public institutions towards the available data, the ways in which the data can be collated and used and the opportunities for generating new data need to be reconsidered. In particular, the development of the strategic framework of science and innovation could rely more on data-based analysis.

The following steps are required for this purpose:

- Complete the introduction of e-government services in the work of national and regional level institutions and change the approach to administrative services to businesses and households in full compliance with the principles of accessibility, transparency and predictability.
- Create an electronic platform for technology transfer, in which all the components of the research infrastructure in the country are presented with a clear description of their capacity and the possible tasks for which they can be used, including rules for use by all stakeholders. The aim is to make the platform visible to businesses and to provide knowledge of the available research infrastructure and quick routing to components that can be used.

Box 2. BEAIT – A REPRESENTATIVE OF THE HIGH-TECH BUSINESS

In 2020, high-tech and innovative companies formed an association and positioned themselves as an important participant in the innovation ecosystem of Bulgaria. The Bulgarian Employers' Association of Innovative Technologies (BEAIT) was established in February 2020 in Sofia as a successor to the Association of Business Clusters, an organisation with over 11 years of history and many successful projects.

BEAIT has set itself the mission of improving the conditions for business and entrepreneurship in the country in accordance with the best European and world practices. The organisation has the ambition to harmonise cluster policies and work to improve the economic development of its members in partnership with all participants in the innovation ecosystem.

Box 2. BEAIT – A REPRESENTATIVE OF THE HIGH-TECH BUSINESS (CONTINUED)

The initiators for the establishment of BEAIT are organisations from the most important industries in Bulgaria: automotive, IT, education, energy, furniture, maritime, health and life sciences. Members of BEAIT include the largest companies in these industries, which set the trends and determine the direction of technological development in Europe and worldwide. These are companies such as Bosch, Etem Gestamp, Festo, SAP Labs, Sensata, Visteon Electronics, VMware.

As of October 2020, the association represents companies that make up 8.7% of the Bulgarian economy, with a network of activities in 114 municipalities, which at the same time are responsible for 80% of economic growth in 2019. In 2021, BEAIT members plan to make capital expenditures of over USD30 billion worldwide, a lot of which could be in innovation and innovative production in Bulgaria.

BEAIT is also seeking membership in the National Council for Tripartite Cooperation to enhance the voice of high-tech business, which is key to the future competitiveness of the Bulgarian economy, creates value-added products and is the basis of growth. The association has national representation with over 70 thousand employees in 24 economic sectors and unites a significant part of the innovative companies in Bulgaria which so far have not been represented in the dialogue between employers' organisations and the government.

This is especially relevant and necessary in the current moment of global economic crisis, which provides a unique chance for Bulgaria to take advantage of both the processes of near-shoring and anti-cyclical development of certain economic sectors. Many of the members of the association are an integral part of global supplies to industries such as the automotive, ICT and energy, which positions them as players with the capacity to expand their own production, generate demand from local producers, help increase incomes and improve the social climate in the country.

Source: Applied Research and Communications Fund, 2020.

Innovation potential of the Bulgarian economy

Innovation index

The Applied Research and Communications Fund has been conducting regular research on the innovation activity of enterprises in Bulgaria (INA) since 2004, adopting as a basis the methodology of the European Innovation Scoreboard. The index considers three equivalent groups of innovations, from the point of view of innovation positioning – product innovations (what is produced), process and organisational (how it is produced) and marketing (for whom it is produced and how it is sold).

Innovation in times of crisis

World and Bulgarian economic histories teach that **companies** that **continue to invest in innovation** during a crisis **do better** and **outperform** others in the **post-crisis recovery period**.

The global financial crisis in 2007 and 2008 caused hitherto unimaginable levels of innovation activity in the country. About 71% of Bulgarian enterprises in 2009 innovated (*Innovation.bg 2010*), compared to pre-crisis levels of 35% in 2006 (*Innovation.bg 2007*). The growth in 2009 was due to optimisation of work processes (56.1% of enterprises introduced organisational innovations) and marketing innovations (41.6% of enterprises). Innovative enterprises then benefited from the crisis – either by capturing foreign markets of their competitors or by increasing labour productivity. As the country's economy is in the "eye of the storm" in 2020, it is still difficult to assess the effect of the current Covid crisis, but early signals show similar behaviour of companies as in 2009.

Last year, about 58% of companies implemented innovations, and just over 30% of those which refrain from innovation activity plan to launch a similar project next year. If all intentions are realised, 70.4% of enterprises will innovate in 2020 – 2021, which corresponds to the data from the previous crisis.

Of course, the two crises are very different. The shock of the first affected demand first and only then supply, and the domino effect spread through the financial relations between the enterprises. The Bulgarian (innovative) industry then, and to this day, remains very poorly open to complex financial instruments and finances its growth mainly endogenously, by its own revenues.

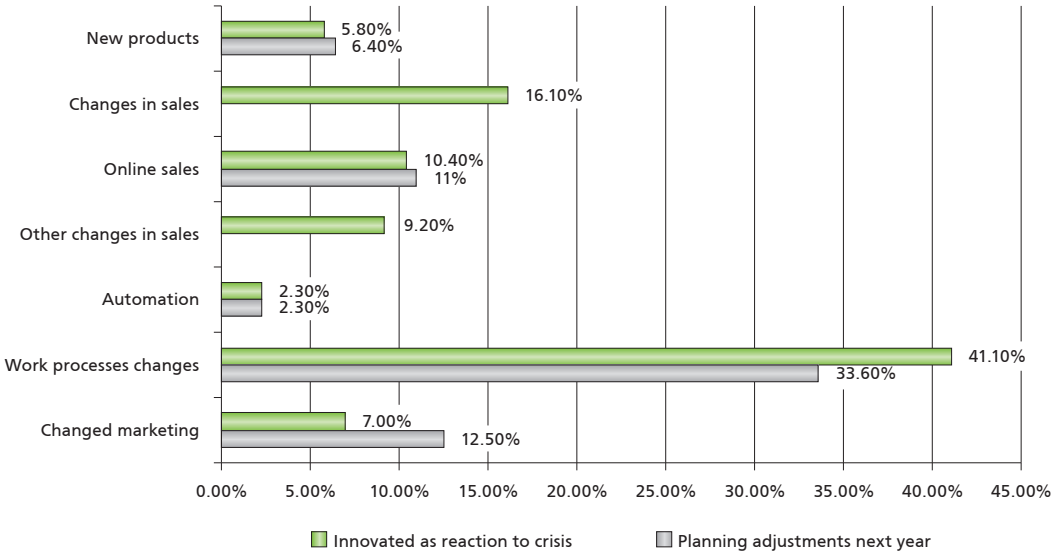
The current crisis first affected directly supply by simply shutting it down – shops and businesses closed, and only later did the shock affect demand. However, **demand was not simply reduced but structurally changed** – for example, consumption in restaurants was replaced by consumption at home, which increased the turnover of food chains and online food orders. Just over 10% of businesses introduced online sales in 2020 in response to the crisis, and another 5.6% plan to start selling online next year. Given that 8.16% of companies made sales through their website or mobile application in 2019 (according to the European Digital Agenda Scoreboard), this is significant growth. The Scoreboard database includes enterprises with 10 and more employees. Excluding micro-enterprises with up to 9 employees, 13.8% of enterprises in the INA-5 database have introduced online sales in response to the crisis and an additional 4.7% plan to introduce online sales next year.

Even successful companies that mainly operate in the B2B segment are turning to online sales channels as a preventive strategy and are in search of new partners. An additional 5.7% of companies have introduced other changes in sales. One such change is the implementation of card payments or inclusion in sales and delivery networks operated by other companies.

Enterprises reacted to the crisis and offered new products – 5.8% of all and 8.6% of those with more than 10 employees. These products were primarily related to the consequences, prevention and counteraction of the pandemic. Demand for these products repeatedly exceeded supply and their price has increased many times (in some cases up to 10 times). Such products include face masks, protective clothing and helmets, as well as special raw materials (such as fabrics) needed for their production. Innovative companies in textiles (such as Mak – Gabrovo and Aglika Trade[24] – Veliko Tarnovo) have developed and tested innovative materials (fabrics) needed for the manufacture of protective clothing. In some cases, the response time and prototyping of new products was less than two weeks from the first reported case of coronavirus infection. For many companies producing clothing and other textile products, the production of masks and protective clothing has successfully replaced their other products, the orders for which

[24] Award-winner of the 2014 Innovative Enterprise of the Year contest.

Figure 2. COVID CRISIS IMPACT: SHARE OF COMPANIES THAT HAVE UNDERTAKEN CRISIS-DRIVEN INNOVATIONS AND THOSE THAT PLAN TO ADDRESS THE EFFECTS OF THE CRISIS NEXT YEAR



Source: INA-5,[25] Applied Research and Communications Fund, 2020.

had been cancelled. As a result of the sharply increased demand, many new companies have entered this market, including companies from completely unrelated markets such as opera houses (as a strange alternative to opera performances) and individual designers (new clothing collections are offered in combination with a mask).

Other products whose demand has increased significantly are disinfectants, detergents, food additives, probiotics and immunostimulants. One of the largest manufacturers (and innovators) in the field of personal hygiene and cleaning in Bulgaria (Fikosota) increased its sales (as during the previous crisis) and continues to export to markets on all continents.

This is a recurring model – **Bulgarian innovative companies actually benefiting from international crises**. An important lesson for policy from this model is that the **Bulgarian government must be able to recognise such tendencies** and support them in order to strengthen their positive effect on the country's economy. Instead, the government seems to have chosen a policy of "support for all". While this is justified in order to avoid the immediate liquidity problems of companies as a result of the crisis, such measures must be carefully calibrated to avoid support for market-inefficient companies, and especially those that routinely avoid paying taxes. In this respect, even large chains in the restaurant and hotel sector avoid paying VAT by constantly registering new companies, which they use until the mandatory VAT registration threshold is reached. Moreover, the government is transforming funds intended to support innovation under the Operational Programme Innovation and Competitiveness into "support for all". In the medium term, such solutions may hinder the growth of innovative companies in the country, which could have a more favourable effect on the economy through larger and higher paid employment.

A relatively small share of companies (about 2%) **have implemented projects related to increased automation.** An example of such automation is the integration of modules for courier services in the e-shops of companies in order to more efficiently process the increased number of orders online. Some of the companies probably include in this group the change of the online sales systems to comply with Ordinance No. 18,[26] which never came into force.

This category also includes companies that introduced new robots during the crisis. Robotisation has lagged behind in Bulgaria, mainly because labour costs have been

[25] The study of the innovation activity of companies in 2020 was conducted within the project "Effective and transparent policy for smart specialisation of Bulgaria 2021 – 2027", implemented with the financial support of the Operational Programme Good Governance, co-financed by the European Union through the European Social Fund.

[26] The introduction of Ordinance No. 18 is an extremely bad example of over-regulation, which, although formally inducing a number of innovations, practically destroyed a significant part of the value in IT companies and among their customers.

much lower than the capital costs of implementing robots. According to the Professional Association of Robotics and Automation there are about 4-5 companies in Bulgaria that produce new or recycle used robots by reprogramming them. The largest exporters of robots are Spesima[27] and Milara (a leading manufacturer and key supplier of military robots for the US Army). Robots are even entering hotel services (room deliveries) and increasing efficiency while reducing risk in the context of the Covid crisis.

Changes in marketing in response to the crisis have been made by 7% of the enterprises. Half of them and another 9% who failed to innovate in 2020 believe that changes in their marketing to reduce the negative impact of the crisis will be needed next year.

As in the previous crisis, most often – **41% of enterprises have changed (innovated) the process of work (**in 2009, 37% of enterprises implemented significant changes in the organisation of work; *Innovation.bg 2010*). In 2020, this usually includes work from home, implemented cloud technologies, changed standards and routine of work related to sanitary requirements, but also work in shifts (for faster production in the first half of the year) and part-time work. Some businesses, especially in the service sector, went mainly online and this required additional staff training and reorganisation for the provision of distance learning courses, psychological counselling, management consulting, accounting services and more.

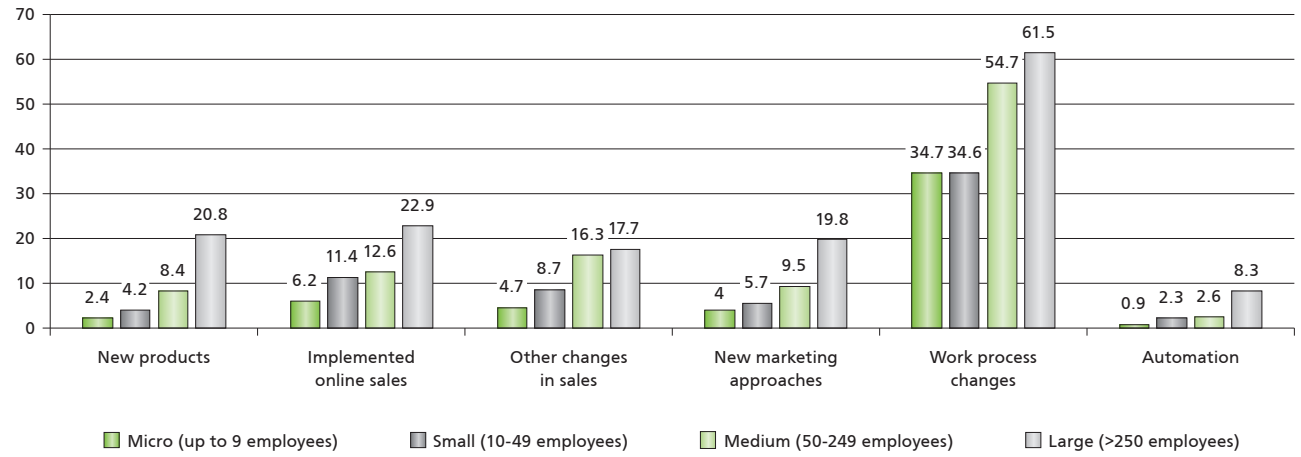
In addition to innovation, the pandemic has certainly caused many significant problems for some economic sectors. Businesses such as tourism, events organisation, and industries that are highly integrated with shrinking European markets (such as the automotive industry) are experiencing serious difficulties and in some cases are postponing their innovative projects.

Social distancing and lockdowns have changed the demand for clothing and footwear. Online demand has increased at the expense of shopping in physical sites. As a result, many smaller stores have focused on developing their digital presence, and companies offering e-shops as services (CloudCard and GombaShop) and related services such as search engine optimisation and digital marketing enjoyed customer growth and sales.

One of the sectors complaining that it suffers most from the measures is the restaurant sector (including bars and discos). For the first nine months, however, the decline in the tax base in 2020 compared to 2019, according to expert estimates, is only 20%, which means that the crisis has caused a significant internal redistribution. In general, the crisis transformed cash-based consumption which avoided taxes into taxable card-contactless transactions. Part of this consumption remains in restaurants through online orders or through larger restaurant chains, due to better disinfection measures. Another part is replaced by grocery shopping.

All surveys of enterprise innovation since 2006 show that **larger enterprises innovate more**. The reaction

Figure 3. ENTERPRISES' REACTION TO THE COVID CRISIS DEPENDING ON THEIR SIZE

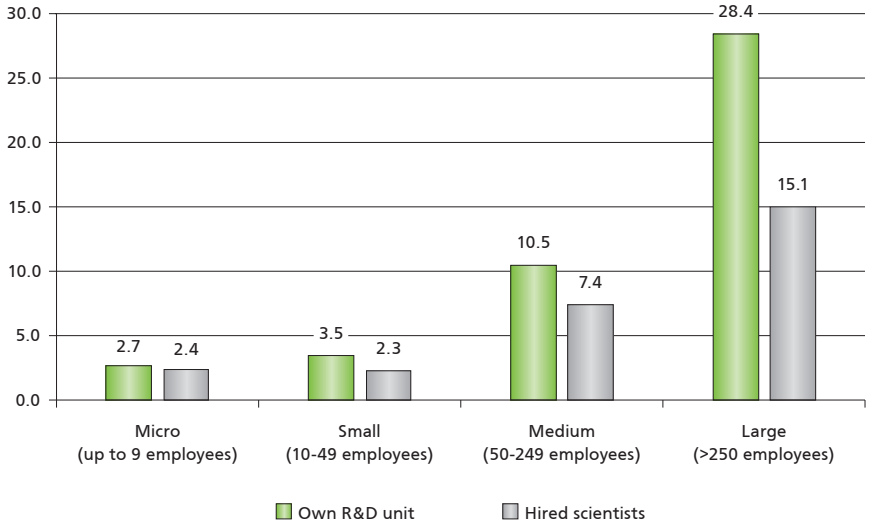


Source: INA-5, Applied Research and Communications Fund, 2020.

[27] Award-winner of the Innovative Enterprise of the Year contest in 2004, 2012 and 2018.

of enterprises to the Covid crisis follows the same trend. As many as 58% of micro-enterprises and 55% of small enterprises did not react in any of the ways shown in Figure 3, while 66% and 74% of medium and large enterprises, respectively, reacted in at least one way. The intensity of the reaction (if any) also differs significantly – only 4% of micro-enterprises have reacted in 3 or more ways (12% of small, 18% of medium), while in large companies this share is 30%. Only **companies with more than 50 employees have a complex reaction in 5 different ways.** The biggest difference according to the size of enterprises is observed, as expected, in terms of innovations aimed at increasing the automation of production.

Figure 4. SHARE OF COMPANIES WITH THEIR OWN RESEARCH AND DEVELOPMENT UNITS AND WITH HIRED SCIENTISTS



Source: INA-5, Applied Research and Communications Fund, 2020.

Despite the high frequency of innovations, especially in response to the Covid crisis, their level of novelty is not high. Typically, the novelty in product innovations is considered on three levels: new products for the company, for the national and the international (world) market, and the novelty for process innovations on two levels: to be new for the company and new for the sector.

Out of a total of 19% of enterprises that have implemented **product innovations** in the last year, **3% have introduced new products for the company, 13% for the Bulgarian and 3% for the international market**. About 80% of the new products introduced as a reaction to the crisis are for the company or for the country. Although there are Bulgarian companies that are international leaders in their markets and each of their new products is a global innovation, the remaining 20% are rather new products that have been long in development, but their launch simply coincided with the crisis.

Process innovations are directly related to product innovations, but are significantly less common – in around 10% of companies. Just over 20% of process innovations are related to increased production automation. **Just over half (57%) of process innovations are new to the sector**. Over 2/3 of the companies that have implemented process innovations in the last year have introduced new products, but only 37% of the companies with new products have also implemented process innovations.

Bulgarian companies **rely mainly on themselves** in product innovations (66%) and process innovations (69%). A small share of companies rely entirely on an external organisation: 9% for product and 8% for process innovations, and the rest work together with external contractors – respectively 25% and 23%. However, of the companies developing products that are new to the world market, **60% work with external organisations, which is a global trend – to develop new products and technologies in partner networks and clusters.**

The research done by the Applied Research and Communications Fund over the years of the relationship between science and business in Bulgaria shows that it exists, but is not institutionalised in contracts between companies and universities or research institutes. Rather, it takes the form of direct hiring of scientists or through the academic entrepreneurship of scientists themselves. About a third or **29% of the companies with global product innovations in the last year have their own research and development units, and about 12% have hired scientists**. Among those with new products for the Bulgarian market, a quarter have R&D units (25%), and a tenth (10%) employ scientists.

Just over a quarter of large companies (with more than 250 employees) have their own R&D units, and 15% have hired scientists (usually part-time, under civil contracts, but long-term). Among medium-sized enterprises, the companies with R&D units are 11%, while 7% employ scientists. In smaller companies, these shares are between 2% and 4%. These levels show that there is actually a linkage between business and academia in the country but it is not institutionalised. Another matter is how effective

this linkage is and whether all scientists who work for companies actually commercialise their research. Sometimes hiring scientists and academics is part of the marketing of companies, especially when working in foreign markets.

Academic entrepreneurship in all its forms – owning a company, nonprofit organisation, individual consulting practice or its institutionalisation through university centres and companies has a significant effect on the innovative potential of the country. According to expert estimates, **between 10% and 30% of scientists are also entrepreneurs**, and this is a stable trend since the beginning of the transition. Examples of successful innovative academic entrepreneurship are Datex, Rila Solutions, Technologica, Denima 2001, LogSentinel, Ontoidea, Alex 1977, Primavet, Eurotrust Technologies,[28] a number of professors and associate professors – medical doctors, owners of hospitals and medical centres, construction companies and architectural offices, various small consulting companies – marketing, accounting, law firms, translation companies and many others.

Forty-four percent of the enterprises have realised organisational innovations in the last year. Of these, 12.2% have introduced new or significantly improved management methods and systems. This group includes complete enterprise resource planning (ERP) systems, customer relationship management (CRM) systems, quality management systems, warehouse or order and delivery management systems, access management systems and accounting for staff working hours. The remaining (within the 44%) is due to a change in the work process of employees due to the Covid crisis, but also to necessary organisational changes resulting from the introduction of new production technologies, restructuring due to change of ownership and changes in methods (organisation) of sales. An interesting example of organisational innovation implemented in major clothing and footwear stores in the United States induced by a global Bulgarian product innovation (developed by Datex) is the transformation of all or almost all consultants in stores into sellers through transformation of the phone into a POS terminal.

Twenty-six percent of the enterprises have realised marketing innovations in the last year. About a quarter of these (or 7% of all) have done so in response to the crisis, while the rest have planned it prior to it. About 9% of the companies have made significant changes in the design and/or packaging of the products. The rest of the marketing innovations are due to the significantly changed methods of selling and distributing products (16% only due to the crisis), including 10% new online stores. **New marketing innovations are mostly digital**, including services such as Google My Business for the marketing of physical objects, maintaining pages on Facebook, Instagram, Pinterest, etc. Increasingly, companies are considering creating their own phone apps.

The innovation index[29] developed by the Applied Research and Communications Fund and first published in *Innovation.bg 2007* shows an interesting dynamic in the innovation of companies. On the one hand, in 2020 the level of innovation was similar to that in 2009 and 2010, with a reasonable expectation

Table 1. THE DYNAMICS OF INNOVATION CLUSTERS

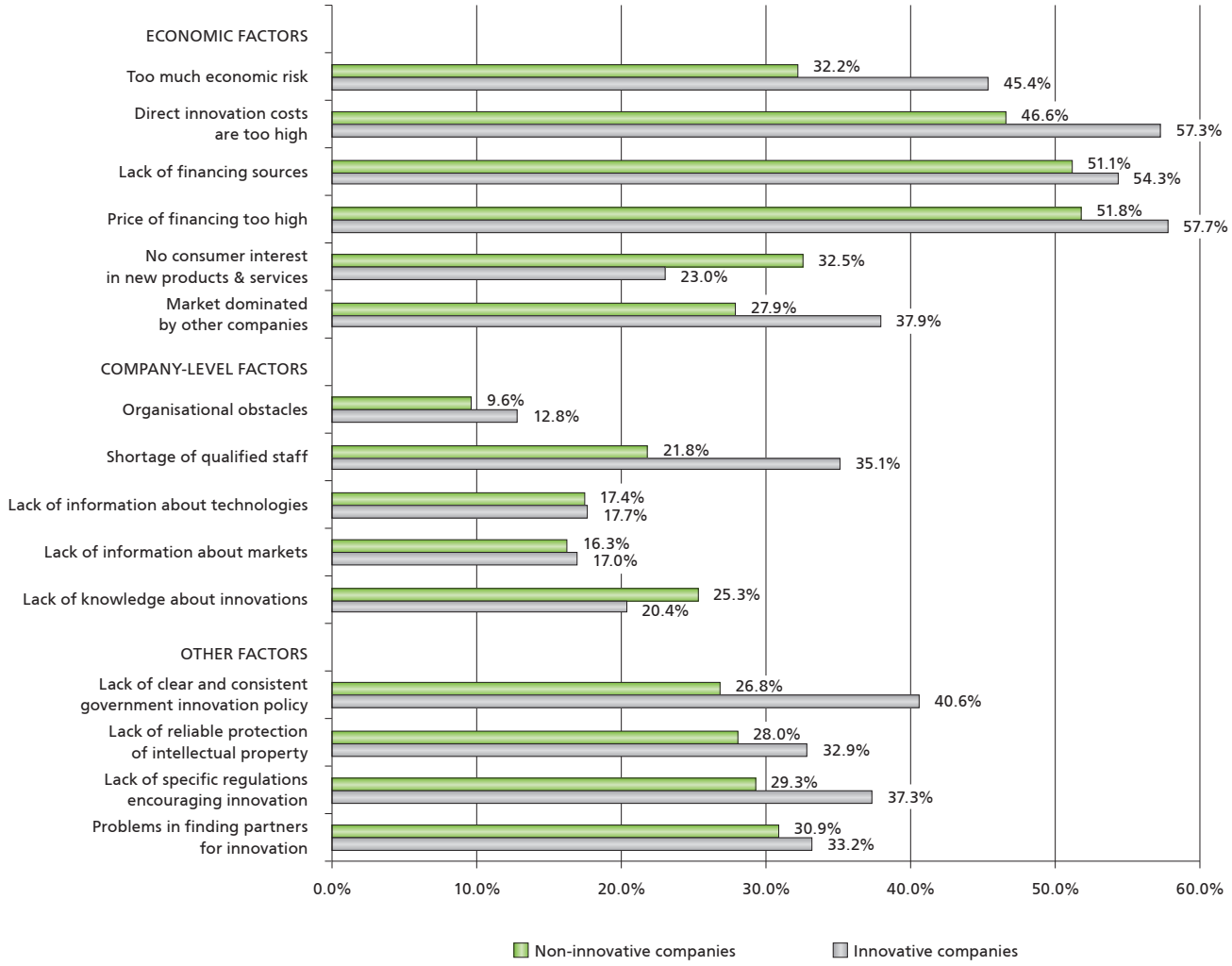
	Innovative leaders		Optimisers		Lagging behind		Catching up	
Index	2010	2020	2010	2020	2010	2020	2010	2020
Product innovations	53	42	6	6	1	2	77	62
Process innovations	78	100	7	2	4	1	6	9
Organisational innovations	68	47	38	75	18	16	42	33
Marketing innovations	62	49	63	43	0	3	43	56
Overall index	63	55	30	29	4	5	48	46
Share of enterprises	10%	6%	26%	12%	52%	74%	12%	8%

Source: INA-4 and INA-5, Applied Research and Communications Fund, 2020.

[28] Many of the most famous academic entrepreneurs in Bulgaria are award-winners in the Innovative Enterprise of the Year contest of the Applied Research and Communications Fund.

[29] The index is a summary measure of innovation activity at company level and aggregates seven different kinds of innovations of four types carried out by enterprises (product, process, organisational and marketing), and their degree of novelty (new to the enterprise, new to the market and new to the world), registered through INA-4. It takes values from 0 to 100, with an index of 0 meaning that the company has not innovated at all, while 100 means that it has made all kinds of innovations with a maximum degree of novelty.

Figure 5. FACTORS HINDERING COMPANY INNOVATION



Source: INA-5, Applied Research and Communications Fund, 2020.

that the record 2010 levels will be equalled next year. The explanation for this growth in times of crisis is due to the "innovation periphery", which consists of companies that have only one type of innovation (product, process, organisational or marketing).

In 2010, this periphery was estimated at 26% of all enterprises, while in 2020 it is 32% with the potential to increase by a few percentage points next year due to the Covid crisis. On the other hand, **the share of companies – sustainable innovators which implement all four types of innovations routinely is increasing – 3.4% of all**. **The average innovation intensity** is also increasing to 24 points, up from 22 in 2009.

At the same time, there is a **decrease in the innovation intensity** in all groups, except among those lagging behind, as well as a contraction of all groups at the expense of the lagging behind. This is certainly a result of the Covid crisis, which has delayed innovation projects in the groups of more advanced innovators. Still, in each of the clusters there is one type of innovation that is growing. In the case of innovative leaders, these are process innovations, where practically all have implemented such an innovation in the last year, with the highest degree of novelty (from 78 in 2010 to 100 points in 2020). **Process innovations guarantee sustainability**. They will be at the heart of the catch-up strategy (6 out of 9 points), supported by marketing innovation (43 out of 56 points).

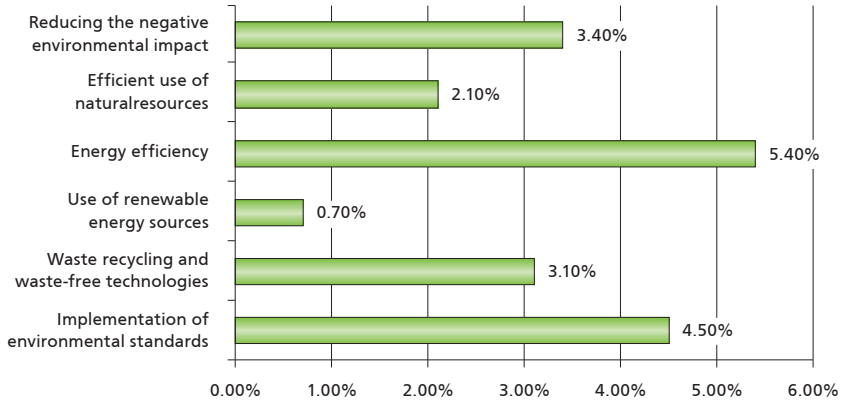
Optimisers have increased their organisational innovation at the expense of losing positions in marketing innovation. The lagging companies have increased their share from 52% to 74% in the last ten years, mainly due to non-innovative companies and the innovation periphery (companies with one type of innovation). The

overall index in this cluster increases from 4 to 5 points, which is due to an increase in product and marketing innovations.

These varying trends in innovative behaviour can be interpreted as a process of convergence between non-innovative and innovative enterprises due to competitive pressure. More and more process, organisational and marketing innovations are born and implemented routinely with the help of external partnerships. Many of the innovations of 10 years ago, which were then sporadic, are now routine. Children in the early stages of their education can now invent and make new applications for smartphones, and high school students can train a chat-robot for the Facebook page of their neighbourhood shop. Companies that implement enterprise resource management software often transfer organisational innovation to their customers without this being realised. And companies that perform outsourced business processes often invent, plan and implement process innovations (e.g. Endeavor and Scale Focus) with their customers.

Economic factors (risk, price, demand, competition), as well as internal factors (knowledge and skills of staff, organisational barriers) and the role of the state (protection of intellectual property, public policy) affect the innovation of companies. Firms that innovate are more sensitive to all factors, except consumer demand and knowledge in the field of innovation. There are two exceptions. More non-innovative than innovative companies believe that they will not find consumers who are interested in their new goods and services (or at least not at a price that will offset the cost of innovation). **Lack of knowledge in the field of innovation is perceived as a hindrance by one in four non-innovative companies**, while only 20% of innovative ones consider it an obstacle.

Figure 6. ENVIRONMENTAL IMPACT OF INNOVATIONS



Source: INA-5, Applied Research and Communications Fund, 2020.

About one-fifth of innovative companies or approximately 12% of all companies have implemented green innovations. Green innovations are defined as those innovations that have at least one of the following six characteristics:

- reducing the negative impact on the environment;
- efficient use of natural resources;
- energy efficiency;
- use of renewable energy sources;
- waste recycling and waste-free technologies;
- implementation of environmental standards.

The intensity of green innovations is significantly correlated (r = 0.358, sign. = 0.000) with the index of innovation, and is determined by the size of the enterprise. Larger companies are both bigger polluters and bigger investors in green innovation (including because of the easier return on investment). Bulgaria is integrating further into the European circular economy and new recycling plants are being built (from clothes or car tires to glass and metal), which in certain respects put the country at the forefront of the European Union (for example, by the plastic recycling factor). New business models are being developed (e.g. Remix and Mania) based on the circular economy. Both companies are major international players.

The Green Deal creates an opportunity for Bulgaria to invest in ecological innovations, gradually moving away from coal-intensive energy. The expectations of Bulgarian companies for the necessary innovations in the next year are statistically significantly correlated with green innovations, although with a rather low coefficient (r = 0.203, sign. = 0.000). It is very possible that the green innovations required by the regulations of the European Union will provide a new impetus to the process and product innovations in the country.

Gross innovation product

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

Innovation product

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

Bulgaria's position on the European and international innovation map

On the eve of the global Covid crisis, the European economy had demonstrated an improvement in innovation potential, which is supported annually by 25 national economies and is most pronounced in Cyprus, Spain and Finland. Compared to the base year 2012, significant progress has been made by Lithuania, Malta, Latvia, Portugal and Greece.

Europe ranks fifth in the world after global innovation leaders South Korea, Canada, Australia and Japan. The results of the United States and China which occupy the next positions are close, but they have a much more pronounced rate of change compared to 2012 (China – 17.3%, USA – 4.9%, EU-27 – 3%).[30]

Over the last year, Europe has further strengthened its advantages in terms of a business-friendly environment, business investment in innovation and financial support through venture capital funds. In somewhat similar areas, Bulgaria has its best positions, but at levels far below the EU-27 average. **There is no progress on the overall innovation index** (49) compared to the previous year, which indicates a relative lag and an entrenched position of the country among modest innovators. The distance from the first country included in the group of moderate innovators (Croatia; 63) is as much as 14 points.

As the comparative data show, **in all areas Bulgaria lags behind** compared to the EU average. While there has been progress on three out of 27 indicators, this is offset by strongly negative performance on other related and more relevant indicators:

- Intellectual property. The better positions in terms of trademark and design applications fail to compensate for the extremely poor performance of Bulgarian inventors in filing patent applications to the European Patent Office.
- Impact on employment. Bulgaria is in a strong position in terms of employment in fast-growing companies from innovative sectors of the economy. This indicator measures the capacity of national economies to react quickly to economic transformations and changes in market demand. At the same time, however, employment in knowledge-intensive activities[31] is less than two-thirds of the EU average.

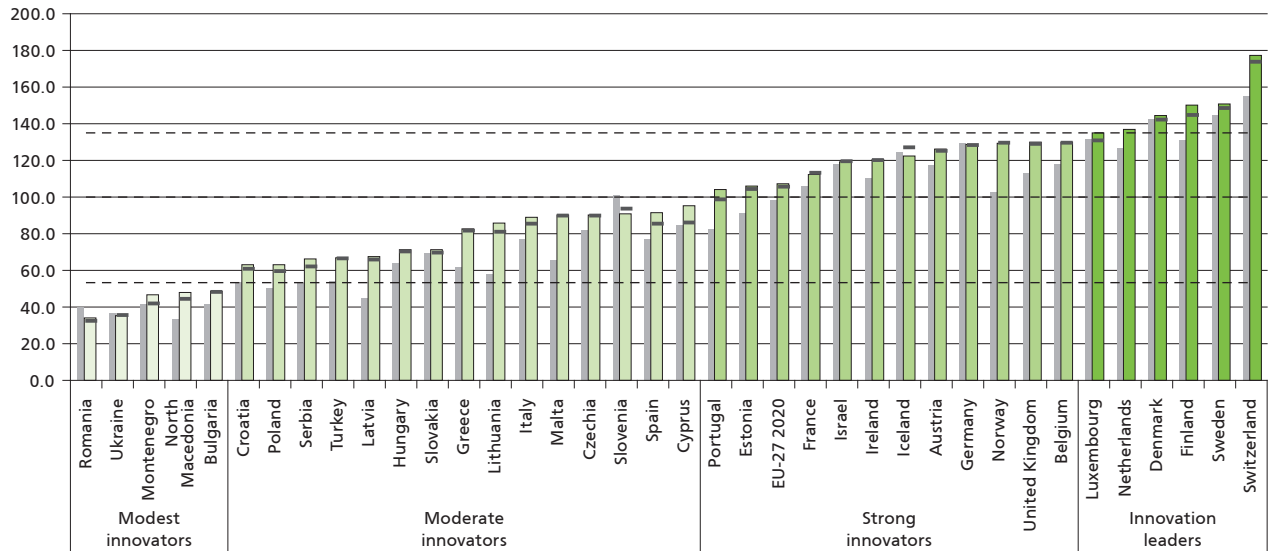
In a number of areas where the European Commission sets priority targets for the next programming period, Bulgaria is seriously underperforming:

- Public expenditure on R&D and innovation. There has been considerable growth compared to 2019 (see the section *Investment and financing of innovation* below), which is however insufficient for reaching the national target of 1.5% R&D spending of GDP.
- Venture financing. Although opportunities for easy access to capital seem to abound, they are concentrated geographically (Sofia) and by sectors (ICT and related activities) and remain inaccessible to the rest of business.

[30] The European Innovation Scoreboard presents a comparative analysis of the innovation potential of EU member states, other European and neighbouring countries. It assesses the relative strengths and weaknesses of national innovation systems and helps the countries in the study identify areas for improvement. The first edition of the European Innovation Scoreboard was in 2000 covering 1999 data for 15 EU member states. The methodology for preparing the annual report has undergone a number of changes, and for the period 2010 – 2015 the name was changed from European Innovation Scoreboard to Innovation Union Scoreboard.

[31] Those in which the number of employees with higher education is over 33% of the total number of employees.

Figure 7. EUROPEAN INNOVATION SCOREBOARD 2020*

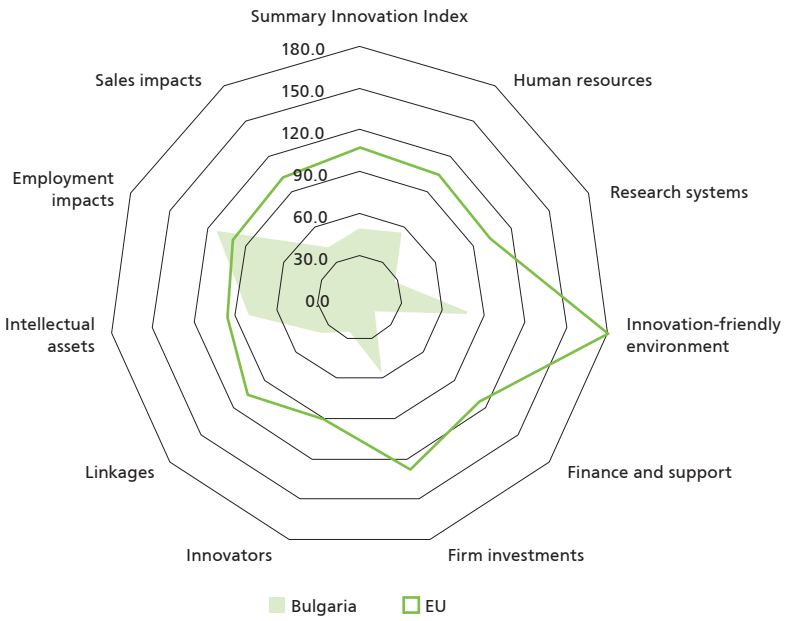


* The coloured bars show 2019 levels based on the latest data on the 27 indicators of the EIS compared to the EU average in 2012. The positions in black on the bars correspond to the same indicator, but for the previous year. The grey bars show the 2012 level of a country compared to the average for the EU in 2012. The dashed lines show the thresholds between the groups of countries in 2019: innovation leaders – over 120% of the EU average; strong innovators – between 90% u 120% of the EU average; moderate innovators – between 50% and 90% of the EU average; modest innovators – below 50% of the EU average.

Source: European Innovation Scoreboard 2020.

- Improving the digital skills of workers. Unsatisfactory results on this indicator are closely related and largely determine low levels of penetration of ICTs in traditional sectors of the economy and willingness to change the business model towards more of virtualisation of processes, jobs and value chain linkages.
- Offering new for the market and new for the company products and services. The innovation index shows a significant drop for both innovation leaders and those catching up, which prioritise the development and launch of new and improved products and services (see the section *Innovation index* above).
- SMEs with marketing and organisational innovations. With few exceptions, all enterprises covered by the innovation index have a reduced intensity of innovations for work processes and customer relations (see the section *Innovation index* above).

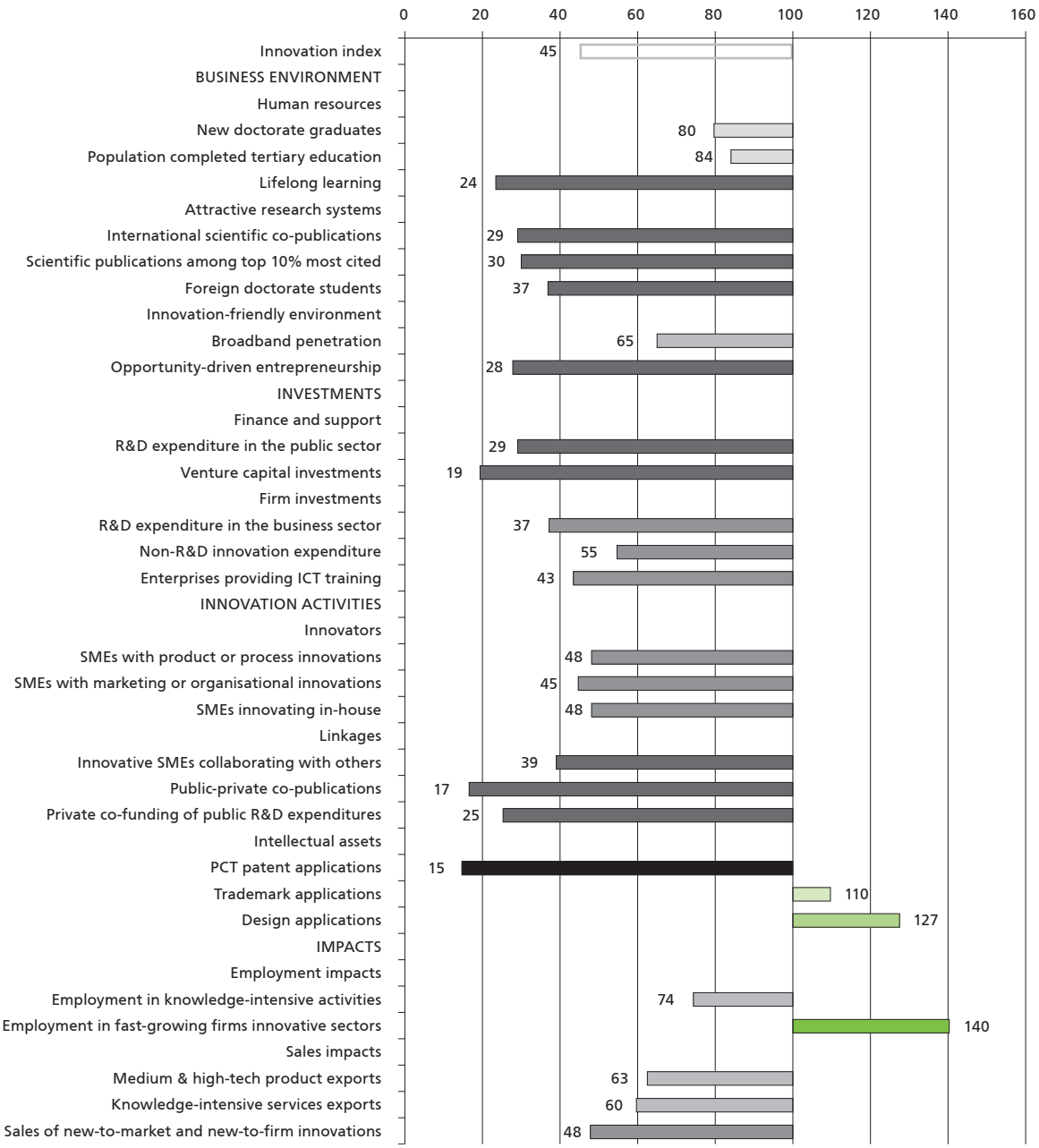
Figure 8. DIMENSIONS OF THE INNOVATION POTENTIAL, BULGARIA AND EU-27, 2020



Source: European Innovation Scoreboard 2020.

Significant progress has been made compared to 2012 in the export of medium and high-tech products, lifelong learning and business expenditure on R&D. There has been growth on a number of other indi-

Figure 9. INNOVATION POTENTIAL OF BULGARIA, SHARE OF THE EU-27 2020 AVERAGE, %, 2019



Source: European Innovation Scoreboard 2020.

cators, but obviously insufficient for the country to achieve qualitative progress.

The analysis of the national innovation practices included in the latest edition of the European Innovation Scoreboard confirms that **the key factor for achieving innovation-based competitiveness is the balanced development of the innovation system**. No input resource is more important than the others, no factor of the business environment should be neglected at the expense of others, no forms of interaction should be underestimated.

The main finding in the latest edition of the Global Innovation Index (GII)[32] is in the same vein: **innovation leaders have a balanced innovation system, which in turn provides balanced support for start-ups, fast-growing and developed companies**. In 2020, the survey covers 131 economies, which are ranked on a total of 80 indicators, grouped into 7 groups, 5 of which measure

[32] Global Innovation Index 2020: Who Will Finance Innovation?

various aspects of the business environment and input resources of the innovation system, and another 2 focus on the results and impact of the implementation of innovation processes.

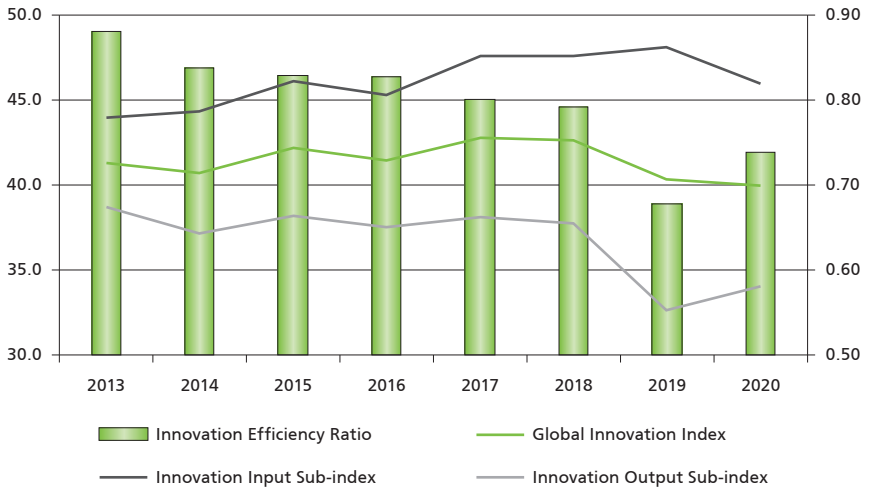
In 2020, Bulgaria ranks 37th in the global ranking, up three places compared to the previous year and back into its 2018 position. This is largely due to the rise by 8 positions on the sub-index measuring results from innovation activity (30), while the result for the sub-index for inputs remains the same (45). Within EU-27, Bulgaria ranks 21st on the GII. The penultimate 26th place for input resources is offset by the better 19th position for innovation performance. In all three categories, Romania ranks last among EU members.

Compared to the beginning of the programming period, Bulgaria has declined by 3% on the synthetic innovation index of the GII. This is a result of the negative influence of weak growth in terms of innovation input (5%) and a decrease in the results of innovation activity by 12%.

According to the GII, **the main weaknesses of the innovation system are in the following fields:**

- **human resources and research potential** – the country continues to be at the end of the ranking in terms of education (73), graduates in STEM areas (70), public expenditure for education as share of GDP (70), and interaction between universities and business (63);
- **access to finance**, including investment (102), credit (91), R&D expenditure (48);
- **business environment** – ease of starting a new business (86), political stability (70), rule of law (65), quality of public services (56) public services provided online (55);
- **intellectual property** – cost of access to intellectual prop-

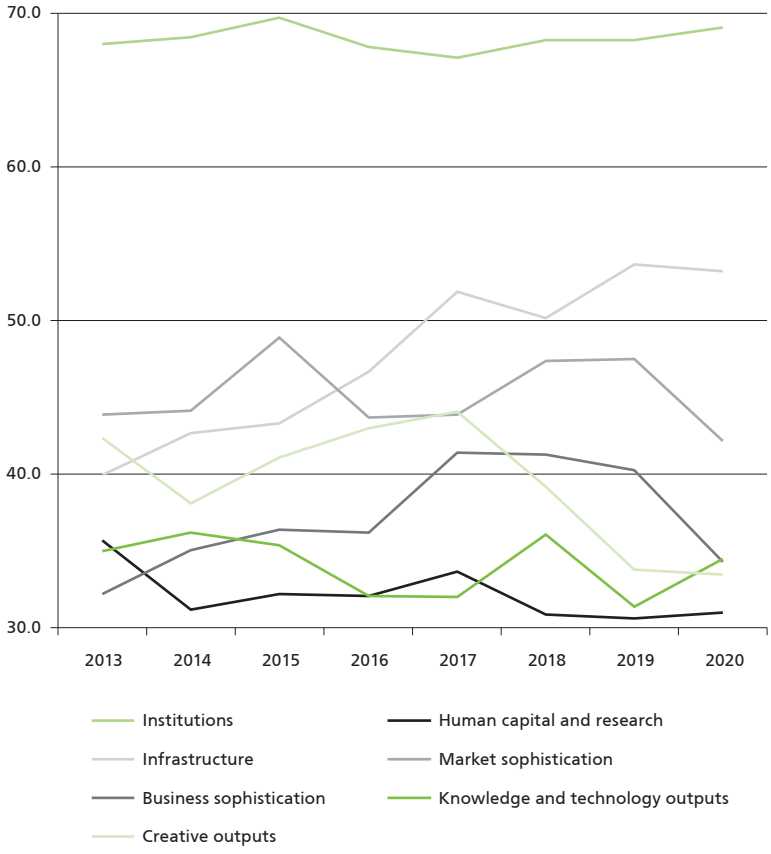
Figure 10. GLOBAL INNOVATION INDEX,* RESULTS FOR BULGARIA, 2013 – 2020



* On a scale from 0 to 100.

Source: Global Innovation Index 2020: Who Will Finance Innovation?

Figure 11. GLOBAL INNOVATION INDEX,* RESULTS FOR BULGARIA BY GROUPS OF INDICATORS, 2013 – 2020



* On a scale from 0 to 100.

Source: Global Innovation Index 2020: Who Will Finance Innovation?

erty rights (64), patent applications (57);

- **ICT penetration in business and households** – import of high-tech products (74), import of ICT services (68), access to ICT (58), digitalisation of business processes (64), computer software costs (56).

The lack of progress in recent years, especially with regard to long-term competitiveness factors, such as education (51), talent development and retention (58), research and innovation (48), is also a finding of the World Competitiveness Ranking[33] of the Institute for Management Development (IMD, Switzerland). Bulgaria ranks 48th among 63 countries (22nd in the EU).[34]

Technological product

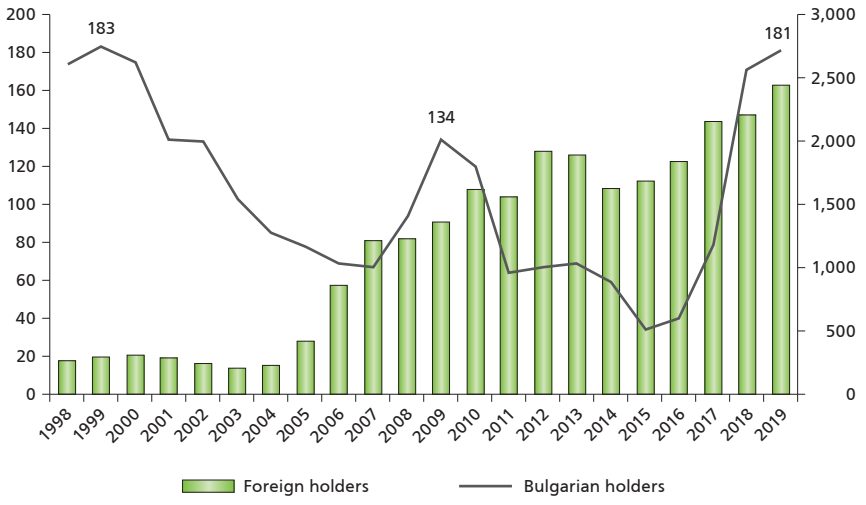
The technological product (protected and unprotected new technological knowledge) is the result of creative activities of various participants in the innovation process. It has unique characteristics and economic significance which make it attractive as an object of transfer. The analysis of application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

In 2019, **patent activity in Bulgaria reached another ten-year peak** (181 patents of Bulgarian individuals and legal entities), almost equalling the achievement of 183 patents in 1999 and more than the 134 patents issued in 2009. The number of foreign patents was 2,624, almost all of which (99.63%) were issued by the European Patent Office (EPO)

[33] The 2020 IMD World Competitiveness Ranking, IMD World Competitiveness Center.

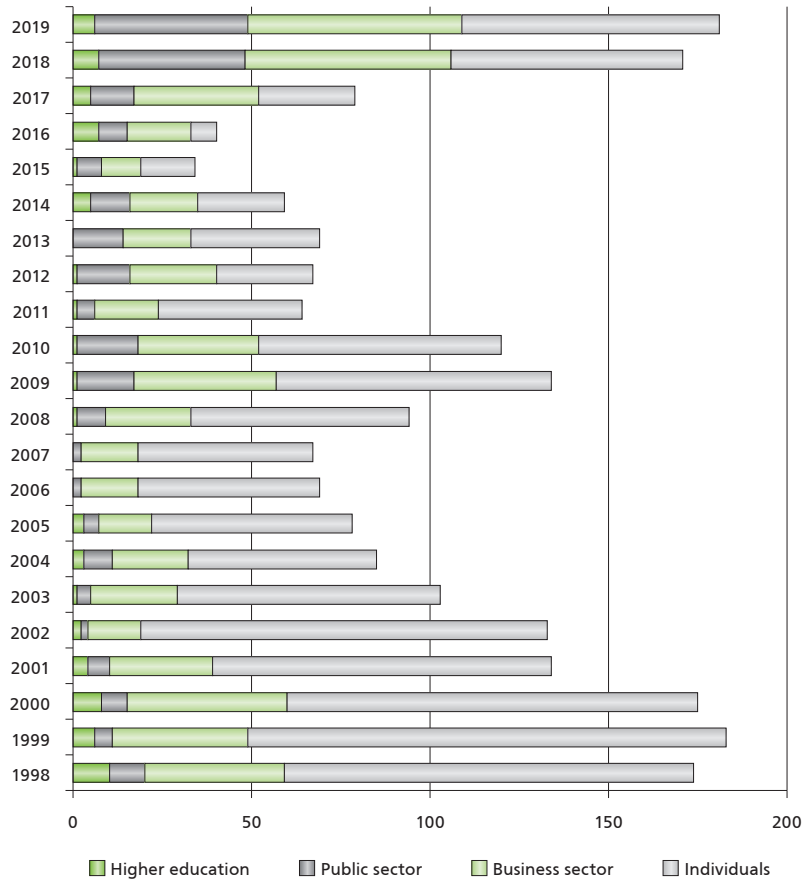
[34] Malta is not included in the 2020 edition.

Figure 12. PATENT ACTIVITY IN BULGARIA, NUMBER



Source: PORB, 2020.

Figure 13. INSTITUTIONAL AFFILIATION OF THE PATENTS ISSUED TO BULGARIAN HOLDERS IN BULGARIA, NUMBER



Source: PORB, 2020.

and have effect on the territory of Bulgaria too.

The patent activity of Bulgarian inventors is relatively evenly distributed among the main classes of the International Patent Classification (IPC). Within the total number of 1,781 issued patents for the last 20 years, nearly 19% of the patents are concentrated in class B-Technological processes, transport; followed by class A-Human needs by 17%. An exception is D-Textiles and paper, where only 7 patents have been issued since 2000.

In most of the last 20 years, **individual patent holders remain the leading segment in the institutional structure of patent activity** in Bulgaria. In 2019, their share was 40%, and for the last 20 years – 57%. Despite growth in the number of patents issued to business and the Bulgarian Academy of Sciences (BAS) (the main representative of the public sector), the role of individuals remains key, and even growing in the last four years.

It can be argued that **the low degree of institutionalisation of new technological knowledge is characteristic primarily of public research organisations**, including the institutes of BAS, the Agricultural Academy (AA) and public universities. In these institutions, a major factor motivating researchers' efforts to take steps and spend on protecting inventions created (most likely) with their leading role is the need to ensure compliance with the requirements of tenure. When this is the only motivating factor, the function of patents is limited to serving one's career development, and they rarely reach practical application. Such are the examples of the so-called **hidden academic entrepreneurship – development of innovative products and creation of new enterprises as a result of personal initiative and without commitment on the part of the public research organisation.**

In 2019, **the business sector added 60 new patents to its portfolio of intellectual assets**, making the patent activity of the business relatively high for a second consecutive year. Among the 55 companies that contribute to this result, Almot OOD-Stara Zagora has 3 patents, with two patents each are Arsenal AD-Kazanluk, Enterprise Communication Group OOD-Sofia and Nanotechnologies-Business-Innovations OOD-Kazanlak.

The patent activity of the business sector is concentrated in Sofia (38 patents or a little over 63%), followed by Kazanluk (4), Plovdiv and Stara Zagora (3 each), Dobrich (2). Companies from ten more towns in the country registered patents last year.

In 2019, five universities in the country had patents issued to them by the Patent Office of the Republic of Bulgaria (PORB). Of these, two patents were issued to Plovdiv University and with one patent each to the Technical University of Sofia, the University of Rousse, Sofia University and the Technical University of Gabrovo.

Table 2. TOP-10 TECHNOLOGICAL AREAS OF BUSINESS PATENT ACTIVITY, 2001 – 2019, NUMBER

IPC classification	Description	Number
A61	Human and veterinary medicine, hygiene, dentistry, medicines	60
H01	Basic elements of electrical equipment: cables, wires, insulators, resistors, magnets, detectors, transformers, switches, resonators, etc.	34
A23	Food and food products, processing, milk, oils, coffee, tea, chocolate, confectionery	21
F42	Ammunition, blasting, pyrotechnics	18
G01	Measurements of physical quantities	18
C10	Oil, gas, coke industry, gas, fuels, lubricants, peat	16
H02	Production, conversion and distribution of electricity, electrical machines, generators, motors, control and regulation	16
C07	Organic chemistry: general methods, acyclic, carbocyclic, heterocyclic compounds, sugar, steroids, proteins	15
G06	Computing and calculating machines	15
A01	Agriculture, forestry, animal breeding, hunting, fishing, pesticides, herbicides, disinfectants	14

Source: PORB, 2020.

Table 3. TOP 10 SUBSECTORS OF THE MANUFACTURING INDUSTRY IN TERMS OF PATENT ACTIVITY, 2001 – 2019, NUMBER

NCEA 2008 code	Description	Number
27	Manufacture of electrical equipment	252
25	Manufacture of metal products, except machinery and equipment	212
21	Production of medicinal substances and products	116
20	Manufacture of chemical products	99
24	Manufacture of basic metals	85
26	Manufacture of computer and communication equipment, electronic and optical products	77
10	Food production	53
28	Manufacture of machinery and equipment for general and special purpose	52
23	Production of products from non-metallic mineral raw materials	42
19	Production of coke and refined petroleum products	32

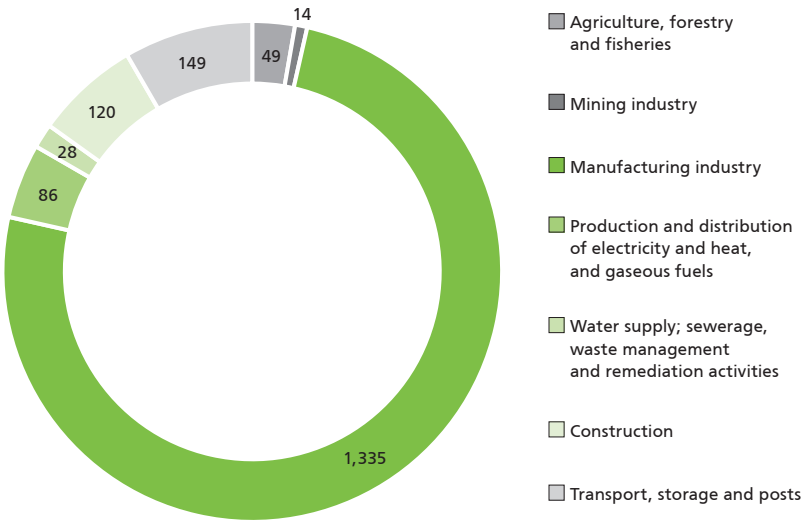
Source: PORB, 2020.

Forty-two patents were registered by the units of BAS in 2019. Half of them are owned by the Institute of Systems Engineering and Robotics (20). Another 12 institutes share between one and three patents. **The patent activity of the Academy has increased significantly in the last two years** – more than three times above the average annual number of 9 patents for the last 20 years.

Outside BAS, only one more representative of the public sector had a patent issued for 2019 – the Institute of Animal Sciences-Kostinbrod. At the same time, however, **AA's institutes are focusing their research on creating new plant varieties and new animal breeds**. Within the Academy, 19 units have 333 certificates issued for new plant varieties in the period after 2007 (11 in 2019), 8 of which are jointly developed with representatives of business or other research units, including the University of Forestry and Agricultural University-Plovdiv.

Another 115 certificates, owned by 24 businesses, including 19 of the company Agronom I Holding EOOD and another 13 of the company Florian OOD are added to the gene pool of new plant varieties in the period 2007 – 2019. Nine of them are joint with institutes of BAS and AA. Regarding new plant varieties, the research activity is concentrated again in the city of Sofia – 27 of the certificates are held by companies registered in the capital. The holders of new varieties of plants are located in a total of 17 towns. Only one certificate for a new animal breed is issued to a company.

Figure 14. PATENT ACTIVITY OF BUSINESS, STRUCTURE BY ECONOMIC SECTORS, 2001 – 2019, NUMBER



Source: PORB, 2020.

The interest of individuals in plant varieties and animal breeds is extremely low – only 5 in the first category (registered back in 2007) and none in the second category.

The total number of new plant varieties registered for the period 2007-2019 is **453**, nearly 40% of which are cereals, followed by vegetable (20%) and technical (19%) crops. **There are**

Table 4. TECHNOLOGICAL AREAS OF GRANTED RIGHTS ON INTELLECTUAL PROPERTY OBJECTS

Patents	Utility models	Know-how
Food	Animal/fish farming	Patient information
Cosmetics	Food additives	Hip prostheses
Waste treatment	Preparations for treatment, incl. veterinary	Orthopaedic implants
Metalworking	Vehicles and transportation	Cultivation of mushrooms
Extraction of oils from essential oil plants	Organic fertilizers and compounds	
	Microbiology (algae)	
Construction	Knitting	
Energy generation	Gas storage	
Batteries	Ventilation and heating	
	Vibration measurement	
	Data processing	
	Educational products	
	Energy conversion	
	Digital and image communication	

Source: PORB, 2020.

23 new breeds of animals in total. Innovation in sheep and butterflies breeding has resulted in 8 new breeds in each of these categories. The registered varieties of plants and breeds of animals with effect on the territory of the country for the period 2007 – 2019 are owned by Bulgarian holders only.

Utility models remain the preferred means of protecting the results of inventions. They seek a way to secure monopoly rights over so-called small inventions. However, they are also an option to avoid the cumbersome, more expensive and time-consuming patenting procedure (in cases, of course, where the invention meets the conditions for doing so). The number of issued certificates for utility models on the territory of the country for the period 2007 – 2019 amounts to 2,377; of these, **the business sector leads with 1,335 utility models, followed by individuals with 833**.

There are ten higher education institutions with a total of 28 utility models registered (3 in 2019), 9 of which are held by the Technical University of Varna. The Technical University of Sofia and University of Rousse have 4 each, followed by the Higher School of Transport and the University of National and World Economy with 3 useful models each. **Public research organisations are in possession of another 47 useful models**, 37 of which are to the benefit of various institutes at the BAS.

Another 118 useful models of foreign holders (representatives of 30 countries) are in force on the territory of the country. The largest number is from Russia and Czechia (18 each), Turkey (15) and Germany (10).

During the period 2015 – 2019, **63 intellectual property objects were subject to licensing**, including 18 patents, 38 utility models, 6 know-how and 1 variety. Of these, 46 are one-time licensed. With regard to the remaining 17 objects, multiple licensing agreements have been concluded. A kind of record is held by a patent licensed 14 times in 2015 – 2016; similarly, there is a utility model with 6 licenses in 2018 and another with 4 licenses in 2018 – 2019; as well as 4 contracts for granting rights to a variety.

Licensors in most cases are individuals (15 inventions, 26 utility models and 1 know-how), **followed by business** (11 patents, 25 utility models and 3 know-how). **For the five-year period, there are only four intellectual property objects for which the licensor is a research unit or a university.** This is indicative of the low capacity of public research organisations to adequately manage their intellectual assets, including through technology transfer forms.

All licence holders are Bulgarian legal entities (89) and individuals (2).[35] Exclusive licenses are typical for inventions. The majority of contracts are short-term, except in the case of know-how. Variety contracts are non-exclusive for a period of up to one year.

[35] For some licensors and licensees, no information has been published in accordance with the requirements of the General Data Protection Regulation (GDPR). Other parts of the contracts are classified.

Research product

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

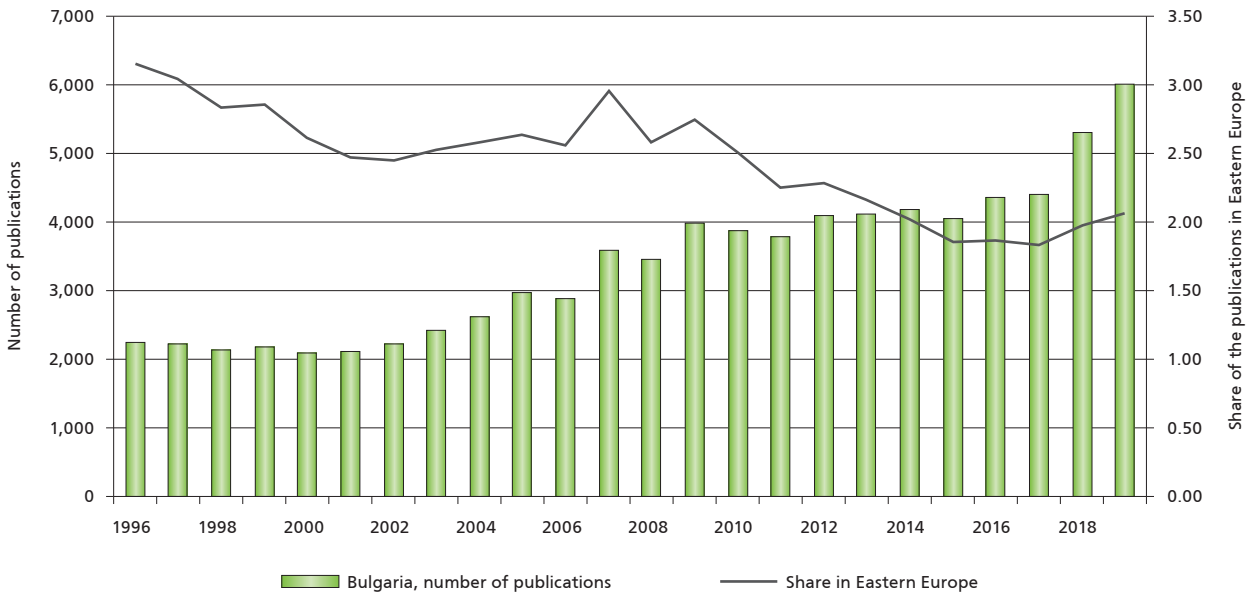
In 2019, Bulgaria was ranked 61st in the world in research production with a total of 6,022 publications, of which 5,752 scientific articles, reports and reviews. They are used to calculate the value of the indicator "number of citations per publication," which ranked the country in 178th place.[36] The positions of the country for 2019 in the world ranking fall behind the indicators for the period 1996 – 2019, in respect of which Bulgaria ranks 55th in publication activity and 164th in the number of citations per publication. **However, the H-index which assesses the productivity and the relevance of publications puts Bulgaria in the 54th position out of a total of 231 countries.**[37]

Within the EU-28, Bulgaria is 22nd in terms of total publication activity both for the entire surveyed period 1996 – 2019 and for the last year. The result is similar (21st) in terms of the number of publications per 1,000 people employed in science and technology.

The regional data for Eastern Europe in 2019 place Bulgaria in the middle of the ranking (11) of 23 countries by total publishing activity in the Scopus database. Data on science and technology employees are available for 14 countries in the region. Among them, **Bulgaria ranks only 13th, ahead of only North Macedonia, with just under 29 scientific articles, reports and abstracts per 1,000 people employed in science and technology**. In leading positions are Slovenia (106) and Czechia (91), which have three times higher productivity of publishing activity. They are followed by Romania (63).

Research organisations in Bulgaria have a growing number of publications in the Scopus database. For a second consecutive year, there is double-digit growth in publication activity on an annual basis – 13% for 2019 after the increase of 20% for 2018. This concerns the share of publications with Bulgarian participation in the world (0.18%) and regional rankings, respectively 0.64% within the EU-28, and 2.25% among the

Figure 15. Publication activity in the Scopus database, Bulgaria within Eastern Europe, 1996 – 2019



Source: SCImago (2007). SJR – SCImago Journal & Country Rank.

[36] SCImago (2007). SJR – SCImago Journal & Country Rank.

[37] The scientometric indicator H-index is known as the Hirsch index named after Californian physicist Jorge E. Hirsch, who launched its use in 2005. The value of the h-index is determined on the basis of the most cited publications: those h in number that have been cited at least h times are counted among them. The H-index is the only number that meets this definition. In practice, this can be done by writing the number of citations obtained from each article in descending order on numbered lines – the value of h is where the line number becomes greater than the number written on it.

countries of Eastern Europe. However, while in the first two cases the growth in recent years allows the country to restore its position from the beginning of the surveyed period 1996 – 2019, when compared to the countries of Eastern Europe the 2019 position is far from the achievement of 1996 (3.17%) and the next peak in 2007 (3.02%).

In the last two years, the double-digit growth in the publication activity of Bulgarian scientific organisations is accompanied by an equally **rapid decline in the share of research publications with international participation**. The relative closure of the scientific community in the country reverts international research cooperation back to the level of twenty years ago.

This is happening against the background of the relatively stable national and growing European funding for research in Bulgaria for the current seven-year programming period (2014 – 2020). The funds are provided mainly through:

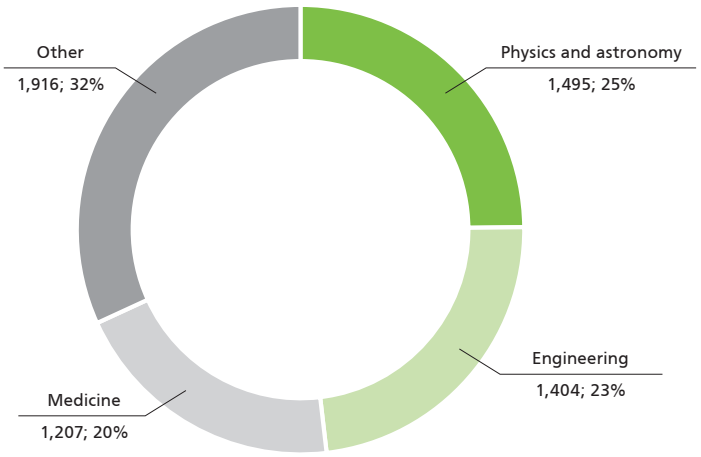
- Operational Programme Science and Education for Smart Growth;
- the National Science Fund;
- the national roadmap for research infrastructure;
- national research programmes;
- the research activity of public higher education institutions;
- the funds allocated for progress achieved on the scientometric indicators, on the basis of which, according to Bulgarian law, they report their activity to the public administration;
- other tools aimed at upgrading the capacity of research organisations.

In 2019, scientific activity in the country was concentrated in several main areas:

- Physics and astronomy – a traditionally strong field for Bulgarian scientists (15.12 citations per document and H-index of 155), with a share of 0.37% of all publications in the Scopus database for 2019 and an increase of 16% on annual basis; 1.38% within the EU-28 and growth of 20% on an annual basis; 2.77% compared to the countries of Eastern Europe and growth of 18% on an annual basis. Here, too, there is a **negative downward trend in international cooperation in the publication of results of joint research activity, with a decrease of more than 32% for one year**; Bulgaria ranks 7th in Eastern Europe and 19th in the EU-28.
- Engineering – 7.15 citations per document and H-index of 105. There was growth in the individual rankings too, most pronounced compared to the countries of Eastern Europe (doubling of the publications in the Scopus database for the last two years). A sharp decline took place in international research cooperation – only 25% of publications were with international participation, which is even below the level of the base year 1996; 9th place in Eastern Europe and 20th in the EU-28.
- Medicine – 14.32 citations per document and H-index of 169; unlike the other two scientific fields in which the country has a distinct specialisation, here the share of publication activity in total and within the EU-28 remains unchanged, accompanied by **a decline compared to other East European countries**. There is also **a decline in publications with international participation**. Bulgaria ranks 22nd in the EU and 11th in the region of Eastern Europe.

There is clear decline on an annual basis in the arts and humanities (-40%), economics, econometrics and finance (-34%), and social sciences (-22%). They are not among the priorities of the Innovation Strategy for Smart Specialisation of the country and financial support is not envisaged for their development. However, such a collapse in the research capacity and research results may invalidate the previous achievements of Bulgarian scientists in this field and undermine their future development. Moreover, such a decline indicates a lack of basis for developing a good national capacity to elaborate or adapt the socio-economic policies that the country needs.

Figure 16. MAIN AREAS OF SCIENTIFIC PUBLISHING, BULGARIA, 2019



Source: SCImago (2007). SJR – SCImago Journal & Country Rank. Retrieved November 1, 2020, from http://www.scimagojr.com

In 2020,[38] the institutional ranking SCImago[39] includes a total of 18 scientific organisations from Bulgaria, including the Bulgarian Academy of Sciences, together with 7 of its units as independent legal entities, as well as 10 universities, three more than the previous year. New additions include the Southwestern University, the University of Rousse and the Technical University of Varna.

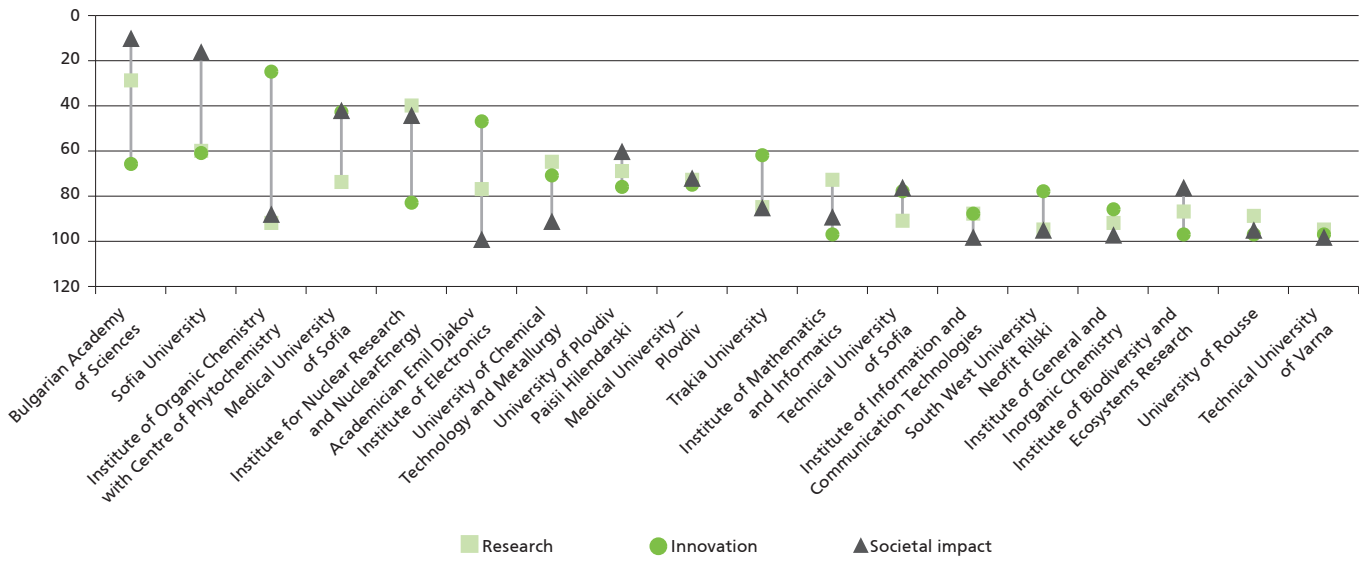
For the most part, these are universities and research organisations that are ranked at the highest positions by the Ministry of Education and Science in assessing research results. In this regard, a logical next step is to apply in practice the definition of a research university to the leading universities in the country, which is defined in law but does not lead to real differentiation in the criteria for evaluation and funding.

Research organisations also show very different results in terms of innovation potential. One of the institutes of BAS, the Institute of Organic Chemistry with its Phytochemistry Center, is best placed on the indicators among Bulgarian institutions, which is indicative of a strong orientation towards applied science. The institute is ranked 416th in the general institutional ranking SCImago. Within the EU-28 it ranks 235th and 33rd among research institutes in the East European region.

In general, research institutions in Bulgaria, including the institutes of BAS and AA, and higher education institutions, do not demonstrate sound capacity in research and orientation to the needs of business and market, implementation of applied science, protection and capitalisation based on intellectual assets, participation in technology transfer, mobility of academic staff and practical implementation of new technological knowledge created by them. Recommendations in this respect were also addressed to the Bulgarian institutions by the representatives of the European Commission in the context of the preparation of the strategic framework for the promotion of science and innovation in the next programming period 2021 – 2027.

As expected, companies that conduct intellectual property transactions are more innovative than others. Those who have sold intellectual property in the last year are 100% innovative and have an average index of 37. Almost all (96%) who have bought some intellectual property in the last year are innovative and have an average index of 30, while those who have not traded in intellectual property

Figure 17. FACTORS FOR SCIENTIFIC EXCELLENCE OF RESEARCH ORGANISATIONS IN BULGARIA, 2020



Source: SCImago (2007). SJR – SCImago Journal & Country Rank.

[38] For each indicated year, the ranking is based on a five-year information with a two-year lag (for example, the 2020 data reflect the 2014 – 2018 period). According to the methodology, the ranking includes institutions that have at least one hundred publications in the Scopus database during the last year of the surveyed period (in this case 2018).

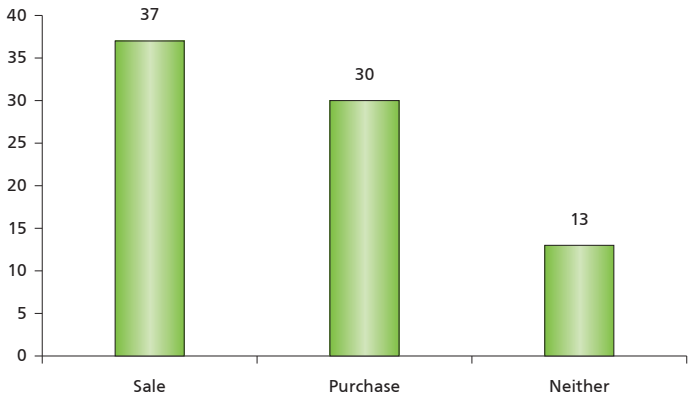
[39] SCImago Institutions Rankings (SIR) lists research organisations (representatives of academic circles, higher education, business sector and NGOs), based on a composite index, which combines three different sets of indicators: research performance, innovation output and societal impact, measured through their web visibility. SIR is product of SCImago Lab. and uses data from the database Scopus.

have a significantly lower index of 13 points.

Intellectual property firms tend to develop their product innovations in partnership with external organisations, while non-traders are more introverted. The same conclusion is supported by the latest Intellectual Property Scoreboard for SMEs, developed by KPMG Spain on behalf of the European Commission's Intellectual Property Office,[40] which demonstrates that more than half of the registered intellectual property of Bulgarian holders is the result of cooperation between them and external institutions (companies and universities).

Bulgarian intellectual property holders have become acquainted with the concept of intellectual property much more often online (37%) and, from business advisors (24%), than the European average – 23% and 21% respectively.

Figure 18. AVERAGE INDEX BY COMPANY GROUPS WHICH HAVE TRADED WITH INTELLECTUAL PROPERTY



Source: INA-5, Applied Research and Communications Fund, 2020.

[40] KPMG (2019) *2019 Intellectual Property SME Scoreboard.*

Entrepreneurship and innovation networks

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

Entrepreneurship in a pandemic

The global crisis caused by the spread of Covid and the economic and human consequences which we are witnessing are factors with a mixed – but in any case critical – impact on business, ranging from a reason to close down operations to an opening of new opportunities. The potential effects of the crisis on entrepreneurial activity are to be found in the following directions:

- Change in the environmental factors influencing the behaviour of entrepreneurs

Significant changes have taken place in terms of access to finance, the structure of the portfolio of financial instruments, and the main guidelines for their spending. The government's financial measures were mainly aimed at overcoming the negative effects of the crisis, including in support of companies from the most affected economic sectors and the laid off employees, in some cases at the expense of initiatives promoting innovation and entrepreneurship.

The education system is also an environmental factor with a strong immediate impact on entrepreneurial activity. In 2020, however, the education system itself was affected by the restrictions imposed during the crisis. The changes affected the educational methods towards virtualisation of learning and a significant reduction in the time for learning-by-doing. In the long run, this will develop certain digital skills of the learners (and their parents), but will prevent the formation of others that are practically oriented and help to develop creative thinking.

- Entrepreneurship as reaction to necessity or entrepreneurship in search of new opportunities

According to NSI data, in the period after March 2020 an average of 43% of non-financial corporations suffered a decline in their revenues from the sale of goods and services on a monthly basis. At the beginning of the period, almost 20% of non-financial enterprises reported laying off/reducing staff. Their share dropped to 8% by July and remained almost stable in the autumn. However, given the low levels of entrepreneurship in Bulgaria driven by external circumstances and the need to provide for the family,[41] it would not be reasonable to expect that higher unemployment resulting from of the Covid crisis will boost entrepreneurial activity and prompt the creation of new enterprises. Lower levels of entrepreneurial activity in response to new opportunities also leaves no hope that the typical Bulgarian entrepreneur will embark on the creation of a new business – an even riskier venture in 2020 given the crisis and high levels of uncertainty.

- Closing social care institutions and relocating work/study at home

The closure of nurseries, kindergartens and schools, as well as work/learning from home, put women's entrepreneurship to a special test. Caring for the family, as well as the stronger involvement of parents in the learning process, limit the opportunities above all for women to develop and put into practice their ideas for entrepreneurial endeavours. A new form of differentiation is emerging between parents with young children who are less productive when working from home than other employees who capitalise on the cost savings from moving to and from work and the introduction of new virtual business models and forms of business communication.

- A boom in social entrepreneurship

Social entrepreneurship in its various forms and manifestations is becoming more necessary than ever as it is a response to the critical need for quick solutions in unprecedented conditions. The University of Rousse is showing the way, which in March 2020 merged the research infrastructure and 3D printers existing in separate departments and laboratories, implemented the patent received free of charge from a Bulgarian inventor and started

[41] Global Entrepreneurship Monitor (GEM) 2018/2019, Global Entrepreneurship Research Association (GERA), 2018, ISBN: 978-1-9160178-0-1.

Box 3. SOCIAL ENTREPRENEURSHIP IN RESPONSE TO THE CRISIS

Naicoms is a Bulgarian start-up company, award-winner in the category "Social Innovation" in the 2019 Innovative Enterprise of the Year contest. In March 2020, it provided a fully developed telemedicine system as an alternative for safe access to health services in a global pandemic. The system (Medcare.bg) is used by hospitals, such as Pirogov Hospital, the St. Anna Hospital in Sofia and in 30 more towns. Each interested doctor can create an individual profile and schedule for online consultations quickly and easily by contacting the company for support. The company also offers a kit (Medcase) with included medical-diagnostic devices and the possibility of quality telemedicine.

"Telemedicine is a technology that does not cure by itself, but – as the World Health Organization notes 'distance is a critical factor' – the use of ICTs allows various specialists to provide consultation to people with suspected infectious diseases or under quarantine," said Ivan Yosifov, CEO of Naicoms.

The core of Naicoms' team consists of four specialists in different areas – business development, product development and process building, technical implementation and trade relations. The start-up also benefits from the support of like-minded people. "Along the way, we had support from various people and organisations, which are too many to list. Undoubtedly, we should mention ARC Consulting and Enterprise Europe Network – Bulgaria, one of the first leading organisations which not only thoroughly considered the solutions we provide, but also gave us the opportunity to access their contact network, where we already have interest in several potential partners", says Yosifov.

In 2021, Naicoms will focus on developing the service of telemedicine, rather than on technology. Talks are being held with several countries that are very interested in the solution. It has been pilot tested in several places and in one of the locations it is already officially working. "I think that Bulgarian solutions should be given a better chance, existing and currently operating services in telemedicine should be considered, so that the system can be upgraded and further developed. This would save resources, help make changes, learn from mistakes and restore faith in the ability of the state to trust and support local business and innovative solutions," concludes Yosifov.

Source: Applied Research and Communications Fund, 2020.

production of helmets for individual protection with the materials provided by business. The helmets were subsequently delivered to the hospitals and social institutions in the region working on the first line of fight against the coronavirus. Social entrepreneurship also provides support for unemployed people or families on the verge of poverty and provides technological solutions to emerging problems, many of which are related to the digitalisation of business processes and social life.

Entrepreneurial environment

In its latest edition of 2020, the Global Entrepreneurship Monitor covers 54 countries. It includes 22 European economies, including EU member states, the Western Balkans and the Eastern Partnership countries. Bulgaria ranks 17th in Europe (37th in the world ranking) with a **national entrepreneurial environment index** of 4.21 (with a maximum score of 10).

The lowest evaluations are for government policy and programmes in support of entrepreneurship. Bulgaria has the lowest levels among all European countries by the indicators of support and relevance of government policies and government entrepreneurship programmes (respectively 2.54 and 2.96; 51st out of 54 for both indicators). Moreover, there is a deterioration in assessments compared to the previous year. Leaders in Europe are Switzerland, the Netherlands, Luxembourg and Germany.

Although with minimal improvement on an annual basis, **the results for entrepreneurship-oriented secondary and higher education remain low**, respectively 2.69 (37) and 3.91 (47) – below the average levels in the regional and global rankings and in the group of countries with similar per capita income.

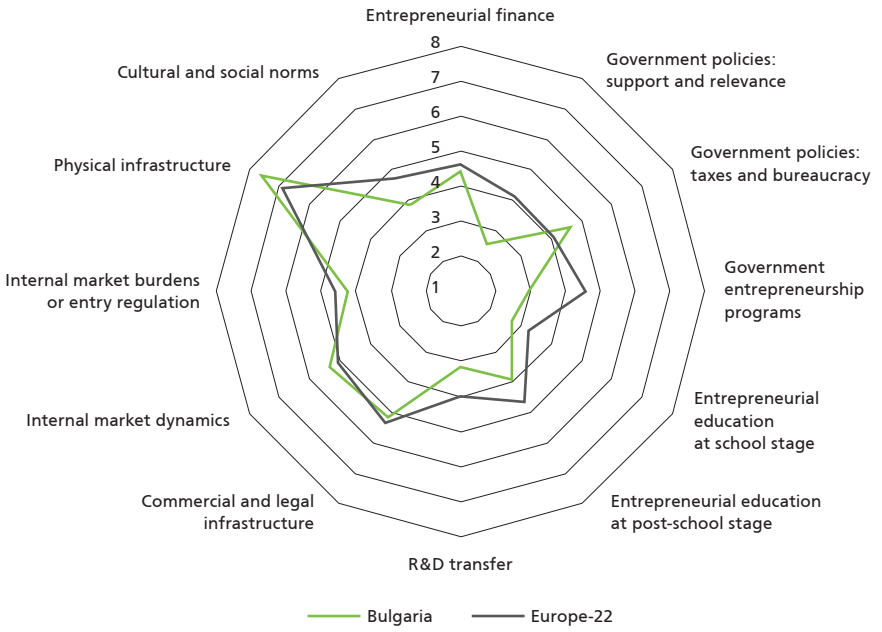
Traditionally, the country has a relatively **high score for physical infrastructure and services** – 7.60 and 8th place out of 54 countries. This includes factors such as internet connectivity and speed, in which Bulgaria has a competitive position, but also road network and accessibility of towns and villages, which outside the big cities remain problematic despite 14 years of European and national funding for regional development and development of rural areas.

There is some backsliding from last year's positions in the indicator of access to **entrepreneurial finance**. The result refers to the period before the onset of the Covid crisis. The expectation is that 2020 will add additional barriers to funding for the creation and support of new businesses. The index for national entrepreneurial environment in the period after 2015 shows **low levels on the indicator of conditions for transferring research results from scientific and university units to practice**. Although some slow steps have been taken in adopting regulations in support of technology transfer,[42] the environment remains unfavourable:

- BAS has one unit for technology transfer for all institutes and the expertise in the field of intellectual property is insufficient.
- A small proportion of higher education institutions have functioning technology transfer offices, almost all of which operate inefficiently.
- The internal regulations of the research and university institutions in the country are extremely unequal. In many, there are no detailed procedures for protection of intellectual property, management of intellectual assets, interaction with business in joint research projects or contracts awarding.
- Procurement procedures are cumbersome, which makes it difficult to interact with business and delays the implementation of research projects.
- A national and institutional regulatory framework for regulating the forms of mobility of academic staff is missing.

At the beginning of 2020, about 11% of the population over the age of 18 in Bulgaria were entrepreneurs (owners of companies or self-employed). The number of foreign entrepreneurs in the country is

Figure 19. FRAMEWORK CONDITIONS FOR THE ENTREPRENEURIAL ECOSYSTEM, 2020



Source: The 2019/2020 Global Entrepreneurship Monitor (GEM).

increasing, as 17% of the owners of new companies in Bulgaria in 2019 are foreigners. Bulgaria is becoming an attractive destination for living and doing business for enterprising people from different countries. The largest group among these are Greeks (15%), followed by Italians (13%), Turks (9%), Russians (8%), Ukrainians and North Macedonians (6% each). Investors from European Union countries are 54%. In recent years, the attractive start-up ecosystem and the opportunities for innovation activity at the global level have replaced privatisation and low labour costs as the main motivating factors. Such examples are the British Hutchison family, who are the founders of Prosfit Technologies and winners of the 2017 Innovative Enterprise Award at the National Innovation Forum, and the American Igor Levin with his Electrosphere (Antelope studio), who received the award in 2016.

The typical Bulgarian male entrepreneur who founded a new company in 2019 is 41 years old, while the female entrepreneurs are on average 42 years old. One third of the entrepreneurs who founded a company in 2019 already had experience in previous business ventures. About 18,000 Bulgarians at the average age of 40 founded a company for the first time in Bulgaria in 2019. Another 14,600 registered as self-employed (farmers, craftsmen, liberal professions). Among the new Bulgarian entrepreneurs in 2019, 44% are women, one of the highest ratios in Europe.

In recent years, the European Commission programmes in support of young entrepreneurs without age restrictions, that is those who have

[42] Regulations for monitoring and evaluation of research activities carried out by universities and research organisations, as well as the activities of the National Science Fund from 2018; Decree № 61 of the Council of Ministers of 02.04.2020 on the terms and conditions for the establishment of commercial companies by public universities for the purposes of economic realisation of research results and intellectual property.

[43] For more information: www.erasmus-entrepreneurs.eu

become such during the preceding 3 years, are gaining popularity. The Erasmus for Young Entrepreneurs programme[43] allows individuals who do not yet have a cumulative three years of experience to go to an experienced entrepreneur in another country (European Union, Israel, Singapore, USA, Turkey, Ukraine and the Balkans) for a period from 1 to 6 months. The budget is estimated for an average of 3 months, with between EUR 560 and EUR 1,100 granted depending on the country; additional funding for transportation is provided for long-distance destinations (USA, Singapore and Israel). This experience allows the entrepreneur to closely observe the management of a small business, to make his first deal abroad and even to discover new areas of activity.

The Faculty of Economics and Business Administration of Sofia University has leading positions in Bulgaria in support of youth entrepreneurship.[44] The university supports entrepreneurs in the search for a suitable host, in preparing individuals to "make a case," in the negotiations for joint activities and the implementation of projects under the Erasmus for Young Entrepreneurs programme. Another initiative of the Faculty of Economics and Business Administration is cooperation with the Bulgarian E-Commerce Success Foundation and the Bulgarian e-Commerce Association, which has launched a special programme for mentoring and training in e-commerce and digitalisation of business processes (e-success.bg). With the help of the programme, one of the businesses became the fastest growing brand and e-shop on Facebook in August and September 2019, and several others increased their sales through the creation of new e-shops.

[44] Яльмов, Т. 2020, Програмата Еразъм за млади предприемачи е отличен шанс за всички, които искат да започнат собствен бизнес, Бизнес клуб, февруари 2020, стр. 30-35 [Yalamov, T, (2020) *The Erasmus programme for young entrepreneurs is an excellent opportunity for those who start a new business*, "Business Club," February 2020, pp. 30-35].

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 and 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

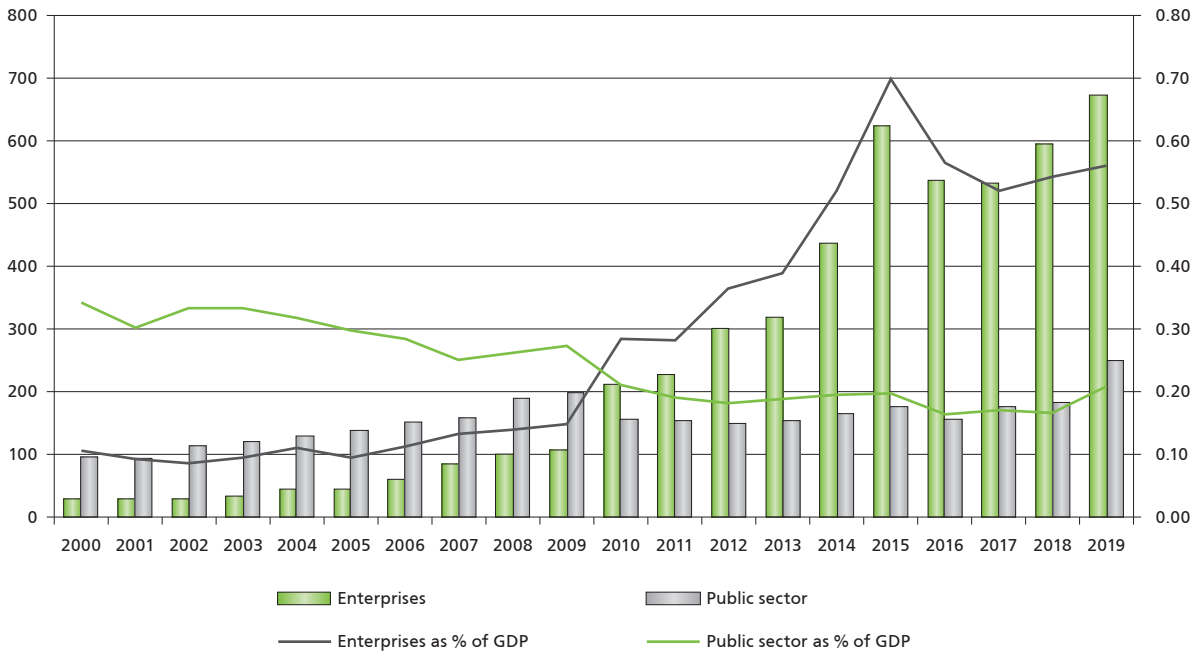
In 2019, R&D spending amounted to BGN 1,002 million or 0.84% of GDP. **The research sector in the country continues to grow steadily in regards to investment** in absolute terms (21% increase on an annual basis) and as a share of GDP (11% increase on an annual basis). After the decline of 2016 and 2017, all R&D sectors improved. However, Bulgaria remains far from its national target of 1.5% R&D spending as a share of GDP by 2020, set at the beginning of the 2014 programming period.

The most significant growth in absolute value is in higher education. After an increase of 63% compared to 2018, investments in research in universities reached **BGN 73 million**. However, as share of GDP they represent only **0.06**%. Post-2000, similar growth in the higher education sector was registered only in 2009. There has been **significant change in the structures of the public sector,** represented mainly by BAS and AA – the increase in the absolute value of investments in research was just over 36% on an annual basis and is the most significant for the last 20 years. The result for 2019 was **BGN 249 million invested or 0.2% of the GDP**.

For yet another year, business has the largest contribution to research and development in the country with a total budget for 2019 of BGN 673 million, or 0.56% of GDP. The increase on an annual basis is 13%, which is within the normal change for the sector in recent years. It should be noted that in 2019 business invested the most in R&D in the modern history of the country. However, the total volume of R&D investments in Bulgaria remains many times smaller than that of an average global company.

Most important for the increase of the investments in R&D is the European financing through the operational programmes. It is of a defining significance for the research

Figure 20. R&D SPENDING, ENTERPRISES AND PUBLIC SECTOR, 2000 – 2019



Source: NSI, 2020.

of higher education and public research institutions. With regard to business, it has the so-called leverage effect, as it mobilises internal financial resources in response to external, mostly grant funding. **Funding for science, technological development and innovation in 2019** included the following main sources:

- OPSESG with BGN 132.629 million European and national (25%) funding for the creation of centres of excellence and centres of competence;
- the National Science Fund with BGN 29.706 million national funding under the programmes for fundamental research, bilateral cooperation, COST, VIHREN, Petar Beron, ERA programmes (77% national funding);
- Ministry of Education and Science with BGN 79.436 million national funding for research in higher education institutions, the Fulbright programme, the Bulgarian-Swiss programme for young researchers (25% national funding), national research programmes (50% national funding), scientific awards Pythagoras, the Young Talents contest, the national programme for young researchers and postdoctoral fellows, PhD fellowships, subscription to scientific databases, annual membership fees for scientific infrastructures;
- OPIC with allocated BGN 279.577 million European and national (25%) funding for the introduction of technological product and process innovations, entrepreneurship, research infrastructure, cluster development and improvement of the business environment;
- National Innovation Fund with BGN 1.513 million national funding for research projects, the joint Eurostars programme and the Eureka initiative.

The focus in recent years has been on building research infrastructure within public research and university institutions. This reflects on **the share of spending for acquisition of fixed assets in the public sector of just over 10**% of the total R&D funding received – an impressive amount compared to the investment of only 2% in 2018, 5% in 2007 and 3% in 2000. The fixed asset costs of the business traditionally have a higher share – a little over 7% in 2019, although they did not exceed the level of 2018 (10%), 2007 (19%) and 2000 (16%).

The regional structure of R&D spending remains unbalanced. The share of SWPR increased again to 73.4%. There is also an increase in SCPR (up to 9.2%) and NEPR (up to 6.4%). For the fifth consecutive year, the comparative positions of the NCPR weakened (up to 3%). A retreat from last year's positions is also observed in NWPR and SEPR.

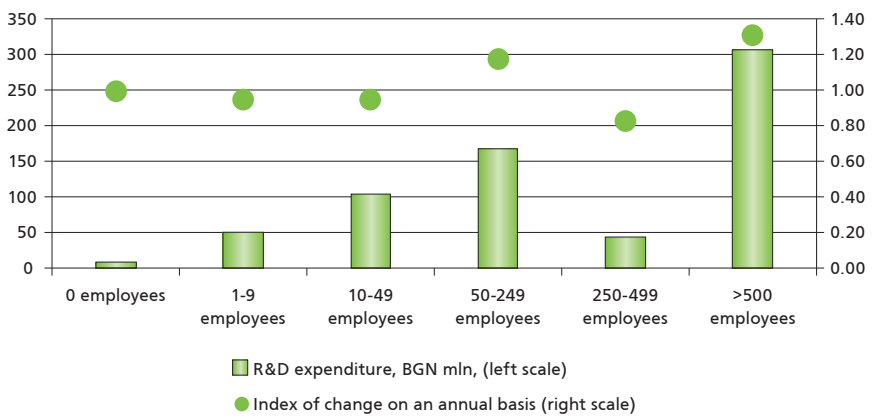
Despite the divergent structural trends, there is an increase in R&D funding in absolute terms in almost all planning regions. It is most significant in the SCPR – 33% on an annual basis, and SEPR – 28%. **An exception is the SWPR, where the funding decreased by 15% on an annual basis, and the decline as a share in the regional structure was more than 29%.**

The main investor in research and development within the business sector still are large enterprises with 500 or more employees, followed by medium-sized companies with 10 to 249 employees. These are the two categories of companies that manage to offset the reduction in R&D spending by the other four groups and achieve a positive change of 13% for the business sector as a whole.

An interesting development in 2019 was the significant growth of R&D spending in two of the economic sectors that traditionally do not have a high R&D intensity – the mining industry with an annual growth of 3.52 times, and hotels and restaurants – 3.05 times. With relatively modest growth are the sectors of human health and social work – 54%, finance and insurance – 41%, construction – 33%, creation and dissemination of information and creative products, telecommunications – 24%, and professional activities and research – 23%.

There are two research fields that concentrate most R&D spending – technical and medical sciences. They accounted for 54% and 18% respectively of R&D spending in 2019. A decisive factor for increasing investment in technical sciences is the intensifica-

Figure 21. R&D SPENDING BY ENTERPRISES, 2019



Source: NSI, 2020.

tion of research and development by business, which in 2019 provided 90% of the funding for technical sciences. Most of the funding of medical sciences is also made by the private sector – a little over 82%. The total share of other research fields is 28%, almost half of which is on natural sciences (16%), followed by agricultural (5%), humanities (4%) and social sciences (3%).

In 2019, enterprises and foreign sources have almost the same contribution to the total amount of R&D spending. The factors, however, that led to the equalisation of their positions are different. Funds from abroad depend on the dynamics of absorption of European funding through operational programmes with a time lag of about 2 to 3 years after the beginning of each programming period. The leverage effect of European funding also has an impact on business investment in R&D, while economic cycles have a significant impact too.

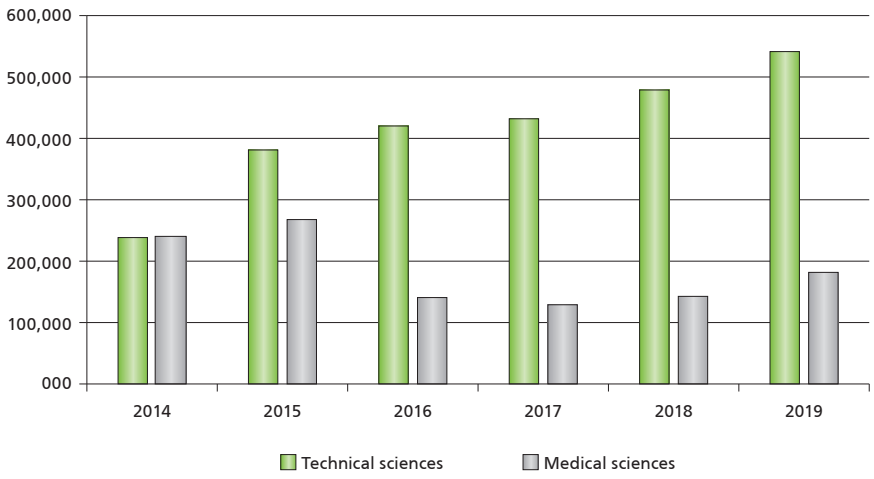
Since 2009, there has been a stagnation in public sector R&D funding as well, which can be attributed to the neglected role of science and innovation in the national strategic development framework. The volume of funding started to recover only ten years later. After 2012, the funds for R&D allocated by non-profit organisations are many times higher than the budget of higher education institutions for research (2.5 times for 2019 with a peak value of almost 9 times in 2014).

Enterprises attract the majority of the R&D budget provided by enterprises (91%), foreign sources (83%), and non-profit organisations (81%). In addition, almost 20% of the funds allocated by higher education institutions for R&D are also directed to enterprises.

A small part of the business sector budget for R&D is used to outsource research to public research units and universities – 7% and 2% of enterprise R&D funds, respectively, which forms 10% of the public sector budget and 13% of the budget of the higher education sector. Typically, such interactions take place within OPIC and National Innovation Fund partnerships. In this respect, the potential for technological transfer from science to business and for the implementation of research results in practice remains unused. Some of the problem areas include:

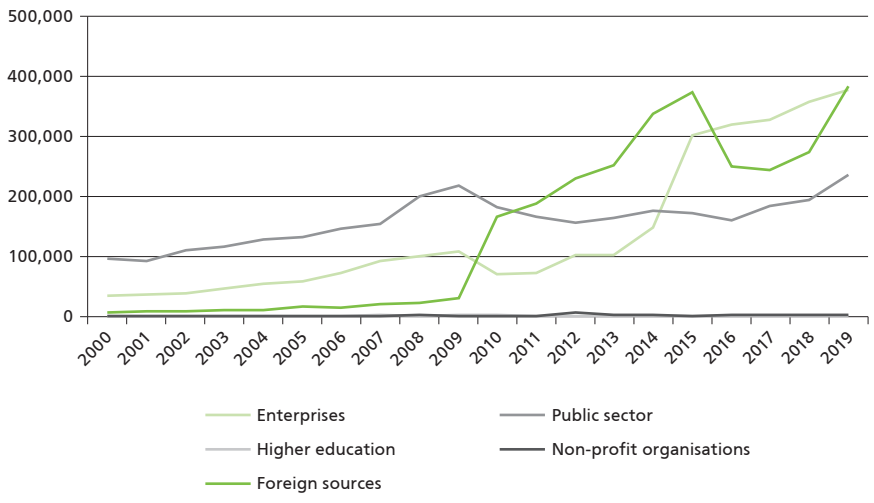
- only a small part of the higher schools and the units of BAS and AA have functioning offices for technology transfer;
- unresolved issues in primary and secondary legislation of the issues of protection and management of intellectual property which is subject to technological transfer, in addition to the disparate and insufficiently de-

Figure 22. R&D SPENDING BY RESEARCH FIELDS, 2014 – 2020



Source: NSI, 2020.

Figure 23. R&D SPENDING BY FUNDING SOURCES, 2000 – 2019, BGN THOUSAND



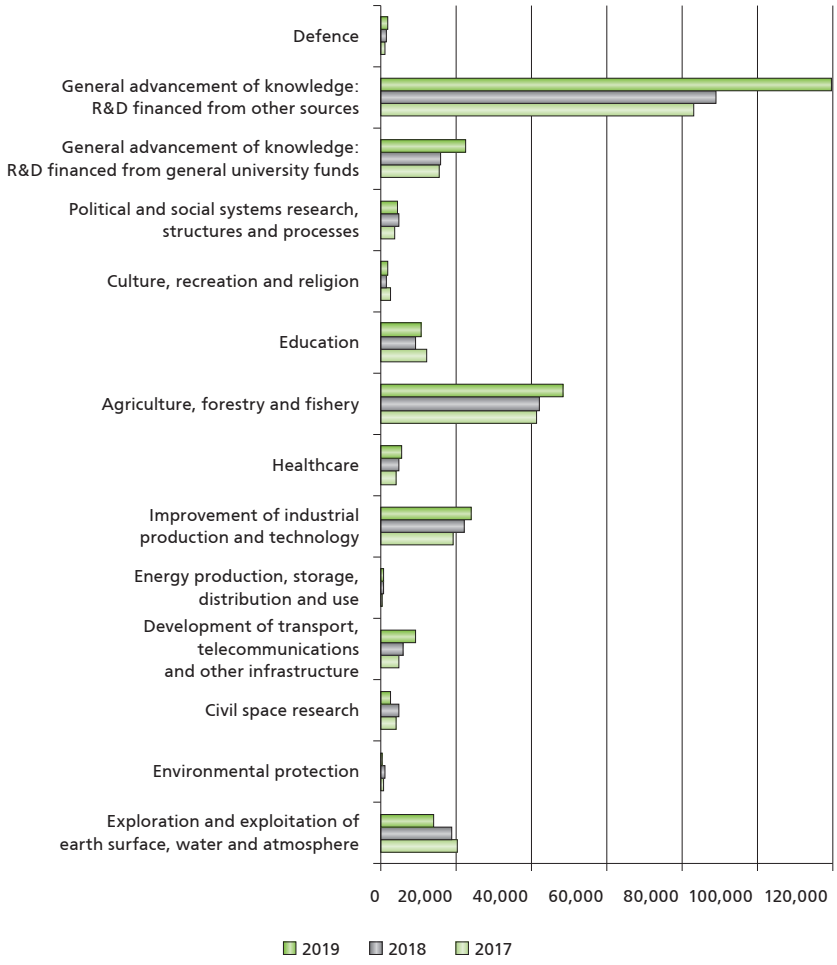
Source: NSI, 2020.

veloped institutional regulatory framework;

- lack of regulation of the establishment and operation of start-ups at research and university units (with their stake in these start-ups) aiming at implementing research results in practice;
- weak linkage between practice-oriented results and the requirements and procedures for career development of the academic staff, accreditation and evaluation of the scientific units;
- insufficient administrative potential on the part of research organisations and universities in the field of intellectual property protection, forms of technology transfer, and public procurement, which significantly hinders business in trying to interact with research units.

The main priorities of the future OP Scientific Research, Innovation and Digitalisation for Economic Transformation (expected to start operating from the beginning of the next programming period 2021 – 2027) and of the State Agency for Research and Innovation which is behind it, are linked to overcoming the above mentioned weaknesses. Their functioning, however, cannot be seen as a panacea for all the challenges in the R&D sector. In order for the country's economy to grow through innovation, a sustainable national public vision and a R&D budget are needed in its support.

Figure 24. PUBLIC SPENDING ON R&D BY SOCIO-ECONOMIC OBJECTIVES, BGN THOUSAND, 2017 – 2019



Source: NSI, 2020.

Box 4. BULGARIA WITHIN THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION HORIZON EUROPE 2021 – 2027: EXISTING CAPACITY AND EXPECTED CHALLENGES

On the threshold of the new Horizon Europe Framework Programme, Bulgarian research organisations, as well as a number of research and development companies, appear to be better prepared to take advantage of the programme's capabilities than in previous periods. As the programme is for a period of seven years, such participation can be planned in terms of its strategic importance for the activities and development of the organisation or company, and not as a one-time participation or randomly.

The analysis of the participation of Bulgarian organisations in the Framework programme for Research and Innovation for the last seven years (2014 – 2020) reveals the following[45]:

- Bulgaria registered a little over 800 participations in projects, which is almost 13% growth compared to the 7th Framework Programme. **The growth in the volume of attracted funds is significantly higher – over 34%.**

[45] H2020 Country Profile, October 2020.

Box 4. BULGARIA WITHIN THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION HORIZON EUROPE 2021 – 2027: EXISTING CAPACITY AND EXPECTED CHALLENGES (CONTINUED)

- Nearly all of the participations are concentrated in Sofia. **In 9 districts of the country there is no single participation in Horizon 2020.**
- **The largest share of the funds received is for the private sector – 31.7%.** Research organisations (excluding universities) received 30.2%. In terms of the absolute amount of attracted funds, the most successful are the Bulgarian Academy of Sciences (as a sum of its various institutes, which participate as separate entities) and Sofia University, which manages to attract over EUR 18 million. In only 7% of the cases the participation is from the public sector (municipalities, ministries, etc.)
- Although Bulgarian organisations participate in over 500 separate projects in Horizon 2020, their participation as coordinators remains extremely low, which reflects the underdeveloped capacity to mobilise partnerships, form consortia and prepare grounded project proposals with high quality and, research and innovation potential.

In order to encourage wider and more fruitful participation in the next Horizon Europe Research and Innovation Framework Programme, and based on the lessons learned from the participation of Bulgarian organisations and companies in the Horizon 2020 final programme, the following is needed:

- Greater knowledge of the conditions, rules and opportunities for participation in Horizon Europe, including among universities and public organisations.

For universities, it is an appropriate tool for promoting research, joining international networks of other research organisations, exchanging knowledge, and the opportunity to participate in the latest and up-to-date research. This can further stimulate the training of doctoral students and increase the quality and thematic scope of research work. The scientific product of Bulgarian scientists can be seriously increased.

With regard to public institutions, such as municipalities, participation in joint projects provides an opportunity to join in the development of future policies relevant to local communities, taking into account the interests of citizens. This would have a significant impact on local research and innovation ecosystems and, over time, on local economic development and the well-being of citizens.

- Increasing the capacity of the national network of contact persons and making them a key resource for providing support to the candidates and assisting in the search for suitable partners, both from the country and Europe.

Organising brokerage events, including virtual ones, focused on programme priorities or around specific competitions, would have a high added value in terms of establishing contacts between interested Bulgarian organisations and raising awareness of the programme rules and expectations under specific competition procedures. The contact persons should be proactive, accessible and a liaison both nationally and to the administrators of the European Commission or the Research Executive Agency, which are directly responsible for the competitions and the monitoring of the project implementation.

- Raising awareness regarding information resources for Horizon Europe, including those giving direct access to already developed products in the framework of successful previous or ongoing projects (database of implemented initiatives, application guidelines, priorities in the various work programmes by key areas).

In addition, it is necessary to encourage the implementation of national initiatives for communication with the public on topics related to research and innovation and the direct results of successful projects with Bulgarian participation.

- At the level of an individual organisation, the development of project management capacity is of key importance, taking into account the specifications of research work, in order to ensure realistic and transparent planning of activities and the necessary budget for implementation.

Box 4. BULGARIA WITHIN THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION HORIZON EUROPE 2021 – 2027: EXISTING CAPACITY AND EXPECTED CHALLENGES (CONTINUED)

Participation in such projects should be developed as a strategic priority – with the necessary human resources, systems of internal rules and interactions, as well as a communication strategy to ensure transparent reporting of results and their impact – inside and outside the organisation, including among the general public.

Source: Applied Research and Communications Fund, 2020.

Human capital for innovation

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

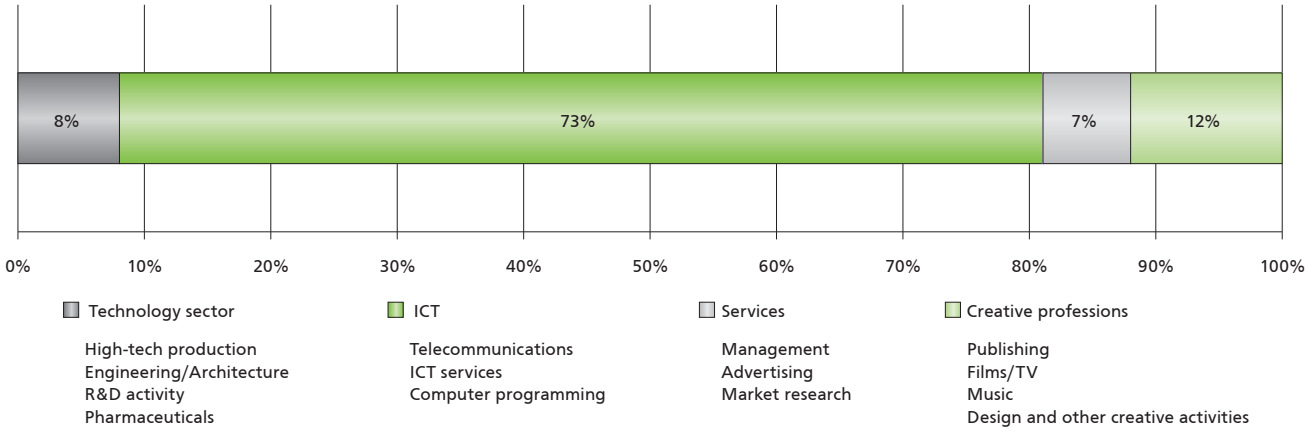
According to the index Geography of Europe's Brain Business Jobs 2020, last year **Bulgaria ranked among the fastest developing business hubs in Europe with growth in employment in high-tech activities** higher than the average levels for the continent. Compared to the base year 2014, Bulgaria is in 8th position with a 28.6% increase in the number of jobs in knowledge-intensive businesses per 1,000 people of the working age population of the country. Of the 39,400 new jobs created 73% are in ICT, 12% are in the creative industries, 8% in the technology sector and 7% in the services.

The lead region in Bulgaria is the capital Sofia – 27th among 278 European regions. Here, 10.1% of the working age population is employed in high-tech activities, which is more than twice the national average and 6.3% higher than the European average. The Southwestern and South Central regions in Bulgaria have the second highest concentration (6.9%) of people employed in high-tech jobs. The weakest position is in the Northwest Planning Region, with only 0.9 % of the working age population employed in the so-called brain business jobs.

Bulgaria has a concentration of knowledge-intensive jobs and thus has the opportunity to shorten the distance with the leading European countries in this field. This is even more relevant in light of the shortage of highly qualified staff such as ICT professionals, teachers, health professionals, engineers, financiers, brokers, administrative staff.[46] In order to use the opportunities and overcome the existing challenges, additional measures are needed to modernise the educational systema and improve the quality of the educational services in order to be relevant to the dynamics of the labour market, and raise the qualification and retraining of adults.[47]

The main advantages of Bulgaria, identified in the Geography Index of Brain Business Jobs are in the field of ICT, design and telecommunications, **while one of the most pronounced weaknesses is in the R&D sector.** In 2018, Bulgaria was ahead only of Romania, Malta and Cyprus in terms of the share of R&D employees in relation to working age population of the country. The growth of R&D

Figure 25. NEW HIGH-TECH JOBS BY SECTOR, 2014 – 2019



Source: The Geography of Europe's Brain Business Jobs: 2020 Index.

[46] *Bulgaria: Mismatch priority occupations*, Skills Panorama, European Commission, Directorate-General for Employment, Social Affairs and Inclusion and Cedefop, the European Centre for the Development of Vocational Training, 2020.

[47] *Education and Training Monitor 2019*, European Commission Staff Working Document.

staff on an annual basis was 11%, but was reduced to 2% in 2019 – a result of the reduction of researchers in the higher education sector, somewhat offset by growth in non-profit organisations and businesses.

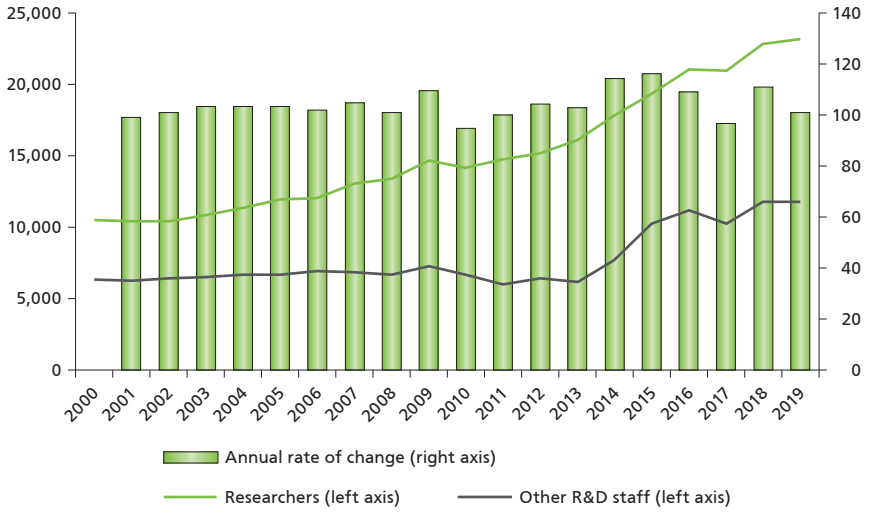
The decline in the number of researchers in the higher education sector has been accompanied by a negative change in the age structure. In fact, there has been an increase only in the category of over 65s; in all other groups the number of academic staff has decreased. Despite significant fluctuations on an annual basis, this trend has continued over the last three years.

There has been a more gradual but still clear downward trend in the number of researchers in the public sector, mainly in the institutes of the Bulgarian Academy of Sciences and the Agricultural Academy. The two organisations are not homogeneous and the research units in their structures are a diverse picture of both achievements at European and global level, on the one hand, and mounting challenges and weaknesses that become impossible to solve, on the other.

In its 2020 edition, the **Global Talent Competitiveness Index**[48] makes an international comparison of the state of 132 economies in terms of the factors that contribute most to the development of human capital and hence national competitiveness. **Bulgaria is 55th in the world ranking – a drop by 1 position compared to 2019** and ahead only of Croatia and Romania among EU member states. This unenviable position is the result of:

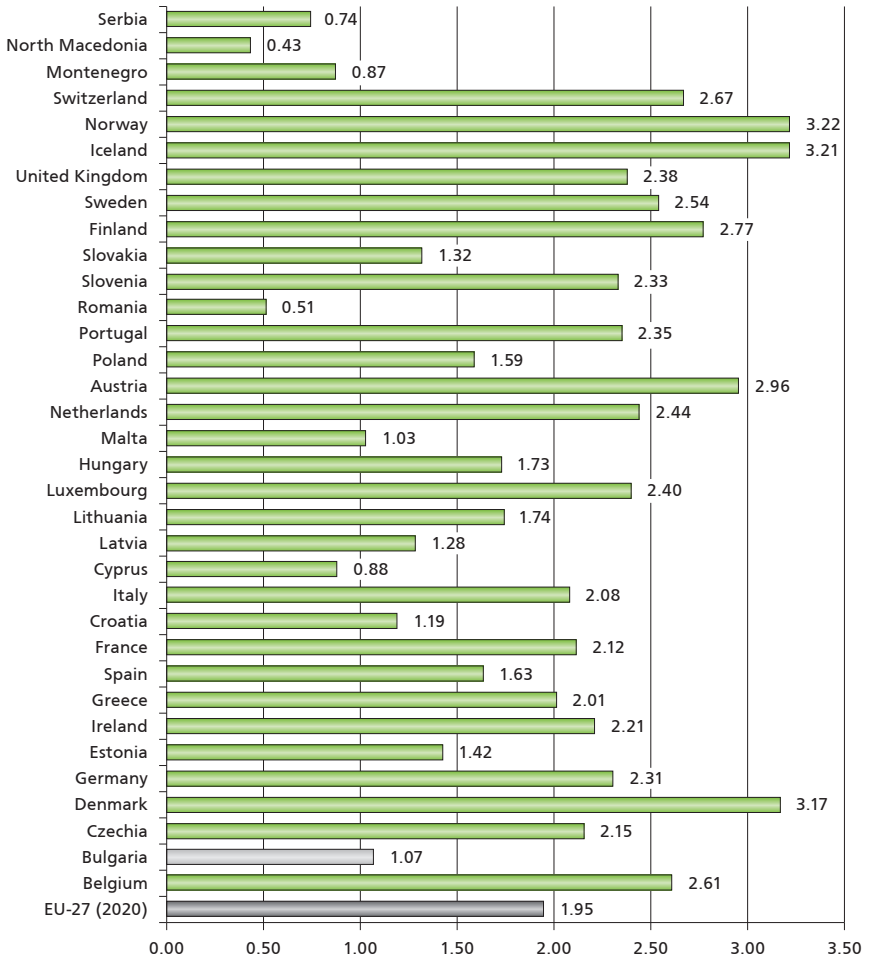
- **Enabling factors.** This includes elements of the legal and market environment facilitating business and entrepreneurs – 55th

Figure 26. R&D STAFF, 2000 – 2019, NUMBER



Source: NSI, 2020.

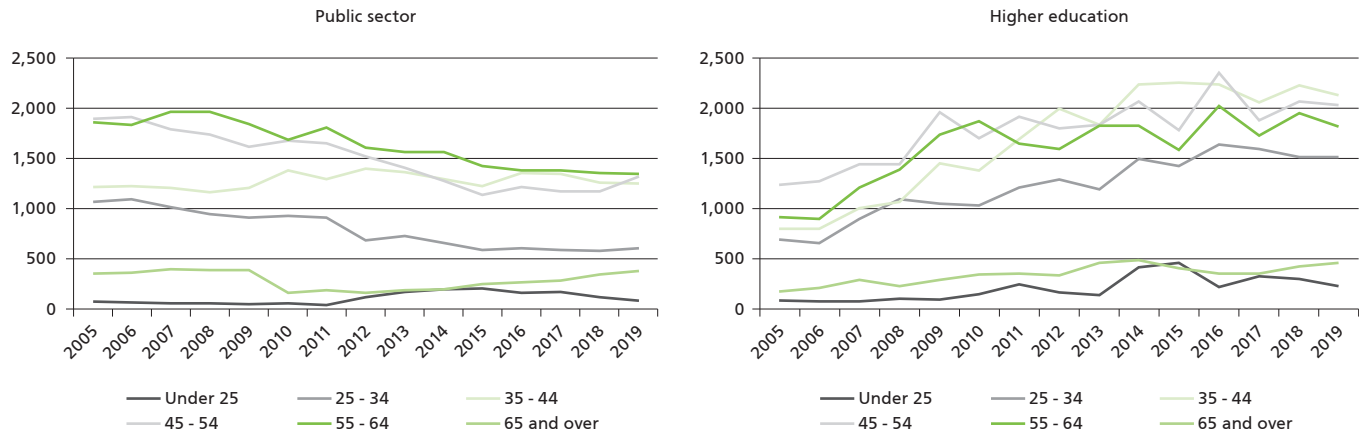
Figure 27. R&D STAFF, % OF WORKING AGE POPULATION, 2018



Source: Eurostat, 2020.

[48] INSEAD (2020): *The Global Talent Competitiveness Index 2020, Global Talent in the Age of Artificial Intelligence*, Fontainebleau, France.

Figure 28. AGE STRUCTURE OF R&D STAFF, 2019



Source: NSI, 2020.

in the world and 24th in Europe, ahead of Greece, Croatia and Romania (slight progress compared to last year), with better results (14) in the number of unemployed with higher education.

- **Attracting talents,** which is an indication of the attractiveness of the national business environment for foreign investors and highly qualified workers, as well as career opportunities for young people after school - 91st place in the world and 25th in Europe, ahead of Croatia and Romania (a drop compared to 2019), with better results (26) in the number of women graduates.
- **Growing talents** covers both the system of formal education and all forms of accumulation and development of knowledge and skills through non-formal and informal learning. By this measure Bulgaria occupies the 63rd place in the world and 25th in Europe, ahead of Hungary and Romania (deteriorating positions), with better positions (20) in the number of those enrolled in vocational training.
- In terms of **talent retention,** which measures the sustainability of talent development policies, including by the level of quality of life, Bulgaria is 43rd in the world and 22nd in Europe, ahead of Lithuania, Poland, Hungary, Croatia and Romania (moving 4 positions up), with the best values (11) in the geographical coverage of doctors.
- **Vocational and technical skills.** These include skills at secondary vocational level with an impact on employment and the correspondence between educational/qualification level and workplace requirements – 60th in the world and 26th in Europe, ahead of Romania (slight improvement compared to 2019), with a comparative advantage (18) in terms of the number of employed with secondary education.
- **Global knowledge skills** include knowledge at a high professional level, creativity and problem-solving skills, with an impact on the innovation potential and entrepreneurship with application in the knowledge-intensive sectors. Here Bulgaria is 43rd in the world and 23rd in Europe, ahead of Slovakia, Poland, Croatia and Romania (retreat from last year's positions), with strong positions (10) in the geographical spread of start-ups.

In the **World Talent Ranking**[49] of the Institute for Management Development (IMD, Switzerland) **Bulgaria falls into the group of the 10 most backward countries in the field of talent development and capitalisation on this basis**. The country descended by 3 positions compared to 2019 and now ranks 55th out of a total of 63 countries included in the survey. Bulgaria has its best results in terms of investment in talent development – 45th place (up one position). In the other two dimensions included in the ranking – ensuring a competitive environment for attracting talent and the availability of human resources with adequate skills and competencies – Bulgaria is 57th (a retreat by two positions on the first factor and an "improvement" by one position on the second compared to 2019).

[49] IMD World Competitiveness Center, World Talent Ranking 2020.

Box 5. INNOVATION IN EDUCATION: A STRESS-DRIVEN BOOST

The education system in Bulgaria underwent a shocking change with the outbreak of the coronavirus pandemic in March 2020 and the consequent forced transition to online learning for all educational institutions. The unexpected situation focused public attention on the long overdue introduction of methods of teaching and learning appropriate for the digital age.

1. **A number of vulnerabilities in the system became evident, in particular the large number of teachers who had** difficulties using digital learning platforms and tools. There were differences in the online platforms used by different schools and teachers, as well as many different levels of mastery of the functionalities and their proper administration.[50] Gradually, however, the overall level of digital teaching skills increased. The education system now has a much larger number of educators who have expanded their understanding of the digitalisation of education beyond computers, interactive whiteboards and multimedia projectors. However, the lack of digital and interactive learning content and working methods still remains ubiquitous, which will limit the development of e-learning in the future.
2. **The digital divide along socio-economic lines is clear: between 20% and 40% of students could not be effectively** included in distance learning due to the lack of digital devices, platforms unsuitable for learning or even because they had no internet access at home.[51]
3. **At the same time, over 40% of parents have appreciated the benefits of digital technologies and the wide range** of opportunities for their application for educational purposes.[52]

Now the challenge for the educational system is to build on these results and to develop them further in order to achieve a thorough digitalisation of the educational process. This will require a profound change in the quality and type of educational content offered.

Source: Applied Research and Communications Fund, 2020.

[50] [Media Literacy Coalition (2020) *Online education and media literacy skills*, A survey of teachers] Коалиция за медийна грамотност (2020) *Дистанционното обучение и уменията по медийна грамотност*, Допитване до учители.

[51] [National Network for Children, 30 July 2020, *Online learning in schools with vulnerable groups: What happened and lessons learned.]* Национална мрежа за децата, 30 юли 2020, „Дистанционното обучение в училище с концентрация на уязвими групи – какво се случи и какви уроци можем да научим от него?" [National Network for Children, 30 July 2020, *Online learning in schools with vulnerable groups: What happened and lessons learned.]*

[52] [Parents Association, *The voice of parents – distance learning.* Survey results.] Асоциация Родители, „Гласът на родителите – дистанционното обучение, Резултати от анкета сред родители 28.03 – 01.04.2020."

Information and communication technologies

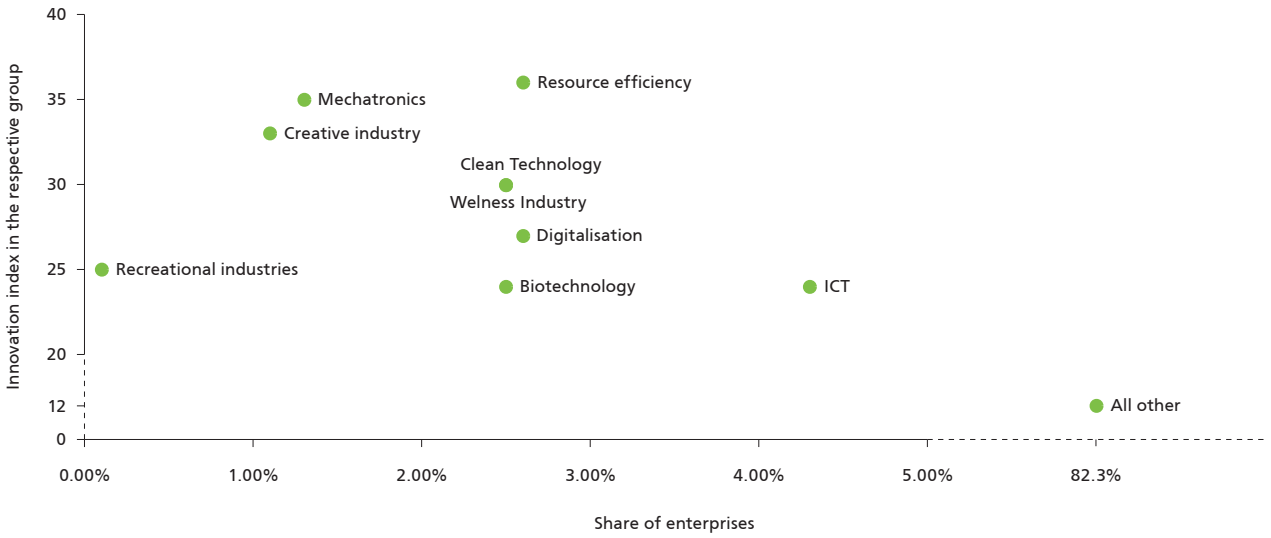
Information and communication technologies (ICT) are one of the most important engines for innovation in enterprises and growth of economies. ICT enter enterprises as general purpose technologies which are integrated in the new production and management processes. ICT also change the organisational boundaries and transform the models for adding value, competitiveness, and consumption. The effects of their use include decreased relative transaction costs, shortened product life cycles and structural changes in markets (convergence, concentration and power of bargaining). The expenditure for R&D, patent activity and risk financing in the ICT sector exceed substantially that in the other sectors in the OECD countries. R&D, focused on ICT, nanotechnologies and new materials is among the most important driving forces leading to product innovations. The driving forces are connected to the health and leisure industries (including electronic games). The modern processes and marketing innovations cannot exist without ICT. The internet and web-based services have caused important social innovations, including such in the sphere of political processes and government. The ICT infrastructure is already considered an essential element of the critical infrastructure of each country, while the issues of digital security are of primary importance for the policy of each country or corporation.

Innovation and smart specialisation

The information and communication technology (ICT) sector has grown for yet another year along all indicators – number of companies, number of employees, share of exports, share of GDP. In the top 100 companies by employment in 2020, 21 are in ICT and provide 21% of the employment in the largest companies. There is a rapid diffusion of borders and convergence between ICT and other sectors (finance, insurance, retail, security, entertainment, education). The digital transformation of the various sectors leads to a significant change in the source of added value and this increasingly comes from the ICT department in the enterprise. Competitive machine building companies in Bulgaria have turned mechatronic, and mechatronics is increasingly about ICT. The construction of warehouses has been upgraded to fully automated warehouses, robots that can combine different products from boxes in cartons to pallets (the leading place in this market in the Balkans belongs to Stamh Ltd., see Box 6 below).

About one-fifth of enterprises work in the sectors identified as priorities

Figure 29. INNOVATION INDEX OF THE SECTORS INCLUDED AND NOT INCLUDED IN THE SMART SPECIALISATION STRATEGY (INCLUDING ICT-INTENSIVE SECTORS)



Source: INA-5, Applied Research and Communications Fund, 2020.

Box 6. MECHATRONICS INNOVATIONS ARE IMPACTING ALL SECTORS

Stamh Ltd. is a Bulgarian company providing consultancy for design and engineering of automated management of multilevel warehousing (pallets, boxes, containers). The storage systems are operated by robots working in a low oxygen environment, which reduces fire hazards. Storage management is fully integrated with ERP systems and allows efficient management of deliveries. Stamh is an example of an innovation hub-type of company in which every completed project is a process innovation (or a set of several innovations) implemented for the customer at high level of efficiency. The presence of such companies in Bulgaria allows firms with little experience in logistics but with products competitive on the international market to grow faster.

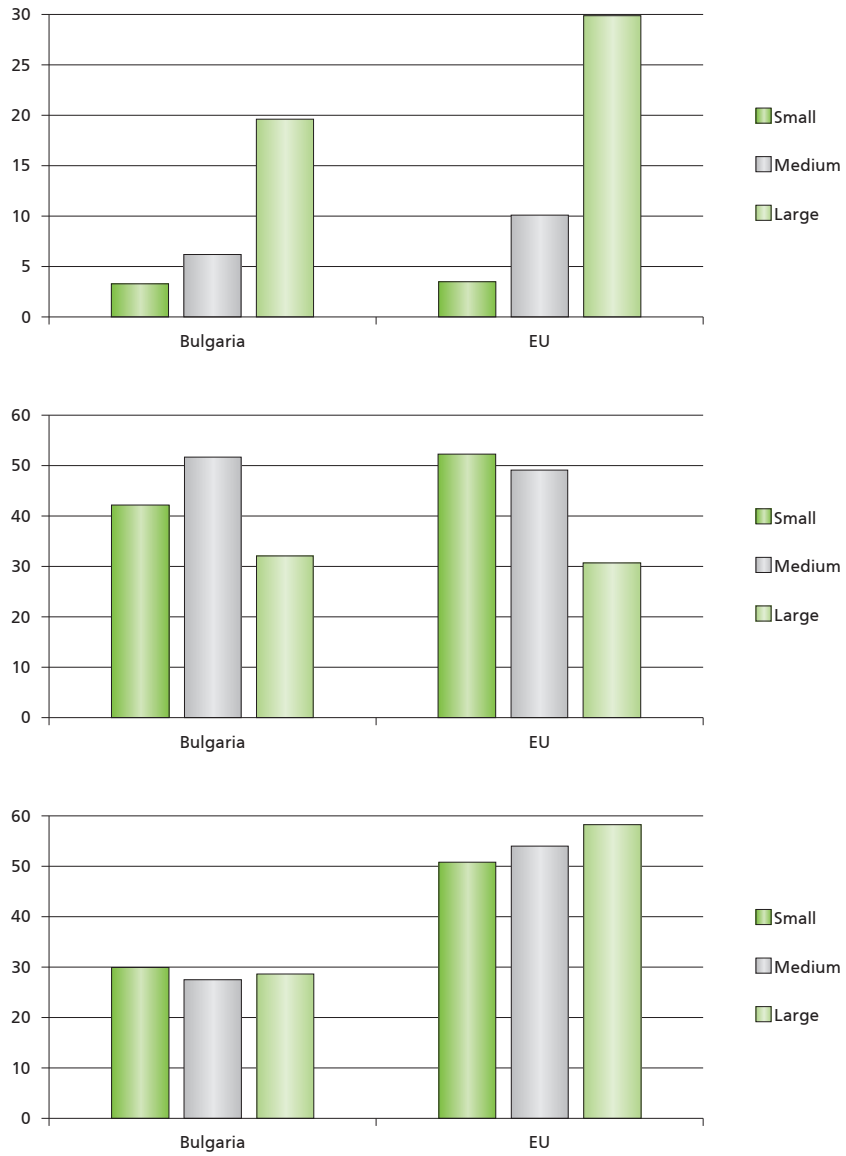
Source: Applied Research and Communications Fund, 2020.

in the smart specialisation strategy. Half of them are in very high information and communication-intensive sectors, such as classical ICT – 4.3%; another 2.6% work in the digitalisation sector, 1.3% in the mechatronics sector and 1.1% in the creative industries. ICT companies have twice the innovation intensity of those that do not operate in the priority areas of smart specialisation, but companies in the mechatronics, resource efficiency and creative industries are even more innovative (they have about 3 times higher innovation intensity than companies outside the smart specialisation of Bulgaria). The reasons for this, on the one hand, are related to the process of many ICT services becoming routine, such as the provision of e-commerce as a service, website design and hosting services, computer maintenance, etc. On the other hand, most new technologies used in other sectors of smart specialisation have built-in ICT (sensors, automation, integration into other systems). Around one percent of companies operate in three or more sectors of smart specialisation, and 40% of ICT companies operate in at least one other sector of smart specialisation.

About 43% of enterprises in Bulgaria outsource their main ICT functions, compared to the European average of 51%.

For medium and large enterprises this share, however, is consistently higher than the European average (by 1-2 percentage points). The difference

Figure 30. COMPARISON OF BULGARIA AND THE EU BY SMEs: (A) THOSE STRUGGLING TO RECRUIT ICT EXPERTS; (B) THOSE OUTSOURCING KEY ICT FUNCTIONS; (C) BY TOTAL NUMBER OF EMPLOYEES USING COMPUTERS WITH INTERNET ACCESS AT WORK



Source: European Digital Agenda Scoreboard, 2020.

can be explained by the fact that in Europe medium and large enterprises find it much more difficult than in Bulgaria to find ICT specialists, while small ones experience similar difficulties.

Compared to 2012, in 2019 Bulgarian medium and large enterprises were more likely to hire ICT specialists but lag behind their European counterparts by between 10 and 14 percentage points. In Bulgaria, the number of employees in enterprises who use computers with internet access is about half of the average for the European Union.

Innovation partnerships

Partnering with a company in the ICT sector is associated with higher innovation intensity – the index is 22 at an average level of 12 for those not partnering. In a certain type of partnership, such as staff recruitment, the value is 39, in sales it is 28. The impact of external partnerships in the mechatronics sector on the innovation of enterprises is even stronger – the index is 35 for partnerships in the field of logistics and 39 in the development of new products and production automation.

These data illustrate the changing pattern of product and process innovation and the key role of the ICT sector in this. The internal demand for R&D and specific tailored innovative ICT and mechatronic services has increased, and thereby the technological renovation in Bulgarian companies is not done by means of second-hand production lines, but using solutions built especially for the needs of their new product. These solutions are complex and include ICTs throughout the whole value added chain – from prototyping new products, through production, sales and logistics, including in terms of supply management, and the end customer.

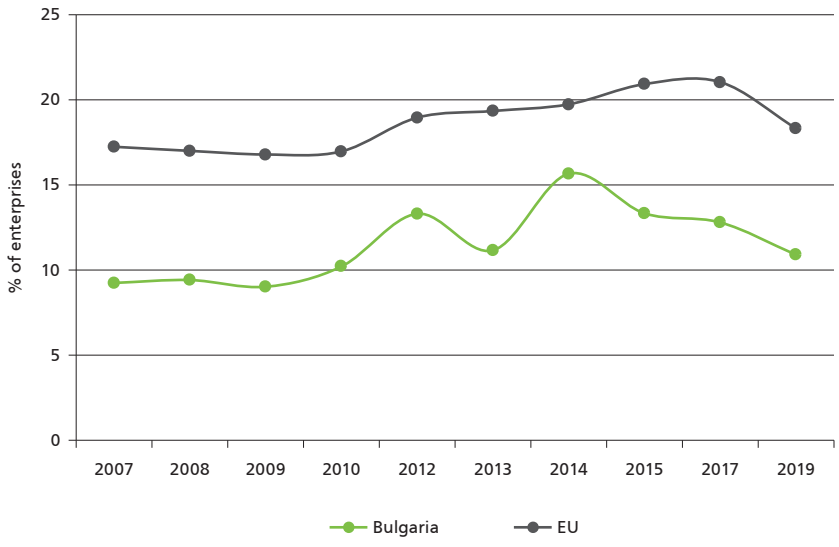
E-business transformation

E-business is a complete transformation of the business processes with the use of ICT and mechatronics. This is most pronounced in companies with ERP systems. These systems have doubled in the last 10 years – from 10.8% in 2010 to 23.4% in 2019. Bulgaria, however, still lags far behind the European average by 10 percentage points. The lag is even greater in medium and large enterprises – 20 percentage points.

The lag is due to the slowdown in the growth of ERP implementation since 2014 and the fact that in this period the number of small companies (10-49 employees) without ERP increased. At the same time, the share of enterprises that have comprehensive supply chain management (SCM) systems has remained stable at the average European level since 2010 – 18%. These companies are included in European value added chains. Important components of that system are logistics and the efficient management of automated warehousing. Since they are in the B2B segment, they do not need customer relationship management (CRM) systems that target other types of end customers. Companies that sell to end customers in Europe are much more likely to have both CRM and SCM systems. This lag is largely due to large enterprises in Bulgaria in the field of services and infrastructure projects and construction (by more than 20 percentage points). Very often, even large (foreign) banks do not have integrated customer relationship management systems and use many separate services with different interfaces.

Given the expectations of companies to work in the field of marketing and sales in 2021, an intensive development in the field of CRM can be expected, mainly due to the opportunity of routine integration of software with basic CRM functionality into online stores. Among the companies partnering with ICT sales companies, 77% have made product innovations, while among those not partnering this share is only 17%. These product innovations require both process and marketing innovations, provided by additional ICT-intensive services. ICT partners are expanding

Figure 31. Evolution of the share of enterprises with ERP



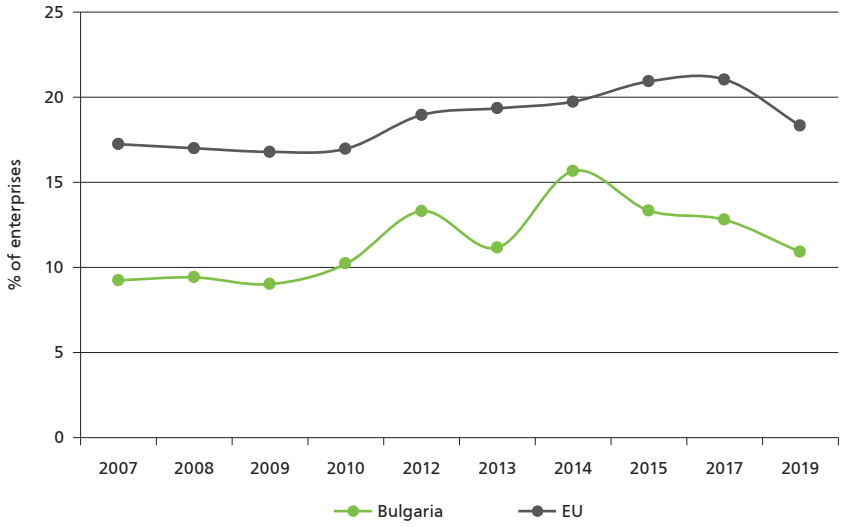
Source: European Digital Agenda Scoreboard, 2020.

their scope of activities with other companies, similar to climbing the ladder of added value of companies engaged in outsourcing. However, there is one difference – Bulgarian ICT partnerships develop in a network of highly specialised small companies which provide each with references to partners, while outsourcing partnerships show expansion and enrichment of teams and product portfolios.

The explanation for the difference in these models is in the demand from large foreign partners, which prefer to work with a trusted partner because their risk management requires it and they are willing to pay a premium for it. For Bulgarian companies, growth is more securely manageable when it is specialised, because demand is still uncertain, short-term and highly price-sensitive. In other words, ICT service providers themselves (especially in the field of digital marketing, online sales, etc.) prefer to grow in clusters when working in the internal market and extensively when working in the foreign market. Projects on the foreign market are much larger and require evidence that companies have enough certified professionals and references for such large projects. This determines the mass supply of IT academies, through which companies operating in foreign markets increase their opportunities to win orders by showing a larger staff list which includes trainees.

More than half of the enterprises in Bulgaria already have websites, and 41% of these sites have complex functionalities. Just over a third of Bulgarian companies use social media, but lag behind the European average, which is over 50%. Around 8% of businesses made sales through their websites or their own mobile apps in 2019, while in 2020 the Covid crisis forced another 10.4% to introduce online sales. Not before 2021 will there be data available about how

Figure 32. EVOLUTION OF THE SHARE OF ENTERPRISES WITH CRM



Source: European Digital Agenda Scoreboard, 2020.

European companies have reacted and whether Bulgaria has surpassed the European average (for 2019 it was 14.9%), although in any case the gap should have been reduced.

E-commerce

According to the Bulgarian E-commerce Association, for the last five years the annual growth of e-commerce in Bulgaria has been between 21% and 35%.[53] In 2019, consumers spent on average EUR 637, while the volume of trade was 1.5% of GDP.

In other European countries, businesses sell online through a number of other online systems, not just through their own websites and mobile phone apps – 18.1% of enterprises in the EU on average (which exceeds the average sales through websites and apps) generate more than 1% of their turnover through online orders. For Bulgaria this share is lower (7.4%).

Although there are two main online markets in Bulgaria (emag.bg and olx.bg), in the first sell mostly companies that have their own websites and online sales, and in the second sell mostly individuals. About 9% of internet users sell online (olx.bg, bazar.bg, Facebook, etc.). According to the Bulgarian E-commerce Association, the largest turnover after emag.bg is generated by Technopolis, Remix, Ozone and Sport Depot. The top 10 Bulgarian online shops generate around 18% of the overall online turnover, while 60% of orders are paid cash on delivery.

About a third (31%) of internet users in Bulgaria in 2019 ordered goods (29%) and services (14%) online, and about 13% ordered (mostly goods) from abroad. These shares do not include services through mobile apps which users do not consider online orders. In 2020, online commerce has certainly reached many more people, and current consumers have increased the intensity of shopping. The crisis has brought to the online market sales of second-hand goods and many people considered this an opportunity for complementary income.

[53] E-commerce industry passport 2020. Bulgarian E-commerce Association, Sofia.

The development of electronic auctions by large companies in Bulgaria is evident in the 3.5-fold increase in the participation of companies in such auctions – from 2.66% in 2010 to 9.74% in 2019. In the European Union, however, a quarter of companies participate in such auctions. Virtually all large companies in the old member states buy everything they need online through auctions.

Overall for the national economy, the turnover of e-commerce has grown 2.5 times since 2010. Individual consumption has grown faster – over 3 times – because of online purchases abroad. Large enterprises are naturally growing faster – their e-commerce revenues have increased 3.5 times compared to 2010. Medium-sized enterprises are advancing slowest – among them, there is a difference of about 7 times in the share of e-commerce revenues of the total turnover of the enterprise.

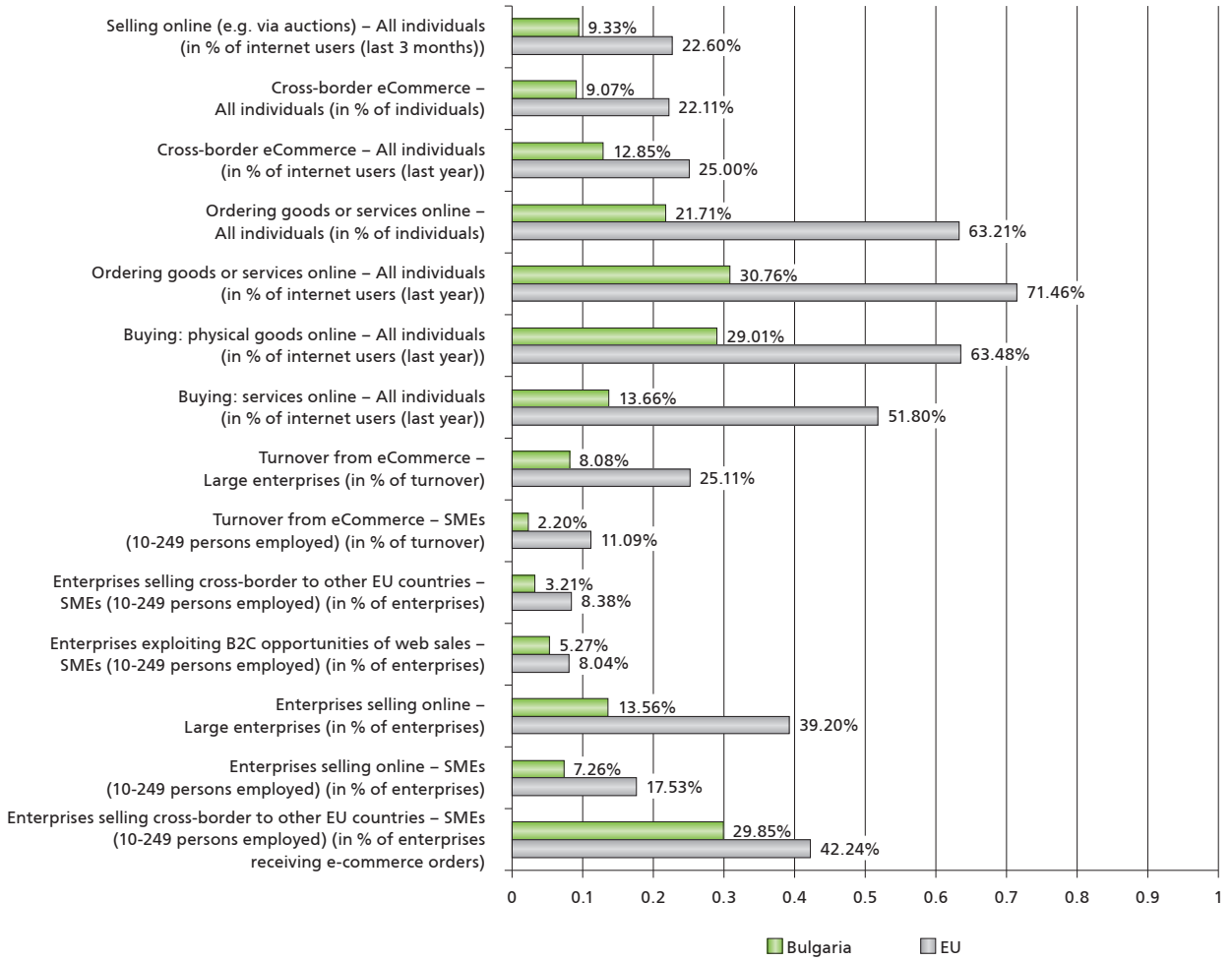
Enterprises selling online abroad increased from 1.24% in 2009 to 3.29% in 2013. There is a lag in companies where a significant part of the revenue (over 25% of total) comes from online sales.

Government as procurer of ICT projects and e-service provider

Over the last 20 years, some countries have been able to drive innovation forward by way of large-scale e-government projects. Perhaps the most famous and good example of this is Estonia, which in partnership with business started and implemented a large-scale program for e-government and provision of public services, which later had significant positive side effects on business.

The Bulgarian government has not done enough in this respect. Despite the spending of public funds there is no clearly visible result. According to INA-5, 75% of the companies believe that municipalities and district administrations do not launch their own projects in the field of ICT, although still do something in the field of digitalisation. The number of Bulgarians using e-government services is about half of the

Figure 33. E-COMMERCE PROFILE OF BULGARIA



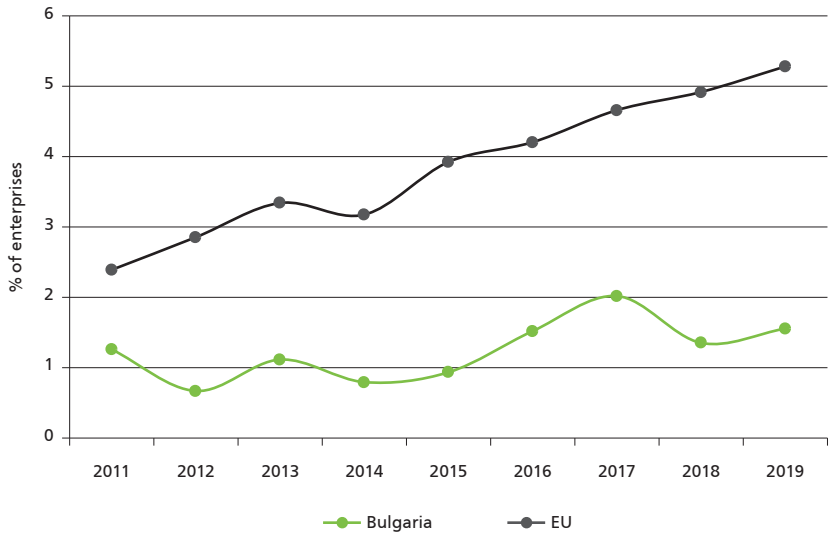
Source: European Digital Agenda Scoreboard, 2020.

European average number. Being able to incorporate a company online is arguably the only public e-service with significant impact and was associated with tangible changes in business processes.

In 2020, the greatest impact in the field of public services was achieved by Eurotrust Technology, whose system for online identification of persons with access to the systems of the Ministry of Interior for personal documents and the provision of free qualified electronic signatures will lead to digitalisation and complete transformation of many services – from applying for and taking university exams, through fully online loan application, to the provision of administrative services. The first companies to start such services were the fintech companies, but others are expected to follow soon, especially if the Covid crisis is not resolved in 2021.

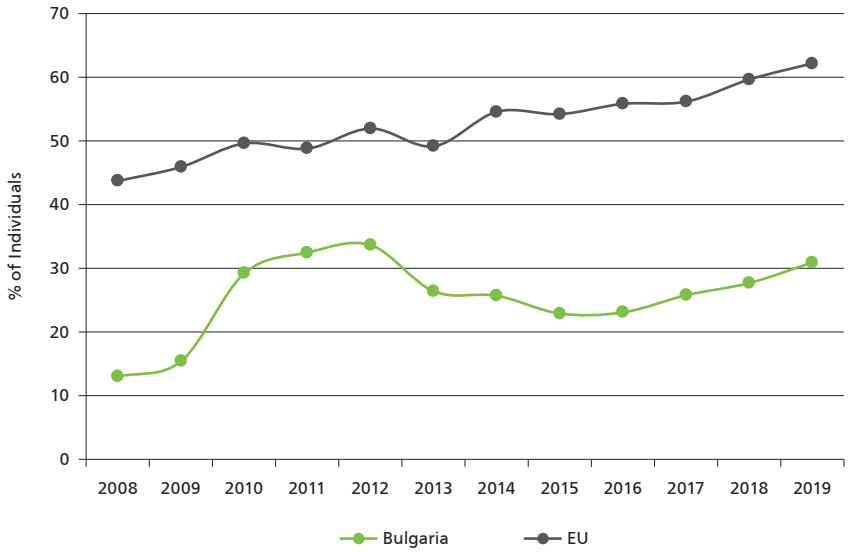
Bulgaria is still behind global trends in e-health. In this context, the decision not to use the potential of innovative Bulgarian ICT companies but to rely only on the state-owned company Information Services will have long-term negative effects. A system for electronic prescriptions and referrals is yet to be introduced and there are no effective electronic health records, although individuals can now check what services have been paid for by the public health insurance fund. This functionality is expected to prevent insurance fraud through false claims for services.

Figure 34. EVOLUTION OF THE SHARE OF COMPANIES SELLING 25% VIA A WEBSITE OR APPS



Source: European Digital Agenda Scoreboard, 2020.

Figure 35. DYNAMICS OF USE OF ELECTRONIC PUBLIC SERVICES*



* Individuals interacting online with public authorities, last 12 months, by active labour force (employed and unemployed).

Source: European Digital Agenda Scoreboard, 2020.

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APPLIED RESEARCH AND COMMUNICATIONS FUND

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

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

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

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

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