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Innovation Product

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Innovation and Sustainability for
Future Growth

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LIST OF ABBREVIATIONS

AI	Artificial intelligence
BAS	Bulgarian Academy of Sciences
COST	Programme for Cooperation in Science and Technology
DESI	Digital Economy and Society Index
EC	European Commission
EIS	European Innovation Scoreboard
EPO	European Patent Office
EU	European Union
FP	Framework Programme
GDP	Gross Domestic Product
ICT	Information and Communications Technologies
NRA	National Revenue Agency
NSI	National Statistics Institute
NSSI	National Social Security Institute
PORB	Patent Office of Republic of Bulgaria
PRO	Public Research Organisation
R&D	Research and Development
SEPR	South East Planning Region
SIR	SCImago Institutions Rankings
SME	Small and Medium-sized Enterprises
VCC	Variable Capital Companies
WIPO	World Intellectual Property Organisation

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EXECUTIVE SUMMARY

Innovation Potential

The 2024 edition of the European Innovation Scoreboard (EIS) indicates that Bulgaria remains in the group of **emerging innovators**, with an innovation index of 50.6. The country's indicators show minimal improvement compared to the base year of 2017.

Bulgaria has **not met its national targets** of advancing to the moderate innovator category or achieving an R&D expenditure level of 1.5% of GDP. The EU's average target remains at 3%. In 2023, Bulgaria's R&D intensity was 0.79%, reflecting a modest increase of just 0.04 percentage points compared to 2022.

Twenty years ago, in 2004, before joining the EU, Bulgaria was ahead of Romania and nine other old and new EU member states in the catch-up group, showing a 15% annual progress rate. The country's **leading indicators** at the time included patents in high-tech fields, ICT expenditure, and STEM graduates. However, by 2024, Bulgaria's innovation potential has grown by only 1.9% compared to 2023, **widening the gap from the EU average by 10%**. Over the past decade, the divergence between Bulgaria's innovation index and the EU-27 average has increased, reducing the likelihood of convergence.

Technological Product

In 2023, Bulgaria submitted 40 patent applications to the European Patent Office (EPO), six fewer than in 2022, ranking 32nd among EPO member states and 26th within the EU (only ahead of Latvia). In patent applications per million people, Bulgaria ranks 24th (5.78 applications in 2022). Comparatively, Latvia had 14.26 applications per million, Romania 2.19, while Scandinavian countries, the EU's innovation leaders, had over 400 applications per million.

Bulgarian inventors were **more active in domestic patent applications**, filing 197 invention patents (+15%) and 349 utility model applications (+135 applications, or 1.6 times more than the previous year). However, these figures remain below the 2020 peak (246 patent applications and 542 utility model applications). Foreign applicants submitted only 12 patent applications and 9 utility model applications.

In 2023, the Bulgarian Patent Office (PORB) granted 114 patents to Bulgarian applicants, reflecting an annual increase of over 30%. Growth was evident across all institutional sectors, with individuals experiencing the most significant increase (58% to 41 patents). Other sectors saw growth between 16% and 22%.

Research Product

In 2023, Bulgaria contributed 2.67% of Eastern Europe's scientific publications, 0.88% of EU publications, and 0.2% of global publications in the Scopus database. These figures mark an **improvement since 2015**.

Bulgarian research units published 7,936 documents in Scopus in 2023, with an H-index of 347 and an average of 0.6 citations per document. This ranked Bulgaria 63rd among 234 countries. Following a slight decline in 2022, the country continued its upward trend in publishing in high-impact international journals.

In 2025, Bulgaria maintained its presence in the Times Higher Education World University Rankings, with seven universities included—three of which hold “reporter” status, meaning they provided data but did not meet eligibility criteria for ranking. The **Medical University of Sofia ranks highest** (1201–1500), while Sofia University, the Technical University of Sofia, and Trakia University fall within the 1500+ category.

Entrepreneurship

For the first time since 1990, newly registered companies in Bulgaria are expected to exceed 40,000 in 2024. However, only 3% result from corporate entrepreneurship. This trend aligns with **Bulgaria's first-place ranking in youth entrepreneurship** in the EU, as highlighted in Flash Eurobarometer 502 and Innovation.bg 2023. Over the past decade, new company creation has increased by 60%.

Approximately 89% of new companies are owned by Bulgarian citizens or locally registered firms. Among **foreign investors**, Ukrainians were the most active, increasing their new company registrations by 41% in the first ten months of 2024. Ukrainian companies accounted for 18% of all new foreign firms, followed by Turkish (12%), Italian (10%), Greek (9%), German, and Romanian investors (8%). Citizens from 59 countries registered businesses in Bulgaria in 2024. Russian investments continue to decline and now originate only from individuals.

Despite a growing number of entrepreneurial refugees (especially from Syria), they face difficulties in opening business bank accounts. Bulgaria remains attractive to foreign entrepreneurs, particularly young professionals pursuing education. However, bureaucratic hurdles for foreigners reduce the country's ability to capitalize on this potential.

The GUESS student entrepreneurship survey (2023) confirmed **high entrepreneurial motivation** among Bulgarian students. Between 37.3% and 40% of students in 2023/2024 were classified as nascent entrepreneurs, either owning a business or preparing to launch one. Nearly 14% already operate businesses. **Social inheritance** plays a key role—19% of students with entrepreneurial parents are already entrepreneurs. A growing trend also sees experienced entrepreneurs returning to universities for advanced degrees, leveraging academic institutions as incubators and mentorship hubs.

Investment and Financing of Innovation

In 2023, Bulgaria's **R&D spending** reached BGN 1.467 billion, a nearly 16% increase from the previous year. However, as a share of GDP, it remains at **0.79%**, far below the 0.95% peak in 2015 and the EU target of 3%. The gap between Bulgaria's spending and strategic targets remains significant.

A **shift in Bulgaria's R&D financing model** began in 2009 when the private sector overtook public investment in technological development. EU accession enabled businesses to leverage structural funds for innovation. Large enterprises (250+ employees) have driven R&D funding since 2013, now accounting for 60% of total R&D investments. However, **innovation remains concentrated within 770 large firms** out of 461,819 active non-financial enterprises, leaving SMEs underrepresented.

Bulgaria has participated in EU **Framework Programmes (FPs)** since FP3. Its involvement grew significantly, more than doubling in FP5 and increasing by 54% in FP7 and 40% in Horizon 2020. However, Bulgaria remains **near the bottom of EU rankings** for project participation (20th–23rd position). Yet, weighted by population, Bulgaria ranks 4th in FP participation. As of mid-2024, 530 Bulgarian organizations (285 unique participants) were involved in 349 Horizon Europe projects, **securing €201.3 million in funding**.

Human Capital for Innovation

In 2023, **over 35,000 people** were employed in R&D in Bulgaria. The **business sector** employs nearly 46% of researchers, while higher education (29%) and public research institutions (25%) share the rest. However, **the R&D workforce declined by 2,000 people (-5%)**, with businesses losing 2,273 employees (-12%).

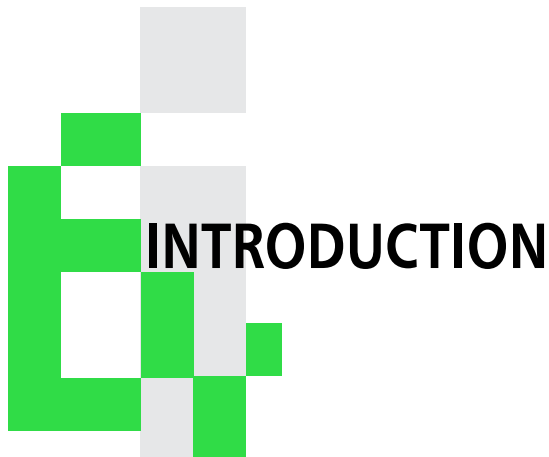
In an **EU comparison**, Bulgaria ranks ahead of Cyprus, Latvia, Malta, Slovakia, and Romania in R&D workforce share (0.91% of labor force), but significantly lags behind the EU average (1.53%). The Scandinavian countries (2%+) exemplify how strong human capital drives innovation.

Universities continue to improve conditions for young researchers, with greater opportunities for **international study, project participation, and business collaboration**. Adjustments in faculty salaries in 2024 have made academic careers more attractive. However, Bulgaria still faces **challenges in digital skills adoption, e-government services, and ICT use in businesses**.

Information and Communication Technologies (ICT)

Bulgaria ranks **7th in the EU for public digital services for businesses**, outperforming Germany, France, Austria, Spain, the Netherlands, Greece, Romania, and Hungary. However, **weaknesses remain** in customer service, transparency, and personal data protection, as well as in public digital services for citizens (ranking above only Croatia, Poland, and Romania).

The COVID-19 pandemic accelerated **organizational digitalization**, with businesses adopting **remote work, online sales, and digital services**. However, while EU funds support digital transformation, **SMEs need talent management strategies** to integrate digital tools effectively and **enhance organizational agility**.



INTRODUCTION

The *Innovation.bg* report provides an annual assessment of Bulgaria's innovation potential within Europe, evaluating the current state and opportunities for developing the national innovation system. It offers policy recommendations for improving innovation strategies in Bulgaria and the EU, drawing on the latest theoretical and empirical research while considering the country's specific economic, political, cultural, and institutional framework.

Over the past 20 years, *Innovation.bg* has proposed numerous concrete measures to enhance Bulgaria's innovation policy and practice. These recommendations have been endorsed by the government, businesses, the scientific community, and the European Commission. However, there has yet to be a breakthrough in national innovation policy, which remains largely dependent on EU vision, instruments, and funding. Bulgaria's EU membership facilitated the creation and implementation of the country's first comprehensive innovation strategy—the **Innovation Strategy for Smart Specialisation 2014-2020**. To sustain economic growth through innovation, Bulgaria must build on private sector efforts and address significant institutional weaknesses in policy development and implementation.

As in previous editions, *Innovation.bg 2024* examines the state and development opportunities of Bulgaria's national innovation system using five key indicator groups:

- Gross innovation product
- Entrepreneurship and innovation networks
- Investment and financing of innovation
- Human capital for innovation
- Information and communication technologies

This year's *Innovation.bg* takes a retrospective look at how research, technological development, and innovation policies have evolved over the past two decades. The lessons learned should help Bulgaria navigate the growing complexities of the globalized world, where regional priorities increasingly shape the innovation landscape.



The big picture: changes in the global environment for innovation

The last five years have seen several key global events and **trends that have profoundly reshaped the environment for science, technology, and innovation**, with largely negative implications for the innovation economy:

- **Russia's invasion of Ukraine** has exacerbated global tensions between the US and China, worsening trade conditions, scientific cooperation, and technology transfer, with the European Union's economy among the most affected. The war has forced the EU to reallocate public resources toward defense, economic stability, and energy security.
- The **rapid spread of disruptive technologies**, particularly in artificial intelligence, is challenging democratic governance and innovation, further distancing European societies and economies from the global technological frontier.
- The increasing impact of **climate change** necessitates the development of alternative energy sources.
- The **global pandemic** has significantly altered global interactions and supply chains, compounding the disruptions caused by the war in Ukraine.

The European Union has responded to these challenges by adopting strategic and legislative initiatives aimed at **realigning the European economy**. These include the Economic Security Strategy¹ and the reports by Enrico Letta² and Mario Draghi³ on reforming the internal market and boosting European competitiveness. All these documents highlight the EU's growing lag behind China and the US, with concerns that these trends may further intensify due to the compounded negative effects of current crises on the European economy.

Against this backdrop, Bulgaria's ongoing political instability since 2021 and the Parliament's refusal to allocate over **BGN 10 billion in EU funds** for the green and digital transition raise serious concerns about the country's preparedness

¹ https://ec.europa.eu/commission/presscorner/detail/en/ip_23_3358

² <https://www.consilium.europa.eu/media/ny3j24sm/much-more-than-a-market-report-by-enrico-letta.pdf>

³ https://commission.europa.eu/topics/strengthening-european-competitiveness/eu-competitiveness-looking-ahead_en

for the evolving global landscape. This chapter identifies four key global trends, their impact on innovation, and recommendations on how Bulgaria can navigate these challenges and opportunities.

Slowbalisation

The deceleration of globalization—often termed “slowbalisation”—stems from multiple geopolitical factors. Since 2015, rising US-China strategic competition has led to increasing trade fragmentation. This trend was further exacerbated by COVID-19, which caused major **supply chain disruptions**, and Russia’s 2022 invasion of Ukraine, which exposed Europe’s vulnerability to energy dependency on the Kremlin. In response, the EU has implemented unprecedented sanctions to reduce this reliance and **mitigate future risks to economic stability**. Additionally, technological advancements are enabling supply chain realignments, as localized production becomes more feasible.

Several trends highlight this shift:

- **Friendshoring**, where supply chains are redirected to allied countries.
- Rising **protectionism**, as demonstrated by US restrictions on semiconductor exports to China and sanctions limiting Russia’s economic capabilities.
- The resurgence of **industrial policy**, exemplified by the US CHIPS and Science Act and the European Chips Act, both aimed at strengthening domestic high-tech industries.

While some argue that these trends signal full-scale de-globalization, the evidence suggests a slowdown rather than a reversal, leading instead to **trade fragmentation and regionalization**. The impact on innovation will be significant, particularly as the main divide emerges between the US and China, with negative consequences for the EU due to its deep integration into global innovation networks.

- **Global innovation output is expected to decline** due to reduced US-China scientific collaboration.
- **Decoupling efforts** between the G7 and BRICS nations necessitate the dismantling of existing innovation networks and the creation of new ones.
- **ICT industries**—historically reliant on global value chains—are likely to face the greatest disruption due to their dependence on user-producer interactions for innovation cycles.

As a small and highly open economy, **Bulgaria faces significant risks** from disrupted global supply chains and rising costs of doing business with China, Russia, and neighboring regions. Given its **lower integration into the EU single market** compared to other member states, Bulgaria’s innovation progress depends heavily on **EU cohesion funding**, which remains blocked due to ongoing political instability. Key **challenges and opportunities** include:

- Leveraging Bulgaria’s **strong ICT sector**—which is well integrated into EU and US markets—by securing more EU funding to attract talent and accelerate digital transformation. There is particular potential in combining ICT expertise with **defense industry advancements**.
- Reducing energy dependence on Russia—Bulgaria remains **the EU’s most Kremlin-dependent economy**, with high energy intensity. The country must swiftly implement EU economic security regulations, including sanctions, to avoid technological isolation from the G7. Unlocking EU funds for the energy transition is imperative.

- Deepening EU integration—Bulgaria should strengthen **trade ties with EU and G7 allies**, particularly in technology transfer, scientific collaboration, and institutional capacity building for innovation.

Accelerated Technological Change

The rapid evolution of new technologies over the past five years has **transformed work and business practices**, disrupting traditional innovation models. This transformation is characterized by Industry 4.0 and the shift toward **Industry 5.0**, driven by:

- Big data and AI analytics
- Horizontal and vertical integration
- Cloud computing
- Augmented reality
- Industrial Internet of Things
- Additive manufacturing (3D printing)
- Autonomous robotics
- Simulation/digital twins
- Cybersecurity

Since 2022, AI has seen an explosion in capabilities, including content generation, video creation, and enhanced accuracy in data processing. **AI-driven innovations** now play a growing role in healthcare, climate change mitigation, and predictive analytics. However, challenges such as job displacement, data security risks, and regulatory concerns require robust governance frameworks.

Bulgaria is well-positioned to **capitalize on technological advancements**, given:

- A thriving ICT sector and **early investments in AI research**, notably INSAIT (the Bulgarian AI institute).
- **Access to cutting-edge innovations** from NATO and the EU, enabling Bulgaria to focus on adapting and deploying new technologies in European markets.
- Initiatives like **Sofia Tech Park and the Discoverer supercomputer**, which bolster data-intensive research.
- Opportunities to enhance public-sector AI adoption, strengthen innovation networks, and expand participation in **EU digital innovation hubs and funding programs**.

The Return of the Defense Industry and Innovation

Russia's 2022 invasion of Ukraine ended the post-Cold War peace dividend, prompting an urgent **increase in defense spending and military innovation**. Key trends include:

- **Defense budgets rising globally**, with NATO members increasing military expenditure to 2-3% of GDP.
- **Digital transformation of the defense sector**, integrating AI, autonomous systems, and cybersecurity advancements.
- Growing **collaboration between startups and traditional defense contractors**, fostering technological breakthroughs.

Bulgaria's defense industry has seen:

- **Over 200% production growth** in the past two years.
- Persistent **talent shortages** despite a rise in private-sector defense research.

- **Insufficient R&D investment and policy coordination**, limiting innovation in the sector.
- **Greater institutional cooperation**, including Bulgaria's participation in NATO's Innovation Fund and the Defence Innovation Accelerator for the North Atlantic (DIANA).

Climate Risk and Energy Security

The shift toward energy independence and sustainability is a key driver of innovation. Key global trends include:

- **Renewables surpassing coal** as the world's primary energy source by 2025.
- **A booming electric vehicle (EV) market**, projected to exceed \$1 trillion by 2030.
- Increased **geopolitical rivalry over battery production and critical raw materials**.

Bulgaria should:

- **Accelerate green innovation** adoption from EU and US partners.
- **Reduce energy dependency on Russia** by expanding renewable energy initiatives.
- **Leverage EU and NATO partnerships** to foster innovation in defense and nuclear energy technologies.

By strategically aligning with **emerging global trends**, Bulgaria can position itself as an innovation-driven economy capable of adapting to the challenges of the evolving world order.



Innovation potential of the Bulgarian economy

Gross innovation product

Gross innovation product, or a nation's innovativeness, is measured by new products/services, new technologies, and scientific output. It results from the interplay of a country's innovation, technological, and scientific products. This is a key benchmark for innovation policy, enabling policymakers to compare innovation system outcomes over time and across regions, and to assess necessary changes in the innovation process's organization and resources.

Innovation product

The innovation product comprises new and significantly improved processes, products, and services based on new and/or adapted existing knowledge. Driven by enterprise innovation, it's the most important indicator for assessing a national innovation system. Business innovation activity and public innovation demand, along with their determining factors, constitute an economy's innovation potential—its capacity for knowledge-based development.

Bulgaria on the European and international innovation map

The July 2024 European Innovation Scoreboard (EIS) shows Bulgaria remains an **emerging innovator**, with an innovation index of 50.6 and minimal positive development since 2017.

Bulgaria missed its national targets of becoming a **moderate innovator** and achieving R&D expenditure of 1.5% of GDP (the EU average is 3%). Bulgaria's 2023 R&D intensity was 0.79%, a mere 0.04 points higher than 2022.

Compared to the 2017 EIS base year, Bulgaria's most significant improvements were in:

- Employment in innovative enterprises (37.4% growth since 2017, nearly 17% annually).
- Foreign doctoral students (33.4% growth).
- Broadband internet access (29.7% increase).

Bulgaria's competitive advantages lie in low-tech intellectual property (trademarks and industrial designs). Patent applications, requiring invention, novelty, and intensive R&D, reached only 38.3% of the EU average. Due to a strong ICT sector, Bulgaria is closer to the EU average for ICT specialists (85.2%) and high-tech/innovative product and service exports (75%).

Bulgaria's comparative disadvantages are more complex and seriously impact its innovation performance:

- **Human resources:** Doctoral students decreased by 11.6% since 2017. Lifelong learning is near-zero (1.4% of the population), declining 0.2% annually and over the study period.
- **Financial resources:** Public R&D expenditure decreased 1.6% since 2017 and 3.3% since 2023. Direct/indirect state R&D support for enterprises decreased 3.9% since 2017 and 1.3% since 2023. Business R&D spending dropped significantly (13.5% since 2017).
- **Digitalization:** Improved broadband internet coverage cannot compensate for the low number of enterprises providing ICT training (below 24% of the EU average). The share of the population with above-baseline digital skills remains stagnant (16% of the EU average),

decreasing 0.4% annually and over the study period. These indicators are crucial for digital transformation and business environment improvement, where Bulgaria ranks among the EU's lowest.

- **Sustainable development and environmental impact:** This category saw no progress and significant declines, further worsening Bulgaria's European ranking.

The European Innovation Scoreboard compares the innovation potential of EU member states and neighboring countries, assessing strengths and weaknesses to help identify areas for improvement. Launched in 2000 (analyzing 1999 data for 15 EU members), its methodology has evolved, including a name change to the Innovation Union Scoreboard (2010-2015).

In 2004, before Bulgaria's EU accession, it was in the "catching up" group,⁴ ahead of Romania and nine other EU members.⁵ Progress exceeded 15% annually. Bulgaria's 2004 leading indicators included European Patent Office high-tech patents, US Patent and Trademark Office patents, ICT expenditure, and STEM graduates⁶—evidence of intensive research and a high-tech innovation focus, unlike today's strength in trademarks and industrial designs.

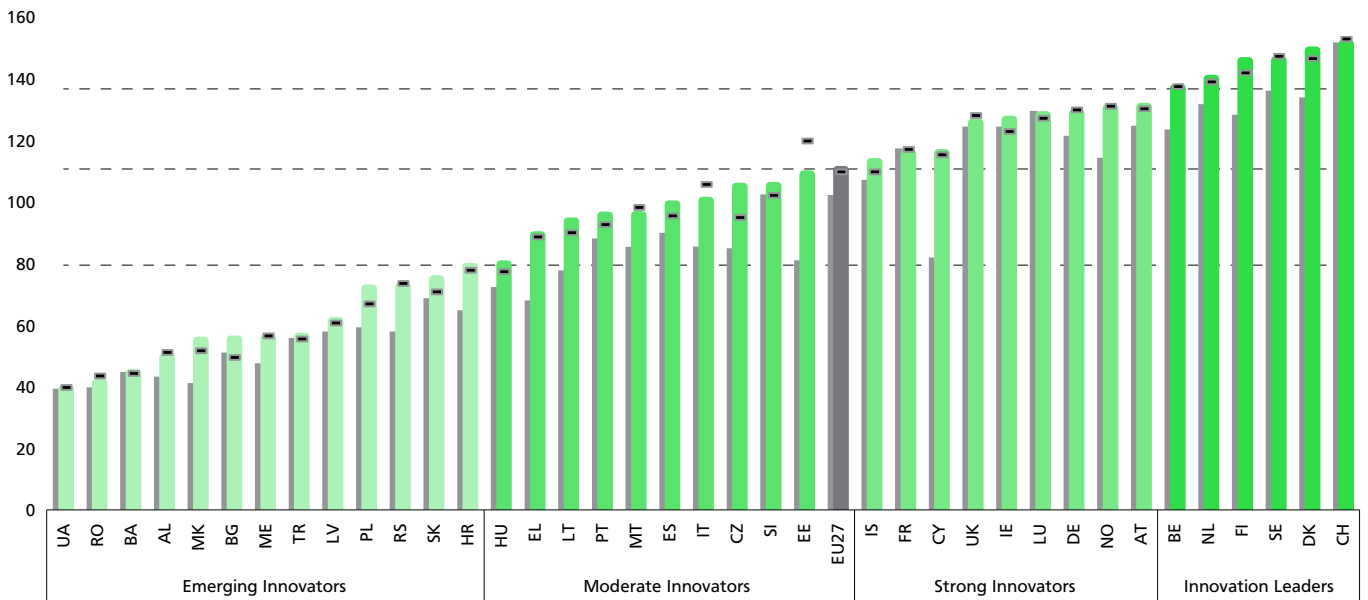


⁴ According to the research methodology, countries were divided into four groups: progressing, stagnant, catching up, and lagging.

⁵ European Commission: Directorate-General for Enterprise and Industry, *European Innovation Scoreboard 2004 – Comparative analysis of innovation performance*, Publications Office, 2005.

⁶ Science, technology, engineering, mathematics.

FIGURE 1. EUROPEAN INNOVATION SCOREBOARD 2024*



* The coloured columns show the state of the member states in 2024 based on the latest data for the 32 indicators of the European Innovation Scoreboard compared to the EU average in 2017. The black dashes correspond to the same indicator, but for 2023 compared to the EU average in 2017. The grey columns show the position of the member states in 2017 compared to the EU average in 2017. The dashed lines show the threshold values of 77%, 110% and 137.5% between the groups of countries for 2024 adjusted as per the growth since 2017.

Source: EIS 2024.

In 2024, Bulgaria’s innovation potential improved by only 1.9% compared to 2023, **widening the gap from the EU average to 10%**. Over the past decade, Bulgaria’s and the EU27’s in-

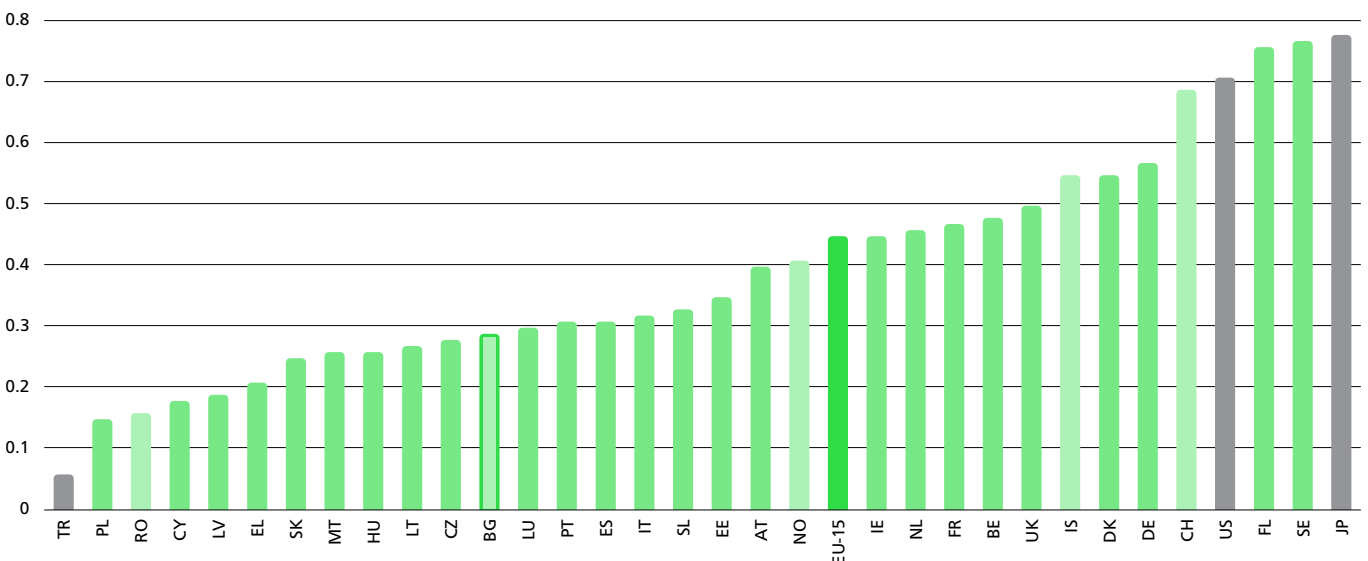
novation indices have increasingly diverged, making convergence less likely.

Bulgaria’s **lack of significant progress** in the European Innovation Score-

board is mirrored in the 2024 Global Innovation Index.

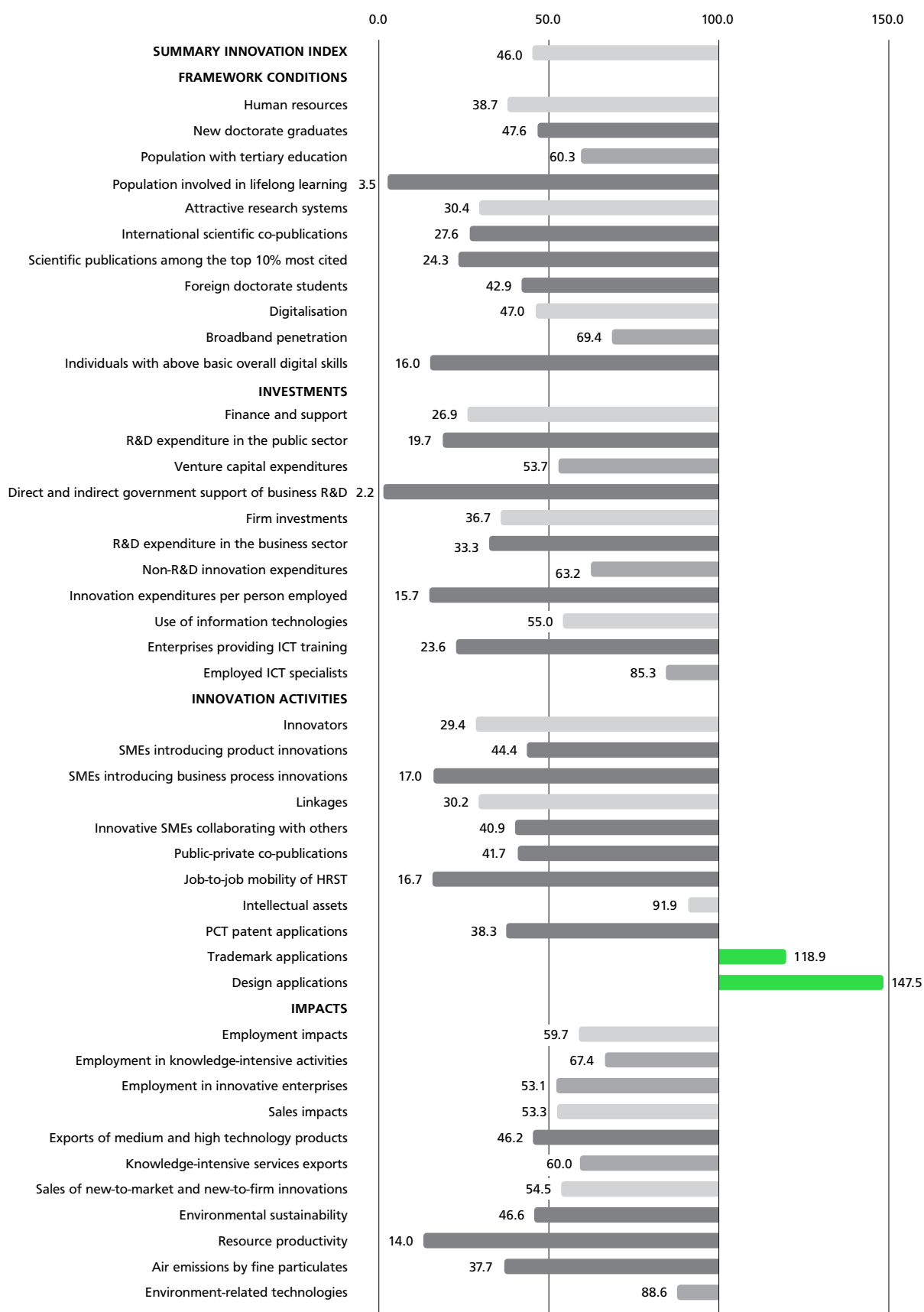
The World Intellectual Property Organization’s (WIPO) methodology uses

FIGURE 2. EUROPEAN INNOVATION SCOREBOARD 2004



Source: European Innovation Scoreboard 2024.

FIGURE 3. INNOVATION POTENTIAL OF BULGARIA, SHARE OF EU-27 AVERAGE LEVELS, %, 2024



Source: EIS 2024.

FIGURE 4. GLOBAL INNOVATION INDEX, 2024



Note: The closer to number 1 and the smaller the circle, the better.

Source: Global Innovation Index 2024. Unlocking the Promise of Social Entrepreneurship

80 indicators across seven pillars and two sub-indices: 1) innovation input (business environment, markets, human, financial, and intellectual resources invested in R&D and innovation); and 2) innovation output (new knowledge, technological assets, entrepreneurial activity, market expansion, ICT development, and creative industries).

Bulgaria holds its 38th position out of 133 countries in the Global Innovation Index. Within the EU, it ranks

21st (up one place), ahead of several member states. Among upper middle-income countries, Bulgaria ranks fourth (down one place), after China, Malaysia, and Turkey.

Over the past five years, Bulgaria's innovation output has seen uneven progress. In 2024, it ranked 32nd (down two places since 2020, but up two since 2023). As with the European Innovation Scoreboard, Bulgaria's relatively good positions here are primarily due to intellectual assets

(industrial designs, trademarks), creative industry results, and knowledge dissemination.

However, innovation input (resources for innovation) has almost continuously deteriorated, reaching 50th position. Bulgaria's lowest scores are in institutions and the business environment: political stability (99), entrepreneurial policies/culture (60), rule of law (69), regulatory quality (56), and government effectiveness (82).

Technological product

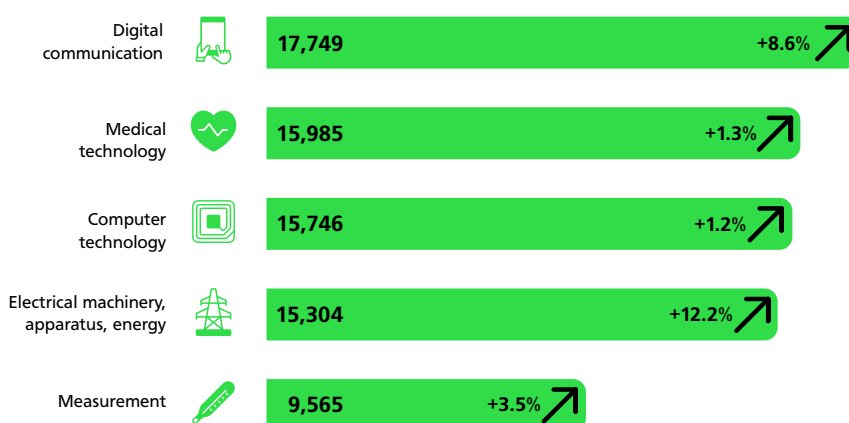
The technological product (protected and unprotected new technological knowledge) stems from the creative activities of various innovation stakeholders. Its unique characteristics and economic value make it transferable. Analyzing patent activity and the perspectives of Bulgarian and foreign actors provides insights into the innovation system's functioning and helps identify areas for improvement.

In 2023, Europe remained an attractive technology market for inventors from around the world. Global patent application activity at the European Patent Office (EPO) increased by 2.9% on an annual basis and reached nearly 200,000 applications. Most notable has been the growth in patent applications from Korea (21%) and China (8.8%). In structural terms, the 39 EPO member countries form a share of 43% of all patent applications, followed by the United States with 24%, and Japan and China with almost equal shares (10.8% and 10.4%, respectively). Among European countries, Germany holds the best position (12.5% share overall and 1.4% growth), which is almost three times more than the next European economy, France (5.4% share and a drop of 1.5%).

In 2023, Bulgaria submitted **40 patent applications** to the EPO (six fewer than in 2022), ranking 32nd among EPO member states and **26th among EU members** (ahead of only Latvia). Bulgaria ranks 24th in patent applications per million people (5.78 in 2022). For comparison, Latvia has 14.26, Romania 2.19, and leading Scandinavian innovators over 400.

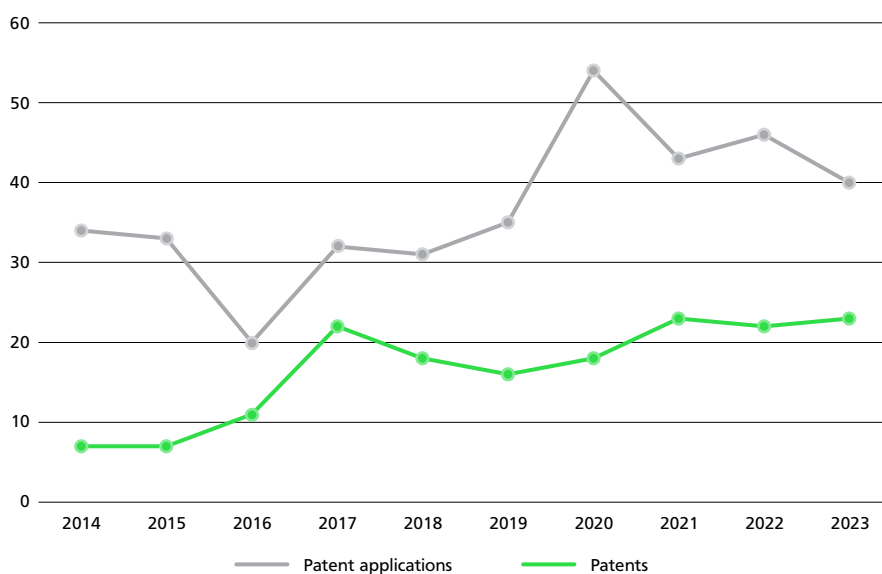
In 2023, Bulgarian inventors were more active at the Patent Office of the Republic of Bulgaria (PORB), with 197 invention patent applications (a 15% annual increase) and 349 utility model applications (a 1.6x increase). However, both figures re-

FIGURE 5. LEADING TECHNOLOGY AREAS OF APPLICANT ACTIVITY TO THE EPO, 2023



Source: EPO Patent Index 2023

FIGURE 6. PATENT ACTIVITY OF BULGARIAN APPLICANTS AT THE EPO, NUMBER



Source: www.epo.org/en

main below 2020 peaks (246 patents, 542 utility models). Only 12 patent and 9 utility model applications came from foreign entities.

Applicant activity was **evenly distributed across institutional sectors**. The public sector (BAS and universities, 69 applications) slightly led the private sector (65) and individuals (63). While shifts continue, the trend of more institutional applications at the expense of individual applica-

tions persists, likely due to increased awareness of intellectual assets' competitive advantage and funding potential.

The 2023 success rate was 65% for patents and 95% for utility models, resulting in 435 new protection documents (172 patents, 263 utility models). As of December 31, 2023, there were 625 active national invention patents and 751 active registered utility models.

2023 application activity also included:

- 109 industrial design applications (a slight annual increase, but below 2014 and 2019 peaks). 99 were registered.
- 3,556 trademarks (3,144 from Bulgarian applicants).
- 4 designation of origin applications (2 approved).
- 21 new plant variety applications (no animal breed applications). In 2022, there were 37 total applications (32 plant, 5 animal).

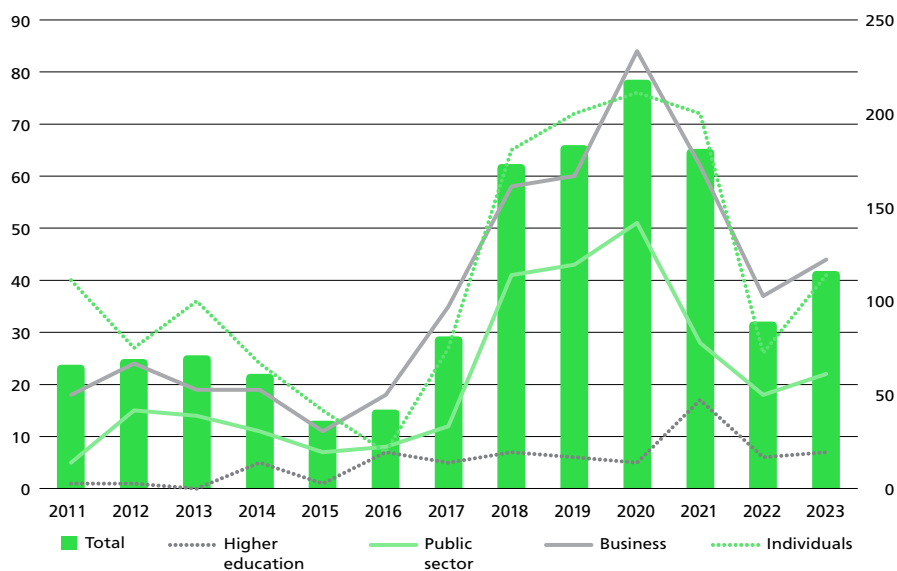
In 2023, PORB issued 114 patents to Bulgarian holders (a ~30% annual increase). Increases occurred across all sectors, most notably individuals (41 patents, a 58% increase). Other sectors saw 16-22% growth. It's unclear if 2023 marks a new uptrend or a fluctuation after last year's decline. Increased invention patent applications suggest the former. **Businesses and individuals have near-equal patent activity shares** (36% and 39%, respectively), with recent shifts in leadership. Public research organizations lag significantly (22 new patents), with higher education institutions registering only 7.

From 2011-2023, **331 Bulgarian companies held 489 patents**. 63 companies hold two or more patents, totaling 221 (just over 45% of all business sector patents). Nearly 9% (42) of business sector patents were European patents. In 2023, only one company (MOJER Ltd., Vidin) registered a European patent.

Patent-holding companies are located in 47 towns. **Sofia concentrates over half of all business sector patents** (261; 53.4%), followed distantly by Plovdiv (30; 6.1%) and Stara Zagora (23; 4.7%).

AMG Technologies Ltd., Botevgrad, a nanotechnology micro-enterprise, is **among the top patent holders**, with 10 patents (two from 2023).

FIGURE 7. PATENT ACTIVITY OF BULGARIAN PATENT HOLDERS ON THE TERRITORY OF THE REPUBLIC OF BULGARIA, 2011 – 2023, NUMBER



Source: Own calculations on the basis of data of PORB, 2024

TABLE 1. TOP 3 PATENT-HOLDING COMPANIES, 2011-2024

	Name	Number of patents	Location
1	Hyundai Heavy Industries Co., Ltd.	22	Sofia
2	Almott Ltd.	11	Stara Zagora
3	AMG Technology Ltd.	10	Botevgrad

Source: Own calculations on the basis of data of PORB, 2024.

A 2013 Applied Research and Communications Fund **award winner for sustainable innovation**, the company continues to innovate.

In 2023, the Bulgarian Academy of Sciences (BAS) added 20 patents from six institutes:

- Institute of System Engineering and Robotics⁷ – 11 patents

- Institute of Metal Science⁸ – 3 patents
- Institute of Mechanics – 2 patents
- Polymer Institute – 2 patents
- Institute of General and Inorganic Chemistry – 1 patent
- Institute of Biophysics and Biomedical Engineering – 1 patent

⁷ The Institute of Robotics at the BAS is the legal successor of the Institute of Systems Engineering and Robotics, created in 2010 by the merger of the Institute of Control and System Research – BAS and the Central Laboratory of Mechatronics and Instrumentation – BAS. The current name of the Institute is also a trademark at the National Patent Office.

⁸ With the Protocol of 14.06.2010 from the 38th meeting of the 5th General Assembly of the BAS, the Institute of Metallurgy was renamed the Institute of Metal Science, Equipment and Technologies with a Center for Hydro- and Aerodynamics.

TABLE 2. TOP 10 TECHNOLOGICAL DIRECTIONS (CLASS ACCORDING TO IPC) OF PATENT ACTIVITY OF BULGARIAN PATENT HOLDERS AT THE PORB, 2011-2023, (NUMBER OF PATENTS, %)

Number	IPC class	Name	Total	%
1	H01	Basic elements of electrical equipment: cables, wires, insulators, resistors, magnets, detectors, transformers, switches, resonators, etc.	157	11.5
2	G01	Measurements of physical quantities	140	10.3
3	A61	Human and veterinary medicine, hygiene, dentistry, medicines	106	7.8
4	H02	Production, conversion and distribution of electrical energy, electrical machines, generators, motors, control and regulation	73	5.4
5	G06	Computing, calculating, counting	42	3.1
6	B01	Methods and devices for physical and chemical processes – melting, casting, mixing. Equipment.	39	2.9
7	A01	Agriculture, forestry, animal husbandry, hunting, fishing, pesticides, herbicides, disinfectants	28	2.1
8	F16	Units and details of machines, methods and devices ensuring the operation of machines and installations, thermal insulation	27	2.0
9	A23	Food and food products, processing, milk, oils, coffee, tea, chocolate, confectionery	26	1.9
10	F03	Hydraulic machines and motors, wind, spring, gravity and other types of motors	26	1.9
Total			664	48.8

Source: Own calculations on the basis of data of PORB, 2024.

The **Institute of Defence and International Security, Sofia**, was the only non-BAS research unit with new patents (two).

Four **universities** also obtained patents: Technical University of Sofia (four new, 23 total over the past decade, leading nationally), University of Rousse (one), University of Plovdiv (one), and Southwestern University in Blagoevgrad (one).

In 2023, there were 1,223 **patents with foreign holders** in Bulgaria. Only two were nationally issued by the PORB (one to Greece, one to Germany). The other 1,221 were validated European patents.

Research product

New scientific knowledge is crucial for enhanced innovation. Analyzing the dynamics and structure of research creation reveals Bulgaria's potential to integrate into global scientific networks, its comparative advantages in various knowledge fields, and its ability to compete in the intellectual product market.

In 2023, Bulgarian research units published 7,936 documents in Scopus, with 0.6 citations per document and a **total H-index of 347**, ranking Bulgaria 63rd out of 234 countries. After a slight 2022 dip, Bulgaria **resumed its upward**

trend in prestigious international publications.

Bulgaria's 2023 contribution to international scientific production was 2.67% of Eastern European publications, 0.88% of EU publications, and 0.2% of global Scopus publications. While these figures have **significantly improved since 2015**, compared to 1996, Bulgarian science organizations have barely regained their original global (0.2%) and EU (0.8%) rankings and are still catching up in Eastern Europe (3.18%).

Since 2016, **Bulgaria's contribution to international publications has**

declined almost annually. In 2023, only 37% of Bulgarian publications resulted from international projects—a 2 percentage point annual decrease and a significant drop from 48% in 2007 (when Bulgaria joined the EU and gained access to European research programs).

In 2023, Bulgaria ranked 10th in Eastern Europe and 20th in the EU for Scopus publications. Since 1996, the rankings are 11th and 21st, respectively. Globally, Bulgaria's average performance is 59th, falling to 63rd in 2023.

In 2023, Bulgaria's **priority scientific areas** were:

- **Medicine:** 1,624 documents (20% of output), maintaining its lead. However, Bulgaria's regional share decreased from 5% in 1996 to 2.56% in 2023. Overall performance: 19.59 citations per document, H-index of 232.
- **Physics and astronomy:** 1,170 documents (a >30% annual decline). Bulgaria's 2023 Eastern European share was 2.7% (matching its post-1996 average). EU-27 share: 1.38%; Global share: 0.28% (the best positions compared to other fields). Average citations: 17.64; H-index: 189.
- **Engineering sciences:** 1,001 documents (a 40% decrease). International ranking declined. Average citations: 8.18; H-index: 126.
- **Computer science:** 947 documents (a ~40% decrease). Average citations: 5.34; H-index: 86.
- **Agricultural sciences and biology:** 843 documents (a ~20% decrease). Average citations: 14.03; H-index: 137.

Globally, **China** leads in these fields (except medicine, where the **US** leads, followed by China). In Eastern Europe, **Russia** has the most Scopus documents (**Poland** second), with their positions closest in agricultural sciences and biology. **Germany** leads in the EU-27.

FIGURE 8. PUBLICATION ACTIVITY IN THE SCOPUS DATABASE, CITED DOCUMENTS, 2004-2023



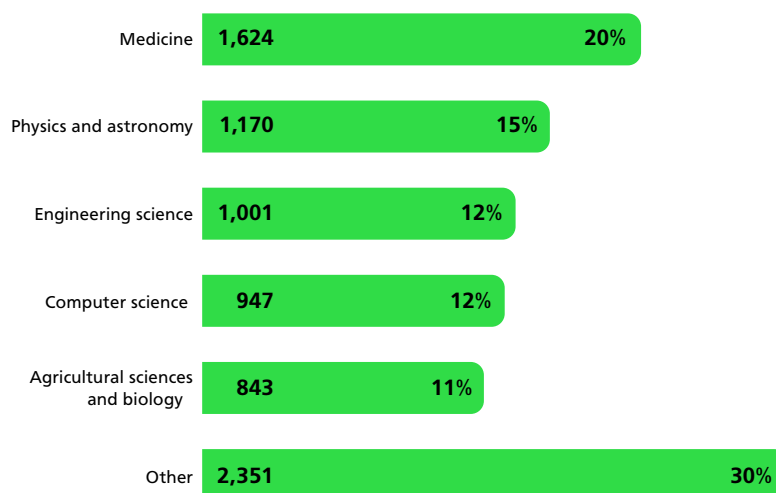
Source: SCImago (2007). SJR – SCImago Journal & Country Rank., www.scimagojr.com

The SCImago Institutions Rankings (SIR) assesses research effectiveness, innovation implementation, and social impact. SIR ranks academic/research institutions using a composite indicator based on research performance, innovation output, and societal impact (measured by web visibility).

SIR aims to provide a useful metric for institutions, policymakers, and managers. Inclusion criteria are:

- At least 100 Scopus-indexed publications in the preceding year.
- Cited documents (articles, chapters, conference papers, reviews) represent at least 75% of total publications.

FIGURE 9. SHARE OF PUBLICATION ACTIVITY IN THE MAIN SCIENTIFIC FIELDS IN BULGARIA, 2023



Source: SCImago (2007). SJR – SCImago Journal & Country Rank., www.scimagojr.com

In 2023, 27 Bulgarian organizations met these criteria (four more than in 2022):

- **Higher education:** 16 institutions, led overall by the University of Food Technology, Plovdiv. Top positions in research performance,⁹ innovation output,¹⁰ and societal impact¹¹ are held by the Medical University of Varna, the Medical University of Sofia, and Sofia University, respectively.
- **Public scientific units:** 10 organizations (BAS and nine institutes).
- **Healthcare:** Aleksandrovska Hospital (Medical University, Sofia), included for the first time.

In 2023, SIR included 8,433 organizations. China and the US tied with 1,042 and 1,041 organizations, respectively. The Chinese Academy of Sciences leads overall. Leaders in subcategories are: Ministry of Education of China (research), Chinese Academy of Sciences (innovation), and Facebook (societal impact).

Compared to neighboring countries, **Bulgaria ranks second to last** (ahead of North Macedonia) in publication activity, citations, open access, and H-index. Bulgaria is catching up in international publications.

In 2025, Bulgaria remains in the Times Higher Education (THE) World University Rankings. THE 2025 includes over 2,000 universities from 115 countries/regions, using 18 indicators across five areas: teaching, research environment, research quality, industry, and international outlook. The 2024 ranking analyzed over 134 million citations in 16.5 million publications and surveyed 68,402 scholars.



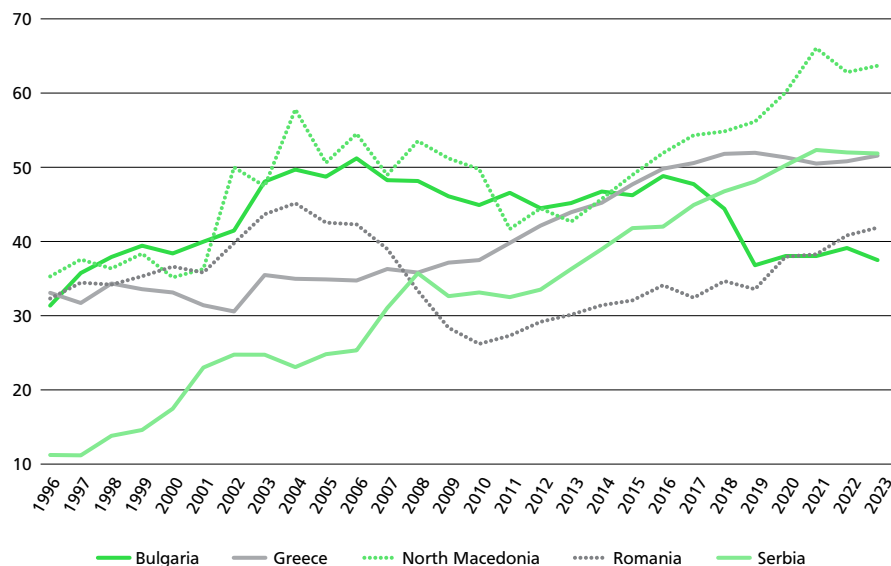
⁹ It includes indicators such as volume of scientific output, scientific publications, international collaboration, open access publications, quality of scientific output, and others.

¹⁰ It is based on indicators such as innovative knowledge (scientific publications cited in patents), patent activity and technological impact.

¹¹ It is measured by the number of documents presented on social media, cited in national and international policies related to achieving the Sustainable Development Goals, impact of the organisation's website, number of women authors of scientific production, and others.

¹² A university's overall score for a given year is calculated by combining its score on Goal 17 with the best three scores on the other 16 goals. Goal 17 accounts for 22% of the overall score, while each of the other goals has a weighting of 26%. This means that different universities are assessed on a different set of goals depending on their focus. The overall ranking score is an average of the overall scores for the past two years. The score on each goal is scaled so that the highest score is 100 and the lowest score is 0.

FIGURE 10. SHARE OF PUBLICATIONS WITH INTERNATIONAL PARTICIPATION IN THE TOTAL NUMBER OF PUBLICATIONS AT THE NATIONAL LEVEL IN ALL SCIENTIFIC FIELDS, %



Source: SCImago (2007). SJR – SCImago Journal & Country Rank., 2023.

Seven Bulgarian universities are represented in the 2025 ranking, three as “reporters” (providing data but not meeting eligibility).

Three Bulgarian institutions are ranked. The Medical University of Sofia (its second appearance) is in the 1201-1500 range. Sofia University, Technical University of Sofia, and Trakia University are in the 1500+ range.

Alongside the World University Rankings, Times Higher Education’s Higher Education Impact Rankings assess universities against the UN Sustainable Development Goals (SDGs), using indicators in four areas:

- **Research:** Scientific research on sustainable development topics.
- **Stewardship:** University resource management (physical assets, staff, faculty, students).

- **Outreach:** University engagement with local, regional, national, and international communities.
- **Teaching:** Educating professionals to achieve the SDGs and integrating sustainability into all graduates’ careers.

The 2024 Impact Rankings (fifth edition) includes 2,152 universities from 125 countries/regions. Universities providing data on Goal 17 and at least three other goals are included. Impact on each goal is assessed using indicators.¹²

In 2024, **four Bulgarian institutions** (up from two in 2023) are in the Impact Rankings: Sofia University (4001-600), Medical University, Sofia (8001-1000), Trakia University (1001-1500), and University of Economics, Varna (1500+).

TABLE 3. PERFORMANCE OF BULGARIAN INSTITUTIONS IN THE TIMES HIGHER EDUCATION WORLD UNIVERSITY RANKINGS

	Sofia University	Technical University of Sofia	Medical University of Sofia	Trakia University
2017	801+			
2018	1001+			
2019	1001+			
2020	1001+			
2021	1001+			
2022	1201+	1201+		
2023	1201-1500	1501+		
2024	1501+	1501+	1201-1500	
2025	1501+	1501+	1201-1500	1501+

Source: Times Higher Education.

TABLE 4. PERFORMANCE OF BULGARIAN INSTITUTIONS IN THE TIMES HIGHER EDUCATION WORLD UNIVERSITY RANKINGS, 2025

	Sofia University	Technical University of Sofia	Medical University of Sofia	Trakia University
Teaching	27.1	22.7	31.9	20.7
Research environment	12.0	11.6	20.7	9.7
Research quality	18.1	21.3	31.5	5.4
Industry	29.1	34.5	47.1	18.3
International outlook	36.8	24.1	51.8	27.0

Note: A higher value denotes a better score. The maximum is 100%.

Source: Times Higher Education.

Entrepreneurship and innovation networks

Entrepreneurial activity is often linked to a country’s innovativeness. New companies can offer novel products/services and develop new markets/demand. Intra-corporate entrepreneurship strengthens existing firms’ innovation capabilities. A national innovation system’s viability depends more on innovation/entrepreneurship networks than individual champions. Sustainable tech transfer mechanisms between academia and business, mentoring/investment, cluster partnerships, and business associations fostering long-term dialogue/policies are crucial for national innovation system success.

For the first time since 1990, newly registered companies¹³ are expected to exceed 40,000 in 2024. Of these, only 3% are the result of corporate entrepreneurship. This is a reason for optimism and corresponds to the country’s remarkable **first place in youth entrepreneurship in the European Union**.¹⁴ Over the past 10 years, the creation of new companies has increased by 60%.

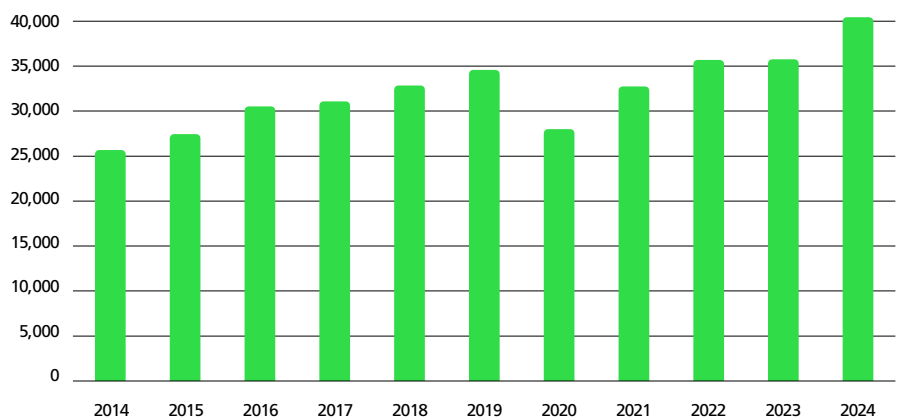
79% of newly registered companies are single-owner (sole proprietor LLCs and JSCs), and 85.3% are majority-controlled, likely due to entrepreneurs’ distrust in dispute resolution mechanisms.

LLCs are the dominant legal form (91%), while JSCs are rare (0.35%). Successful startups often become JSCs after attracting venture capital, and new JSCs often result from partnerships between existing businesses. Unlimited liability companies (mostly sole proprietorships) comprise 3.06%, often registered in smaller settlements with simplified accounting practices.

¹³ This includes limited liability companies, joint-stock companies, sole proprietorships, partnerships, limited partnerships, general partnerships and non-profits. About 1/3 of the new partnerships are either entirely formed by individuals or have at least one such partner. Non-profits include new associations, foundations and even new community centres. The data are for the period January – October 2024.

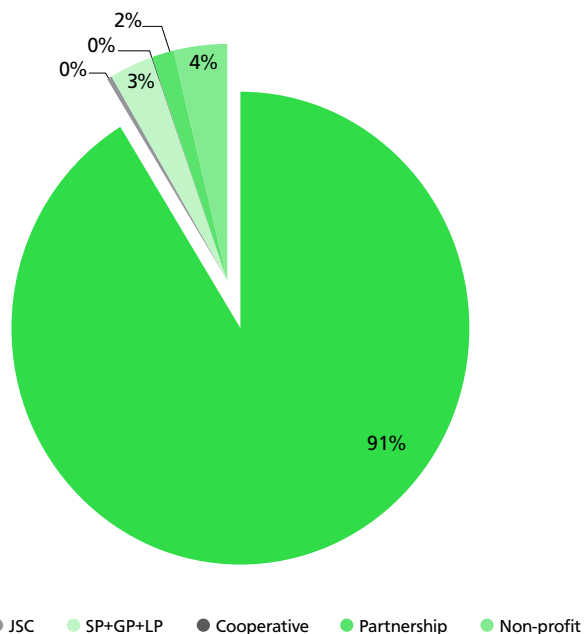
¹⁴ Diagnosed by Flash Eurobarometer 502 and discussed in *Innovation.bg* 2023.

FIGURE 11. NUMBER OF NEWLY REGISTERED COMPANIES



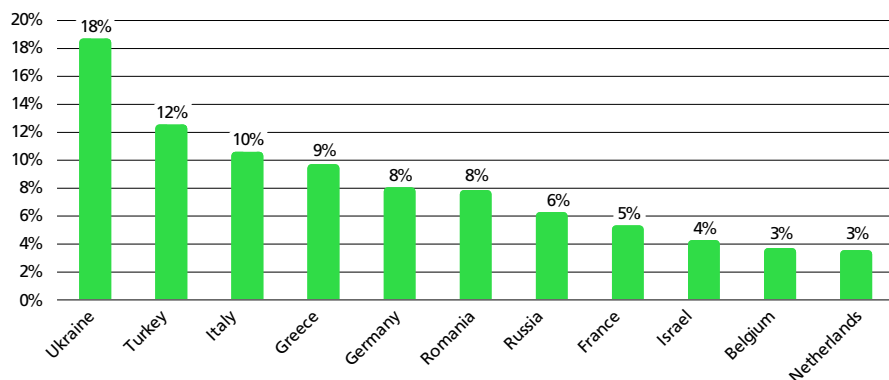
Source: APIS. Data for 2024 are estimated based on the first ten months, when the number of newly registered individuals exceeded the total for 2023.

FIGURE 12. DISTRIBUTION OF NEWLY REGISTERED COMPANIES BY LEGAL FORM



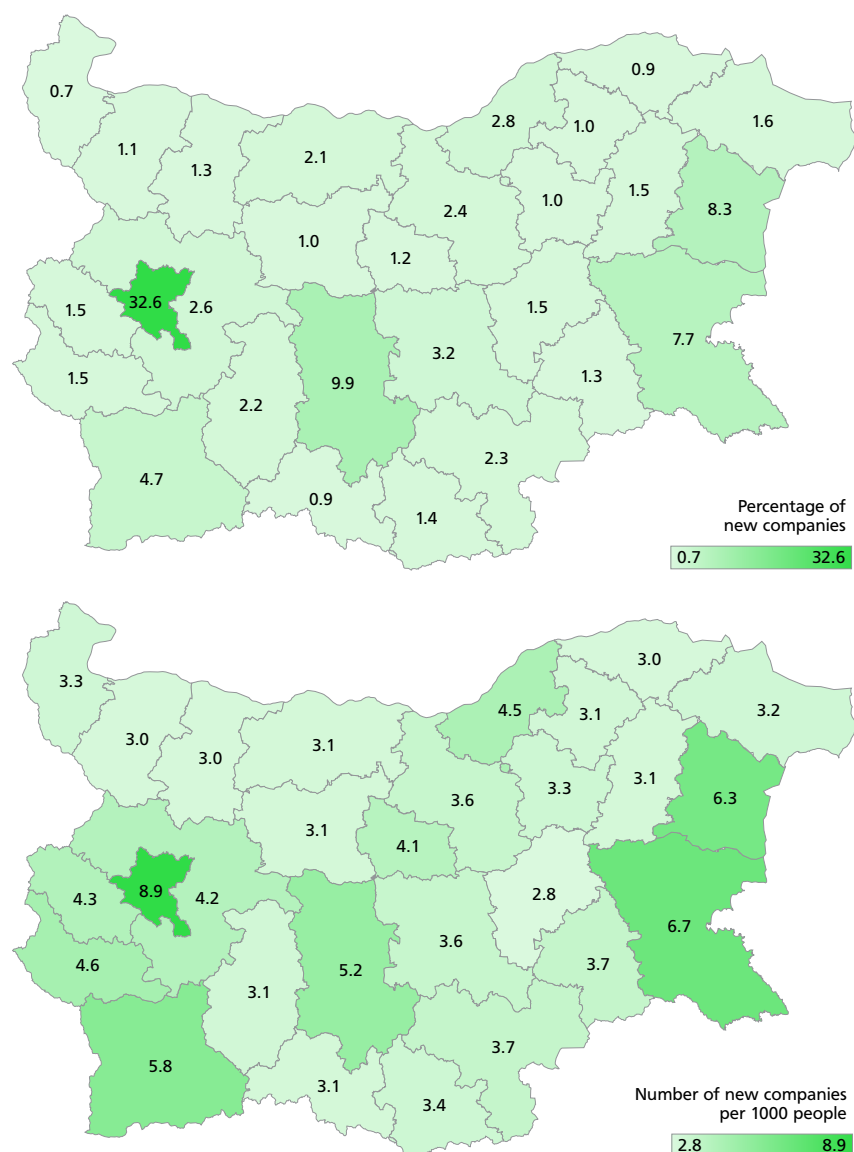
Source: APIS.

FIGURE 13. SHARE OF NEW COMPANIES WITH A LEADING FOREIGN OWNER, BY COUNTRY



Source: APIS.

FIGURE 14. REGIONAL DIFFERENCES IN ENTREPRENEURSHIP IN 2024



Source: APIS.

Non-profits (associations, foundations, community centers) make up about 4% of new registrations. **Social entrepreneurship**, often using these forms plus cooperatives, will increasingly impact the economy. For example, France’s social economy employs 10.4% of the workforce and contributes 5% of value added.¹⁵

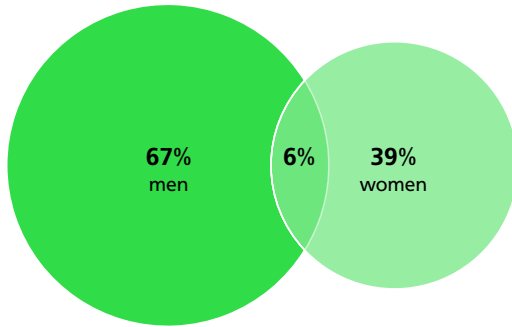
Approximately 89% of new companies are controlled by Bulgarian citizens or companies. **Ukrainians are the most active foreign entrepreneurs**, with 41% more new Ukrainian companies in the first 10 months of 2024 compared to 2023. Ukrainian companies represent 18% of all new foreign companies, followed by Turkey (12%), Italy (10%), Greece (9%), Germany, Romania (8%), etc. Citizens from 59 countries registered companies in Bulgaria in 2024. Russian investments continue to decline and are now only from individuals.

While some refugees (especially from Syria) are entrepreneurial, they face difficulties starting businesses due to banks’ reluctance to open accounts. Bulgaria is attractive to foreign entrepreneurs, particularly young people seeking education, but **bureaucratic residency processes** prevent the country from fully benefiting from this demand.

New company registration locations show clear preferences. 71% of new Ukrainian companies are in Burgas (46%) and Varna (26%) districts. Turkish entrepreneurs prefer Sofia-city (25%), Plovdiv (19%), Haskovo (12%), Kardzhali (11%), and Burgas (10%). Italians and French prefer Sofia-city (76%), Greeks prefer Blagoevgrad (55%) and Sofia-city (33%), and Romanians prefer Rousse (62%).

¹⁵ SSE CFS_France.

FIGURE 15. COMPARISON OF GENDER DIVERSITY AMONG PARTNERS IN NEW FIRMS



Source: APIS.

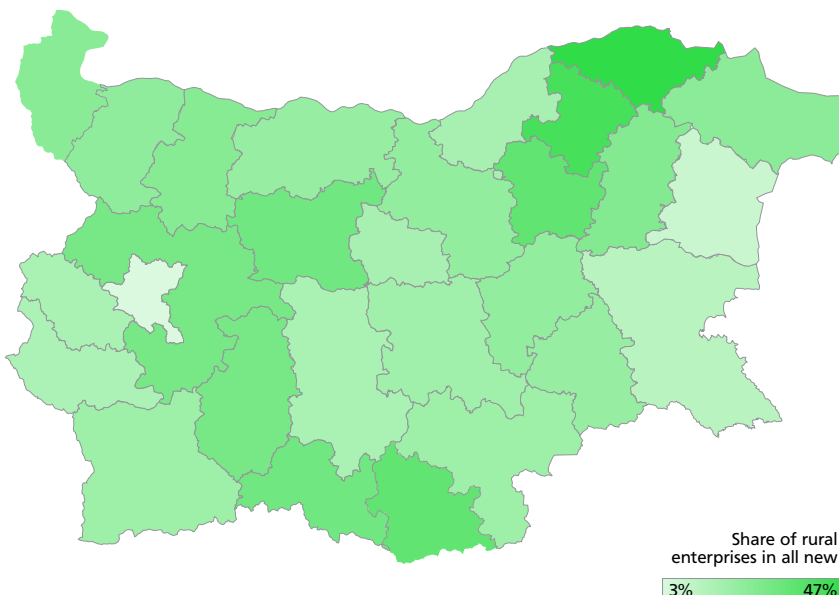
Box 1. ENTREPRENEURSHIP IN RURAL AREAS

Hera 15 Ltd. (Branichevo, Kaolinovo municipality, Shumen region), founded in 2023, is a successful example of rural entrepreneurship. It won first prize for a prunes project at the first Academy for Entrepreneurship in Agriculture (Varna, June 2024), organized by the Association for Promotion of Agricultural Cooperation between China and Central and Eastern Europe.

Another example is the Ecohunt Foundation (Sadovets, Dolni Dabnik municipality, Plevan region), registered after winning the Innovation Academy of the Innovation Starter Accelerator’s grand prize in 2023 for a gamified garbage collection project. It has since won awards and funding from Lidl (You and Lidl Competition) and Sofia University (Entrepreneurs in Science Competition) in 2024.

Source: Applied Research and Communications Fund.

FIGURE 16. RURAL ENTREPRENEURSHIP AS SHARE OF ALL NEW FIRMS



Source: APIS.

Unsurprisingly, new firm partners are predominantly male (67%). Companies with female partners comprise only 39% of new firms with individual partners. In 6% of new firms, there are both male and female partners, typically family businesses (including same-sex family members).[1] However, there are **emerging signs of changing attitudes toward female entrepreneurship** in traditionally patriarchal Bulgarian regions.¹⁶ Identification was done with a combination of prompt algorithms with ChatGPT and verification by personal identification number for Bulgarian citizens.

Entrepreneurship is predominantly urban, particularly for innovation-driven, high-growth ventures seeking venture capital. Only 13.8% of new businesses are registered in rural areas, though significant regional variations exist. In Silistra, nearly half (47%) of new businesses are rural, followed by Razgrad (41%), Kardzhali and Targovishte (34%), Smolyan (31%), and Lovech (30%).

Rural entrepreneurship is typically linked to agriculture, food processing, tourism, transport, construction, and social initiatives. Increasingly, young rural entrepreneurs are founding new companies rather than inheriting family businesses and are participating in national entrepreneurial programs.

Rural entrepreneurs are often “nomadic,” returning from abroad or big cities and embracing organic, “slow,” or “holistic” lifestyles. They typically have multiple residences and sometimes hold a second job.

¹⁶ Identification was done with a combination of prompt algorithms with ChatGPT and verification by personal identification number for Bulgarian citizens.

Box 2. HIGH-TECH AGRICULTURE IN THE BULGARIAN COUNTRYSIDE

Tzarina Winery, established in 2020 in Tzrancha near Pazardzhik, is a prime example of successful rural entrepreneurship. Beyond traditional wine production, they've developed the innovative „Scepter“ system. This **AI-powered software** helps winemakers optimize production and increase efficiency by analyzing real-time data, enabling the creation of custom wines tailored to individual customer preferences. Their innovation was recognized with the ARC Fund's 2023 Innovative Enterprise of the Year award. The winery's predecessor, Valcoder Ltd., was founded in 2016 in Stara Zagora as a computer programming company but remained inactive until the winery's establishment, relocating to Plovdiv in the interim.

Source: Applied Research and Communications Fund.

One-fifth of students (20.3%) plan to start/continue a business immediately after graduation, and just under a third (29.8%) within five years.

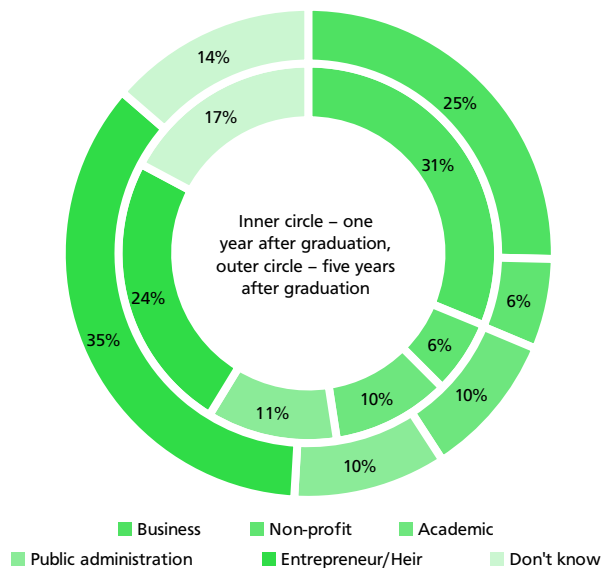
Social entrepreneurship and civil society engagement are increasingly popular among young people. In Bulgaria, about 9% of students plan to be involved in a non-profit within the next five years, compared to the GUESS study's 57-country average of under 2%. Among Bulgarian student entrepreneurs (self-employed or business owners), 23% plan to engage in NGOs within one year of graduation, and 39% within five years. This aligns with the significantly higher growth in non-profit registrations (associations, foundations, community centers)—over 100% in the last 10 years—compared to 60% overall growth in new businesses (including capital companies, unincorporated, and non-profit entities).

Student entrepreneurship

A year after the Flash Eurobarometer 502 survey, the late 2023 GUESS student entrepreneurship survey confirms **strong entrepreneurial motivation among Bulgarian students**. Between 37.3% and 40% of students¹⁷ in 2023/2024 are beginner or nascent entrepreneurs (already owning a business/self-employed or actively preparing to become so).

Almost 14% already own a business, and entrepreneurs are, on average, seven years older than other students. Most students envision their immediate (within one year) and short-term (within five years) careers as employed. Perceptions of career dynamics are diverse, reflecting real role models and the **growing popularity of hybrid roles** (e.g., teacher/entrepreneur, employee/entrepreneur).

FIGURE 17. CAREER ATTITUDES OF STUDENTS WHO ARE NOT CURRENTLY ENTREPRENEURS



Source: GUESS, weighted by university size.

The largest share of student entrepreneurs in the GUESS sample are PhD students (42%).¹⁸ **58% of PhD students are entrepreneurs**, compared to 12% of master's and 8% of bachelor's degree holders. This supports the trend of PhDs being a later career decision, often following an entrepreneurial or managerial career, rather than an early decision aimed at immediate academic pursuits.

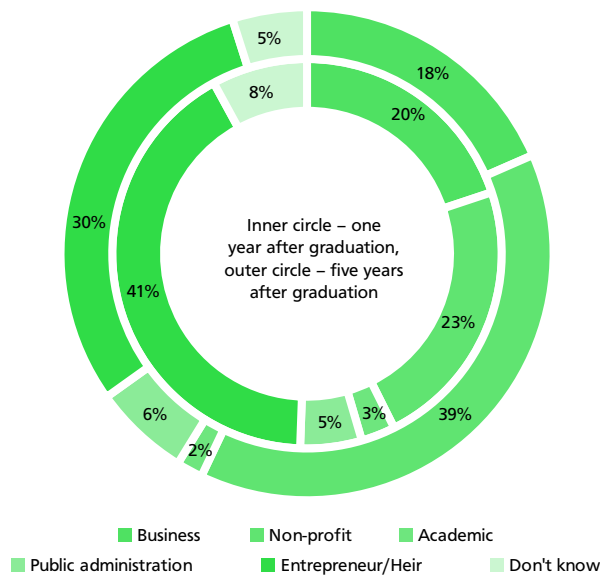
Student gender doesn't affect entrepreneurial attitudes or activity levels. However, men (50%) are significantly more likely than women (32%) to experiment and attempt starting a business.

Social inheritance is a key factor: 19% of students with entrepre-

¹⁷ For the purposes of Innovation.bg, the data is weighted by the relative weight of universities to the total number of students. The global and national GUESS reports use unweighted values, as is the historical practice in other countries.

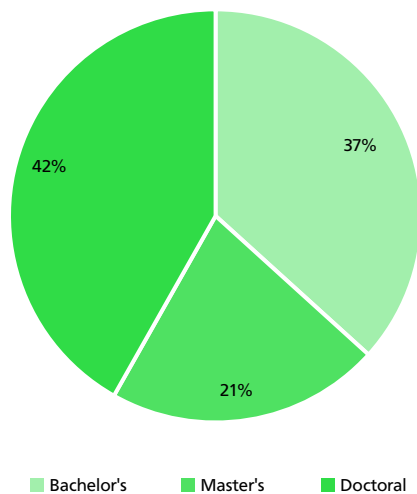
¹⁸ The unweighted sample's PhD student share is 1.7%. After weighting by university (but not education level), the share is 10% (higher than the official 3%). The bachelor's/master's ratio reflects the actual ratio for Bulgarian students. The sample included 7% foreign students (8% in reality).

FIGURE 18. CAREER ATTITUDES OF STUDENTS WHO ARE CURRENTLY ENTREPRENEURS



Source: GUESS, weighted by university size.

FIGURE 19. ACADEMIC DEGREE LEVEL OF STUDENT ENTREPRENEURS



Source: GUESS, weighted by university size.

neurial parents are entrepreneurs themselves, compared to 11% of students whose parents aren't. This often manifests during school years.

For example, Pop!Ed (Learn Ltd.), founded by Viktor Nedelchev and

Ognyan Trayanov (junior),¹⁹ was a top 3 European youth startup at GEN-E 2023 after participating in Bulgarian hackathons and accelerators. Pop!Ed created the KlettAR app, integrated into Bulgarian textbooks and poised for international impact.

Ed-tech traditionally attracts student entrepreneurs. Ucha.se, a prominent Bulgarian example and the 2013 ARC Fund innovative startup winner, was founded by Darin Madzharov while a doctoral student. Ucha.se also has a social heritage element: Madzharov's father is an academic entrepreneur. Another example is Lyubomir Vanyov (Shkolo)²⁰. He started his first company while a Sofia University student and his first projects while in high school.

Sofia Planetarium²¹ (Experimental Design Bureau Photonica Ltd.), awarded the 2023 Excellence in Innovation label by the ARC Fund, exemplifies social legacy student entrepreneurship. The "hidden" driver, Apostol Spasov, won Sofia University's Student of the Year award (economics category) for developing the Planetarium's e-shop. His serial entrepreneur father co-founded the company while Spasov was a student.

While many programs target young undergraduates, data shows **entrepreneurship is more common among experienced students** (master's and doctoral). Entrepreneurs with practical experience are more likely to offer solutions perceived by customers as meeting specific business needs.

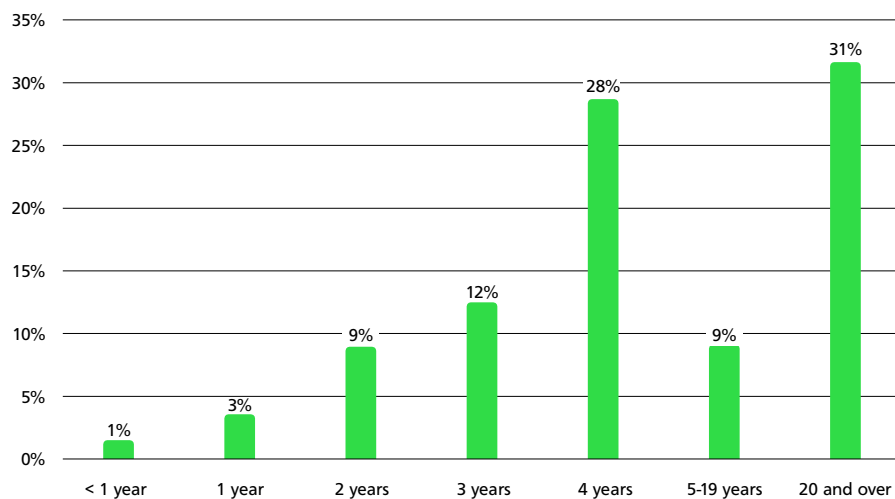
The reverse path is also common: **experienced entrepreneurs are increasingly returning to universities** for second or even third master's or doctoral degrees. Their motivations include gaining knowledge, expanding their network, and leveraging universities as incubators and mentors. The lower entrepreneurship rate among those with 5-19 years of experience is explained by master's students aiming for public sector careers (teachers, administration, university lecturers) or large companies where a master's degree (or even an MBA) is required for advancement.

¹⁹ Zlatina Georgieva, "Digital Layer Above the Textbook," Forbes Bulgaria, September 25, 2023. [2] Shkolo was acquired in early 2024 by Juniper, UK. [3] <https://sofiaplanetarium.bg/>

²⁰ Shkolo was acquired in early 2024 by Juniper, UK.

²¹ <https://sofiaplanetarium.bg/>

FIGURE 20. BUSINESS EXPERIENCE AND SHARE OF ENTREPRENEURS AMONG STUDENTS



Source: GUESS, weighted by university size.

Box 3. VARIABLE CAPITAL COMPANIES: THE BATTLE WITH BUREAUCRACY CONTINUES

Variable Capital Companies (VCCs) were introduced as a legal form for start-ups in July 2023 and were set to begin registration on July 1, 2024. However, the government has yet to make the necessary technical preparations. The Bulgarian Entrepreneurial Association has long advocated for this legal framework, which has proven highly suitable for fast-growing start-ups. A VCC qualifies as an enterprise if it has **fewer than 50 employees and an annual turnover and/or assets below BGN 4 million**. Unlike other corporate forms, its capital is not recorded in the commercial register, allowing for more flexible and frequent share transfers with minimal administrative burden.

A VCC combines the accessibility of an Ltd. with the functionalities of a JSC, offering shares with different rights—such as additional dividends for investors and voting rights for founders and partners. It also simplifies employee incentives by enabling structured share acquisition under predefined conditions. Additionally, VCCs address a significant issue: many **third-country nationals face difficulties opening savings accounts** in Bulgarian banks. This legal form provides a practical solution to that challenge.

Source: Applied Research and Communications Fund.

Investment and financing of innovation

Spending on research and innovation reflects investment in creating, applying, and sharing new knowledge across the public and private sectors. It serves as an indirect indicator of a nation’s future innovation capacity. A high R&D-to-GDP ratio drives dynamic economic growth and enhances competitiveness.

R&D spending

In 2023, R&D spending in Bulgaria reached **BGN 1,467 million**, marking a **16% increase** from the previous year. However, as a share of GDP, it remains low at **0.79%**—up just **0.04 percentage points** year-on-year and still below the peak levels of **0.95% in 2015** and **0.85% in 2020**. The gap between current spending and the targets set in strategic documents over the last two programming periods appears increasingly insurmountable.²²

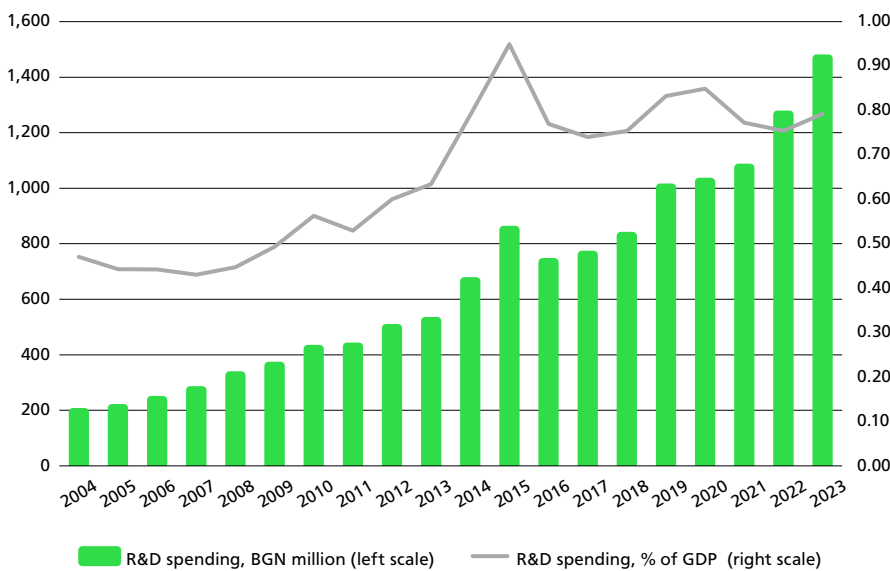
Over the past two decades, Bulgaria’s **R&D financing model** underwent a key shift, when the **business sector took the lead** in funding technological development and innovation, surpassing the public sector by **2010**. A major driver of this shift was **EU accession**, which provided access to **European structural funds** for technological modernization and product innovation. However, **public-sector research organizations** have been slower to capitalize on these opportunities.

In **2023**, enterprises accounted for nearly **two-thirds (64%)** of the country’s **R&D spending**. While business investment in R&D continues to grow in absolute terms, its share of GDP has stagnated at 0.51% for the third consecutive year, as growth in R&D spending matched GDP growth. Total business R&D investment reached BGN 944 million, up nearly 10% from 2022.

However, **political instability, uncertainty in the business environment, and perceptions of corruption** continue to hinder long-term business investment strategies. For the second consecutive year, the National Innovation Fund (NIF) remains inactive. The NIF, a key mechanism of Bulgaria’s first Innovation Strategy (2004)—recognized at the EU level as a best practice—was the only fully national instrument supporting innovative enterprises. It also provided critical funding for SMEs in rural areas. Additionally, **funds under the National Recovery and Resilience Plan remain unabsorbed**, and delays in operational programs persist, further hampering innovation investment.

In 2023, **public R&D spending reached BGN 422 million**, less than half of what businesses invested in science and innovation. While annual growth exceeded 30%, this only resulted in a 0.04 percentage point increase in its share of GDP. Notably, public-sector R&D spending was the sole driver of the national-level improvement in this indicator. **R&D funding in higher**

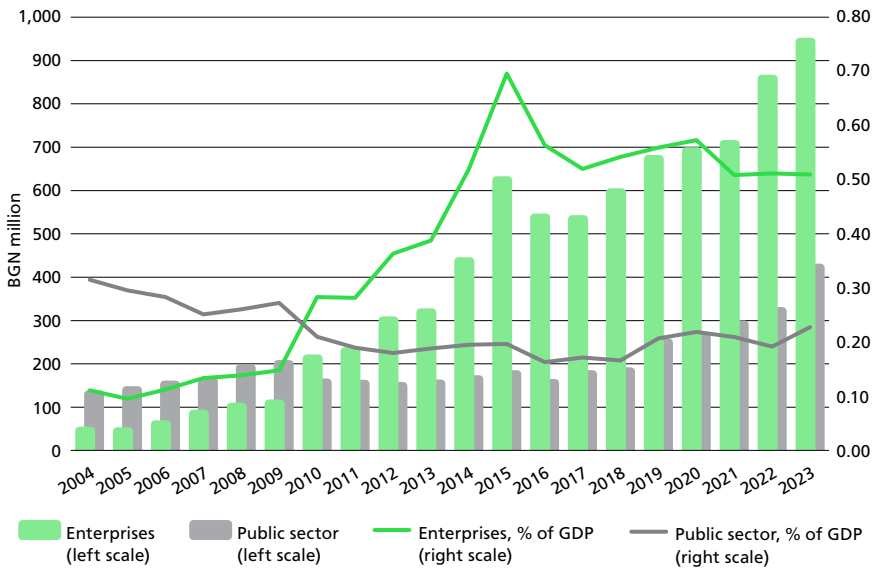
FIGURE 21. R&D SPENDING IN BULGARIA, 2004–2023



Source: NSI, 2024.

²² Due to the lack of progress, the Ministry of Innovation and Growth has carried over the 1.5% R&D-to-GDP target from the 2020 edition of the Innovation Strategy for Smart Specialization into its 2027 update. Meanwhile, the National Strategy for the Development of Scientific Research in Bulgaria (2017–2030), currently being revised by the Ministry of Education and Science, sets even more ambitious—and increasingly unrealistic—targets of 2.4% by 2022, 3.0% by 2025, and 3.3% by 2030.

FIGURE 22. R&D SPENDING, ENTERPRISES AND PUBLIC SECTOR, 2004–2023



Source: NSI, 2024.

- Agricultural sciences saw only a minimal increase (6%) compared to the previous year's budget.

R&D funding by large enterprises (over 250 employees) has grown almost exponentially since 2013, reaching 60% of all technological development and business innovation investment in 2023. This concentration of innovation activity is significant, considering that these 770 large businesses represent only a fraction of the 461,819 non-financial enterprises operating in 2023. Smaller enterprises lag considerably:

- Micro enterprises (0-9 employees, 94% of all businesses): 6% of business R&D spending
- Small enterprises (10-49 employees, 5% of enterprises): 15% of business R&D spending
- Medium-sized enterprises (50-249 employees, 1% of enterprises): 19% of business R&D spending

Clearly, current support measures for SME technological renewal, product innovation, and internationalization lack macro-level impact. This, along with the need to revitalize the National Innovation Fund, warrants

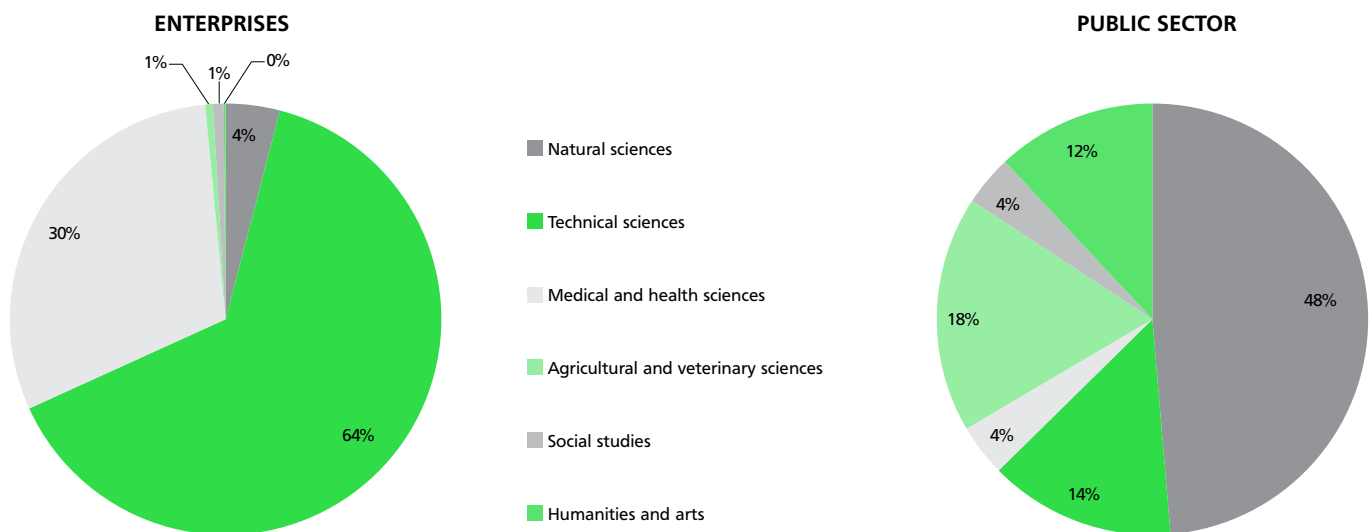
education totaled BGN 95 million (0.05% of GDP), while enterprise investment in R&D grew at the same rate as GDP.

Sectoral distribution of R&D investment:

- Technical sciences attracted the largest share of R&D funding (47% of total spending).

- However, since business is the primary investor in this field, and public funding grew faster than private-sector R&D investment, funding for natural and medical sciences as well as the humanities saw the highest growth rates (26% year-on-year).
- Social sciences received 22% more funding than in 2022.

FIGURE 23. STRUCTURE OF THE BUDGET FOR R&D, 2023, %



Source: NSI, 2024.

close attention from the Executive Agency for the Promotion of SMEs.

While overall R&D investment saw slight growth in 2023, **sector-specific trends varied**. Mining and processing industries, transport, warehousing, postal services, and hotels and restaurants experienced a nearly 5% decrease. Conversely, agriculture, forestry, and fisheries (possibly due to increased transparency in EC support funding) and construction saw significant growth of 37% and 15%, respectively.

Foreign funding remains crucial, comprising nearly 42% of all R&D spending in 2023. Of the BGN 615 million in foreign R&D investment, 85% goes to businesses, primarily through European Structural and Investment Funds, European Framework Programs, foreign direct investment, international organizations, and investors. Public sector and higher education institutions receive only 8% and 5%, respectively. The business sector contributes another 31% of total R&D spending, while the public sector accounts for 26%. Notably, inter-institutional collaboration remains limited, with over 91% of enterprise investments and over 88%

of public funding staying within their respective sectors.

Government R&D budget spending reached BGN 417 million in 2023, a 14% year-on-year increase.²³ This includes domestic and international R&D funded by the state budget, along with membership fees for international scientific organizations and contributions to bilateral and multilateral scientific research programs.

Three areas²⁴ dominate public funding:

- “General development of knowledge: R&D funded from other sources” (35%, BGN 144 million), primarily funding the Bulgarian Academy of Sciences and international scientific collaborations.
- “Development of agriculture, forestry and fishing” (19%, BGN 79 million), mainly allocated to the Agricultural Academy via the Ministry of Agriculture and Food.
- Public university scientific activities (14%).

The “Production, storage, distribution and use of energy” budget saw the largest growth in 2023 (over three-fold), followed by “Environment”

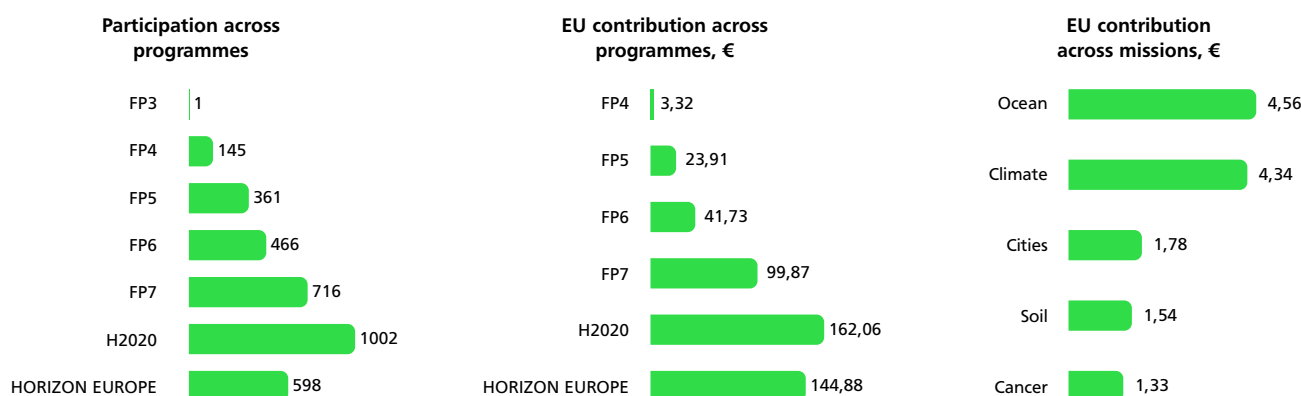
(doubling). However, both remain under 1% of total R&D budget spending. “Healthcare Development” experienced a nearly 5% funding decrease, and higher education institution funding declined by under 1%. The “Education” sector continues to receive only 1% of total R&D resources.

Participation in European framework programmes

Bulgaria’s participation in the EU Framework Programmes began with the Third Framework Programme. The experience and partnerships gained have contributed to **significant growth** in both the number of Bulgarian projects and the funding secured in subsequent programs: more than doubling in FP5, increasing by 54% in FP7, and growing by 40% in Horizon 2020.

While Bulgaria ranks low among EU member states (20th to 23rd) in the number of projects and funding received through Framework Programmes, including the SME Instrument, Seal of Excellence, and EIC Pilot, its **performance is considerably stronger when adjusted for popula-**

FIGURE 24. BULGARIAN PARTICIPATION IN EU FRAMEWORK PROGRAMMES



Source: <https://dashboard.tech.ec.europa.eu/>

²³ Comprehensive study covering all ministries and departments (primary R&D budget spenders).

²⁴ According to the NABS 2007 nomenclature.

tion. On a per capita basis, Bulgaria ranks fourth in FP participation.

As of mid-2024, 530 Bulgarian organizations (285 unique participants) are involved in 349 successful Horizon Europe projects, **securing €201.3 million in funding**. These projects span the program’s priorities as follows:

- Global Challenges and European Industrial Competitiveness: 347 projects
- Excellent Science: 87 projects
- Innovative Europe: 51 projects
- Widening Participation and Strengthening the European Research Area: 45 projects.

Sofia University leads Bulgarian participation in Horizon Europe with 21 successful projects and the

most coordinating roles (3 of the 28 Bulgarian-coordinated projects).

Among participating organizations, **the private sector leads** with 108 representatives, followed by research organizations (46), public bodies (38), and higher education institutions (32). An additional 61 organizations of diverse types also participate. The classification of Bulgarian Academy of Sciences (BAS) institutes as either research organizations or higher education institutions makes the official data for these two groups tentative.

Bulgarian organizations primarily **focus on Coordination and Support Actions (CSAs)**, which foster cooperation between EU and associated

countries to strengthen the European Research Area. These actions encompass standardization, dissemination, awareness-raising, communication and networking, policy dialogues, mutual learning, and studies. The 162 successful CSA projects receive up to 100% EU funding.

Following CSAs, **Research and Innovation Actions (RIAs) represent the next most common project type**, with 154 projects focused on generating new knowledge or exploring new/improved technologies, products, processes, services, or solutions. RIA projects also receive up to 100% EU funding. Businesses primarily engage in Innovation Actions (IAs), developing plans and designs for new/improved offerings, including prototyping, testing, demonstrating, piloting, large-scale validation, and market replication. IA projects receive up to 70% EU funding, with Bulgarian participants involved in 128 successful projects. The COFUND program, supporting European partnerships between public and private partners, has seen 14 Bulgarian projects, with EU funding covering 30-70% of project costs.

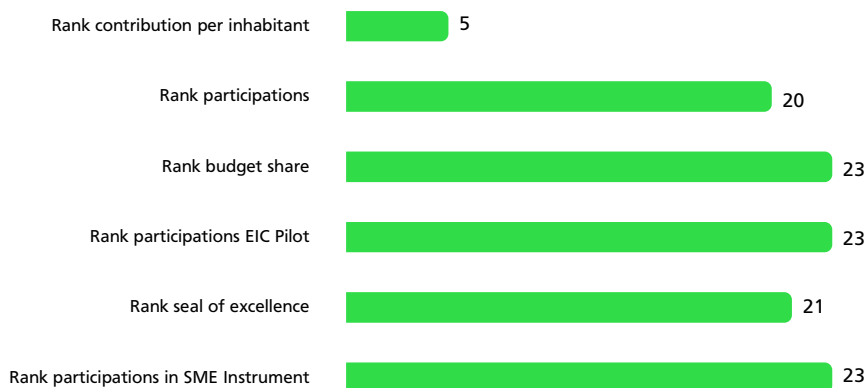
Higher education institutions and research organizations have **concentrated on the following scientific domains** within Horizon Europe:

- Social Sciences: 79 projects
- Natural Sciences: 69 projects
- Engineering and Technology: 37 projects
- Agricultural Sciences: 25 projects
- Medical and Health Sciences: 13 projects
- Humanities: 7 projects.

COST (European Cooperation in Science and Technology)

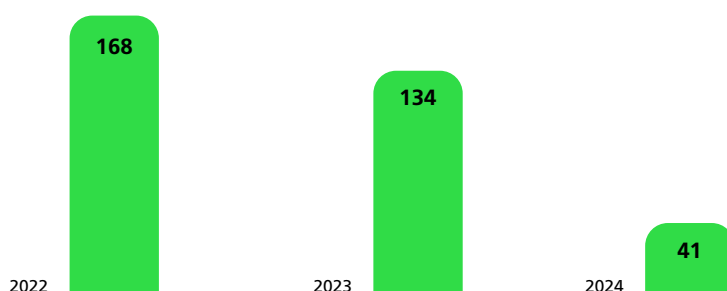
Bulgaria has participated in COST since 1999. The National Science Fund manages national co-financing for Bulgarian teams in COST actions, promoting full participation

FIGURE 25. RANKING OF BULGARIA COMPARED TO EU MEMBER STATES



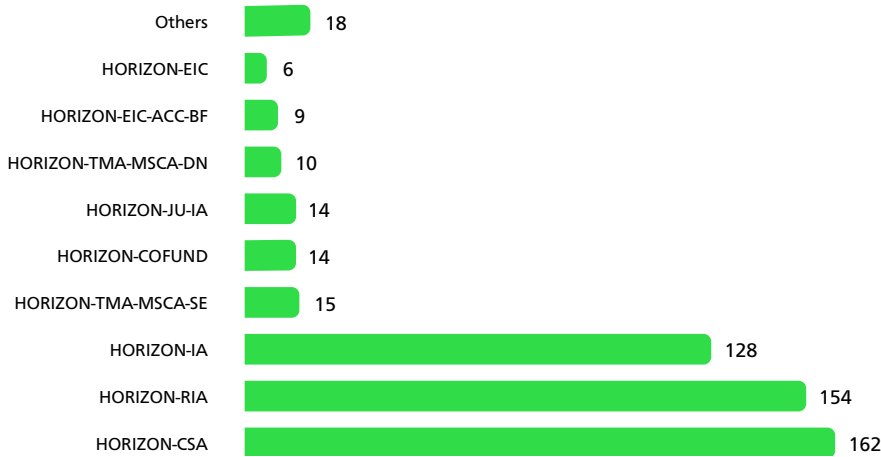
Source: <https://dashboard.tech.ec.europa.eu/>

FIGURE 26. PARTICIPATION OF BULGARIAN ORGANISATIONS IN HORIZON EUROPE, NUMBER OF SIGNED AGREEMENTS



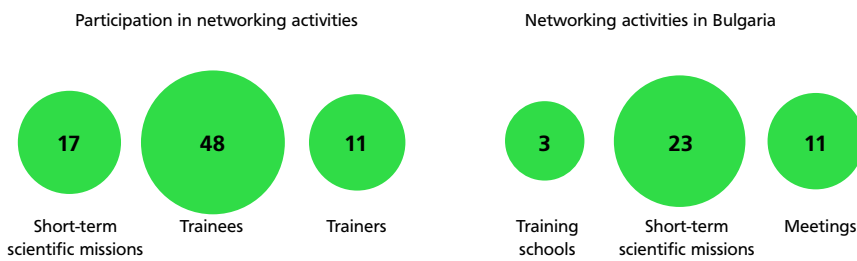
Source: <https://dashboard.tech.ec.europa.eu/>

FIGURE 27. PORTFOLIOS OF PROJECTS WITH BULGARIAN PARTICIPATION IN HORIZON EUROPE PER INSTRUMENT



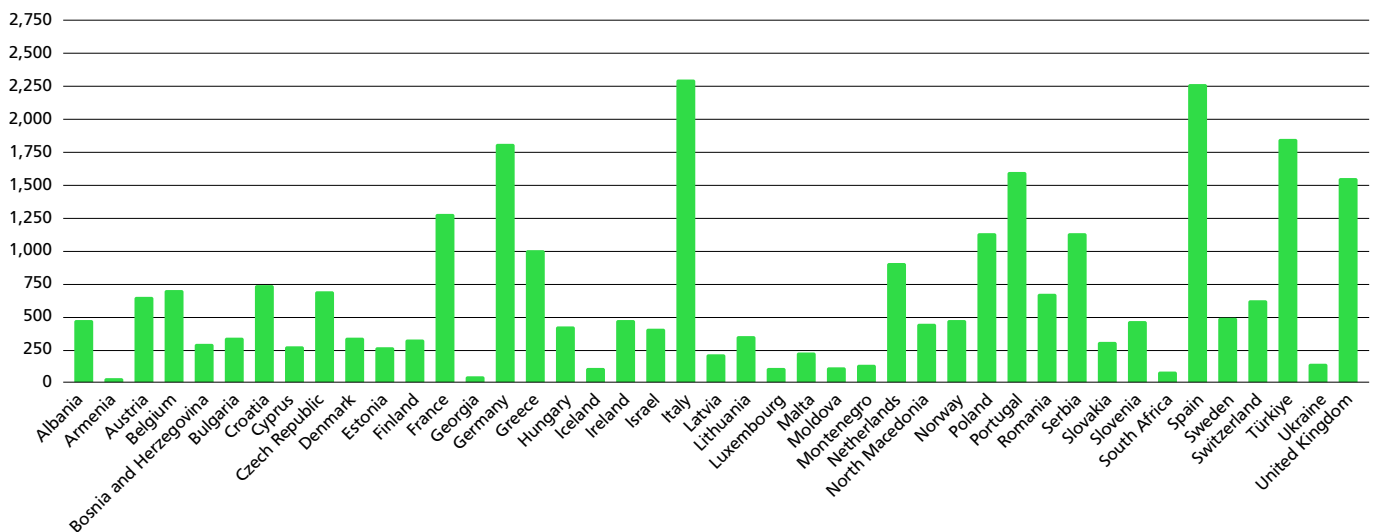
Source: <https://dashboard.tech.ec.europa.eu/>

FIGURE 28. PARTICIPATION OF BULGARIAN SCIENTISTS IN COST ACTIONS, 2023



Source: www.cost.eu/about/members/bulgaria/

FIGURE 29. PARTICIPATION IN ALL COST ACTIONS BY COUNTRY, 2023



Source: www.cost.eu/about/members/bulgaria/

and strengthening the Bulgarian academic community's presence. Eligible beneficiaries are accredited higher education institutions and scientific organizations.

National co-financing supports scientific activities within specific COST actions led by Bulgarian Management Committee (MC) members, not coordination activities. Funding is capped at BGN 25,000 annually per project, with a maximum two-year term and BGN 50,000 total funding.

In 2023, Bulgaria received €381,688.57 for participation in COST actions.

Bulgarian scientists have chaired five COST actions and held leadership positions in 19 others, participating in a total of 969 COST actions.

Following 13% annual growth in 2019, Bulgarian participation in COST actions has stabilized between 77% and 81% (80% in 2023). Similarly, leadership roles remained relatively constant from 2018 to 2021 (14-16 Bulgarian-led actions), increasing to 19 in both 2022 and 2023.

Women are more represented than men in Bulgarian COST participation. In Bulgarian-led actions, 15 participants are women (80%) and 4 are men, including 2 young researchers. In working groups, there are 435 women (61%) and 282 men, with a total of 174 young scientists.

Eureka initiative

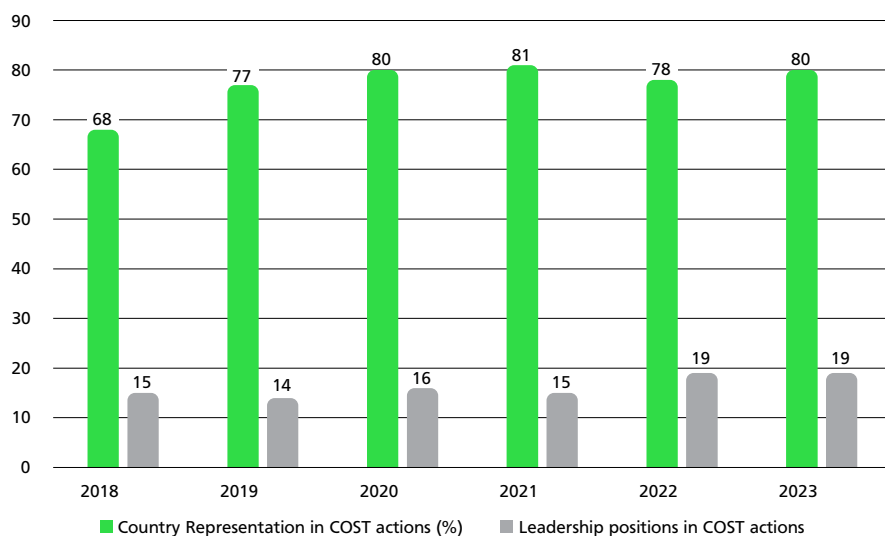
The Eureka initiative is a pan-European network supporting market-driven R&D in industry, fostering international cooperation, innovation networks, and the commercialization of R&D results.

Bulgaria joined Eureka and the Eurostars joint program in July 2009, tasking the Executive Agency for the Promotion of Small and Medium-sized Enterprises with coordination. Funding for Bulgarian participants comes from the National Innovation Fund. Bulgaria became a full Eureka member on June 25, 2010, and signed an agreement with the Eureka Secretariat for Eurostars-2 participation on December 30, 2015. The Executive Agency also coordinates Eurostars activities.

Eureka implementation in Bulgaria focuses on three areas:

- **Individual Projects:** Partnerships of at least two organizations from different member countries, with an SME as the lead partner.
- **Clusters:** Sector-specific projects often built around a large enterprise, with significant SME participation (around 40% of partners).
- **Eurostars Program:** A joint Eureka and European Commission initiative (under FP7) providing joint national and European

FIGURE 30. PARTICIPATION OF BULGARIA IN COST ACTIONS, 2018-2023



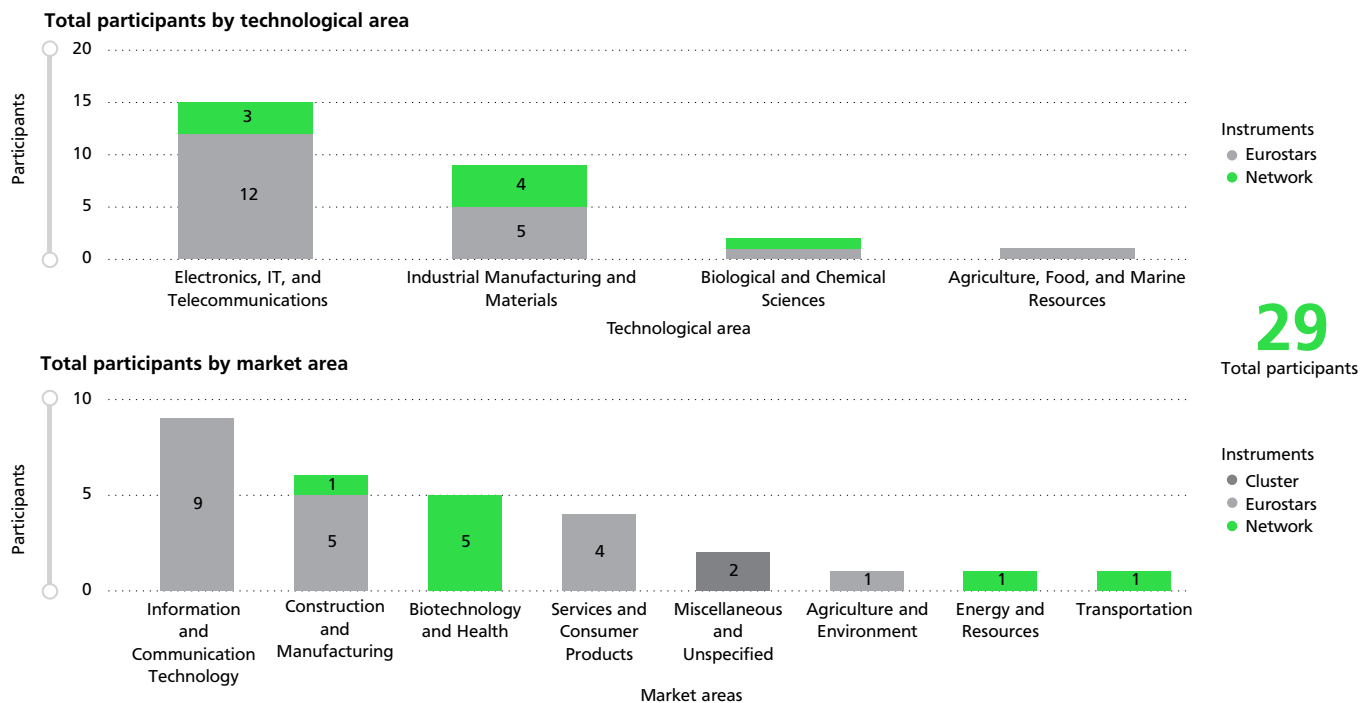
Source: www.cost.eu/about/members/bulgaria/

TABLE 5. COST ACTIONS CHAIRED BY BULGARIAN SCIENTISTS, 2023

Name of the COST Action	Affiliation of Bulgarian scientists
CA22136 – Pan-European Network of Green Deal Agriculture and Forestry Earth Observation Science (PANGEOS)	Space Research and Technology Institute – Bulgarian Academy of Sciences
IC1303 – Algorithms, Architectures and Platforms for Enhanced Living Environments (AAPELE)	New Bulgarian University
ES1206 – Advanced Global Navigation Satellite Systems tropospheric products for monitoring severe weather events and climate (GNSS4SWEC)	Sofia University
FA0904 – Eco-sustainable food packaging based on polymer nanomaterials	Institute of Mechanics at the Bulgarian Academy of Sciences
727 – Measuring and forecasting atmospheric icing structures	National Institute of Meteorology and Hydrology

Source: www.cost.eu/about/members/bulgaria/

FIGURE 31. PARTICIPATION OF BULGARIAN ORGANISATIONS IN THE EUREKA INITIATIVE, PROJECT PORTFOLIO BY TECHNOLOGY AND MARKET AREAS



Source: eurekanetwork.org

TABLE 6. FUNDED PROJECTS WITH BULGARIAN PARTICIPATION UNDER THE CLUSTERS PILLAR OF EUREKA

Year	Project Acronym	Total Project Cost (€ mln)	Participant type	Participant organisation name
2017	SPEAR	309	Research / University	Technical University of Sofia (TUS)
2017	SPEAR	309	SME	Badestnost JSC

Source: eurekanetwork.org

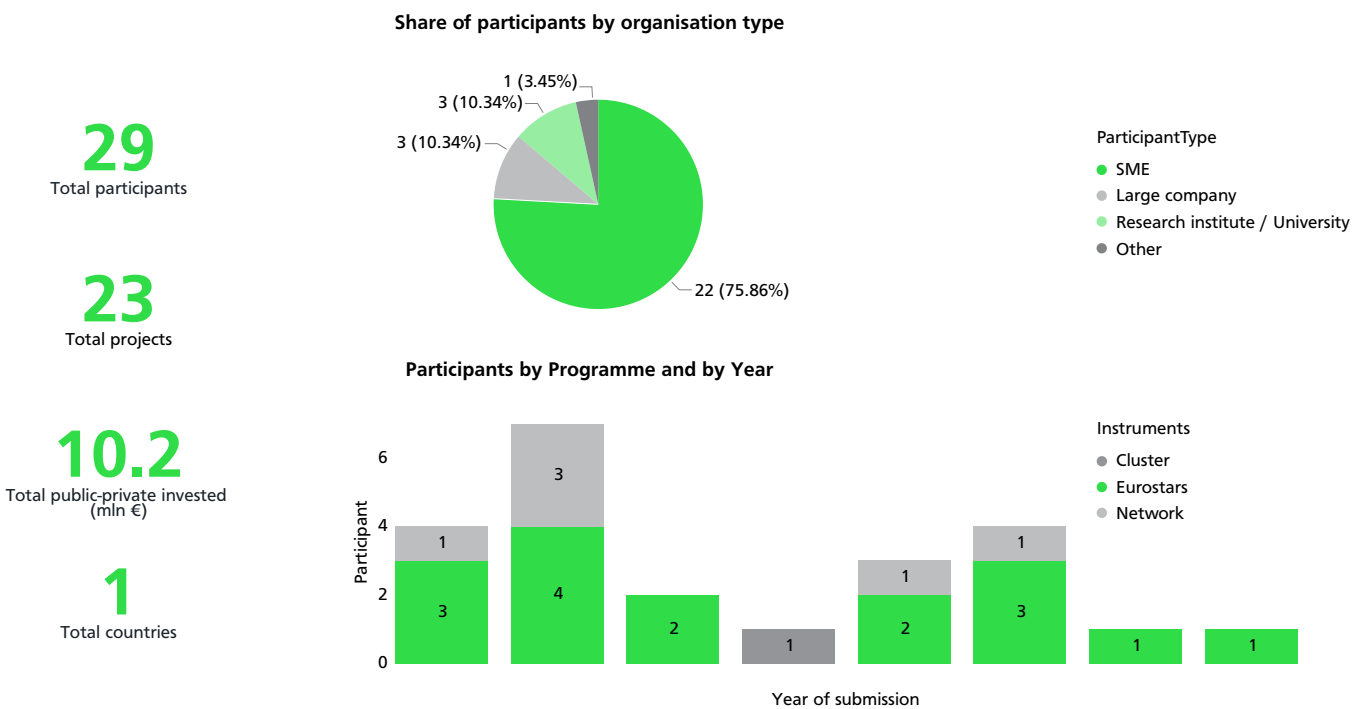
funding for international high-tech projects. Eurostars requires at least two entities from different member countries, an R&D-performing SME as the lead partner, a balanced consortium (no participant exceeding 70% of total costs), and at least 50% SME participation in R&D activities. The resulting product must be implemented within two years of project completion. Eurostars projects last up to 36

months, with an annual budget of at least €500,000. Maximum grant funding for a Bulgarian participant is €100,000.

The Eurostars-2 program facilitates joint national and European funding for international research projects. Its public budget for 2014-2020 was €400 million, with €100 million from the European Commission and the remaining €300 million from member state national budgets.

The Technical University of Sofia is involved in three Eureka projects across two instruments: clusters and individual projects. It is also the sole representative of Bulgarian research organizations (higher education institutions and academic units) participating in Eureka. Aside from the Technical University of Sofia and two large companies (Sirma and Ontotext), the other beneficiaries are SMEs.

FIGURE 32. PROJECT PORTFOLIO OF BULGARIAN ORGANISATIONS IN EUREKA BY ORGANISATION TYPE AND YEAR OF SUBMISSION



Source: eurekanetwork.org

Human capital for innovation

R&D personnel, along with those in scientific and technological activities, constitute the human resources directly involved in creating, applying, and disseminating new knowledge within the economy. Employment in high-tech sectors indicates a country's specialization in industries with significant innovation activity.

In 2023, just over 35,000 people were employed in R&D. **Businesses account for the largest share of R&D jobs** (nearly 46%), followed by higher education institutions (29%) and scientific organizations (25%).

On a yearly basis, **the number of R&D personnel has declined by nearly 2,000 people (5%)**. While the overall trend over the past twenty years has been gradual growth, annual fluctuations make it difficult to determine whether this recent decline is a temporary setback or the start of a negative trend.

Institutional sectors respond differently to the political crisis and business uncertainty when it comes to staffing. **The largest outflow of R&D employees is in the enterprise sector**, where **2,273 people (over 12%)** have left. The impact is most

pronounced in **small and medium-sized enterprises (SMEs)**, while large businesses remain largely unaffected. **Nearly all economic sectors have experienced losses**, with manufacturing being hit hardest, shedding nearly 1,500 employees, followed by real estate, finance and insurance, transport, storage, and postal services.

The **public sector has seen only a minimal decrease (173 people)**, which has been offset by the 530 new researchers hired in higher education—despite the Ministry of Education and Science's initiative to merge institutions.

The **higher education sector has the most balanced regional distribution** of R&D personnel:

- Southwest Planning Region – 35% concentration.

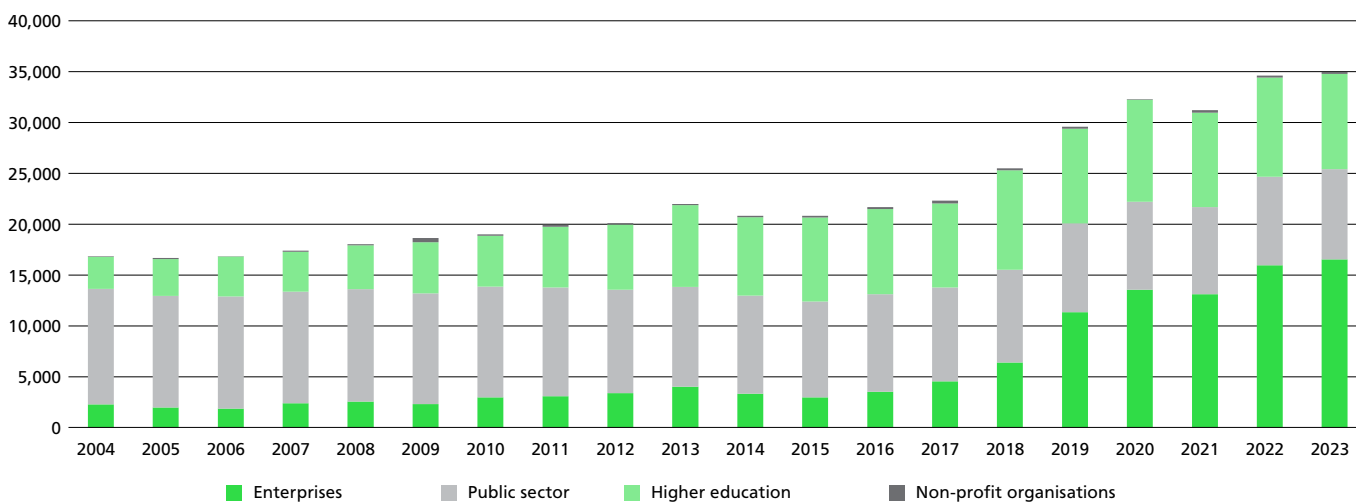
- South Central Planning Region – 20%.
- Southeast Planning Region – 19%.

In contrast, **research organizations are highly concentrated in Sofia**, where 76% of all researchers are based. In other regions, the share of researchers ranges between 3% and 7%, primarily due to the Agricultural Academy's regional structures.

The **highest concentration of business-sector R&D personnel is in Sofia (65%)** and Plovdiv, driven by high-tech enterprises and the well-developed industrial zones nearby.

In terms of R&D personnel as a share of the labor force, **Bulgaria (0.91%) ranks ahead of several newer EU member states** (Cyprus, Latvia, Malta, Slovakia, and Romania) as well

FIGURE 33. NUMBER OF R&D PERSONNEL, BY INSTITUTIONAL SECTOR, 2004-2023



Source: NSI, 2024.

as Serbia and Turkey. However, it remains well below the European average (1.53%).

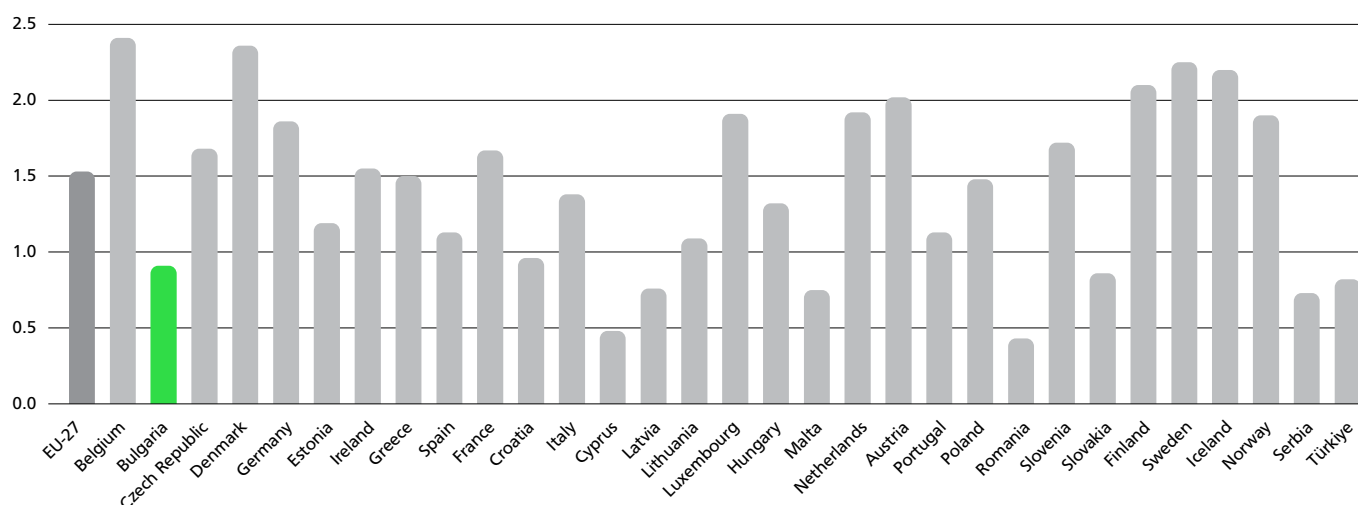
Scandinavian countries, which lead in innovation, have over 2% of their workforce engaged in R&D, demonstrating the critical role of human resources in technological advancement and innovation. In 2022, Belgium (2.41%) and Denmark (2.36%) led the EU by this measure.

Higher education institutions continue to offer a favorable environment and strong career development opportunities for young scientists. The ability to teach and study abroad, increasing capacity for international projects, and growing collaboration with businesses have made universities an increasingly attractive choice for academic careers. In 2024, competitive salaries, following faculty pay adjustments, further

contribute to this trend, which has been strengthening for the past twenty years.

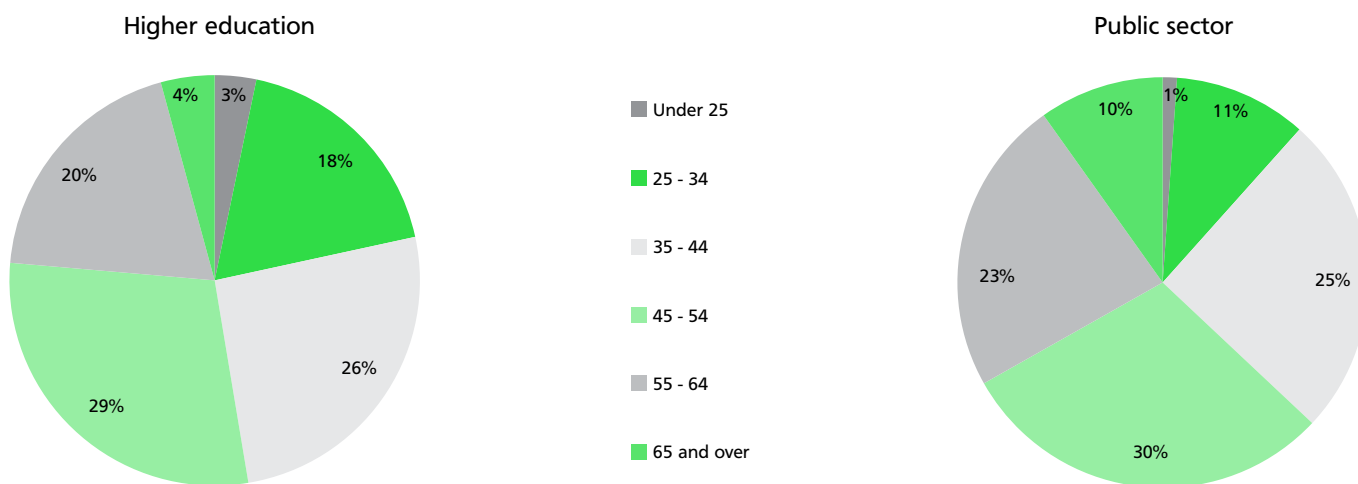
When assessing an economy's innovation potential, it is not only the human resources directly engaged in R&D that matter but also the **digital skills** that drive the adoption of information and communication technologies (ICT) in business, society, and overall quality of life. In this regard, **Bulgaria's development**

FIGURE 34. NUMBER OF R&D STAFF COMPARED TO THE TOTAL LABOUR FORCE, 2022, %



Source: Eurostat, 2024.

FIGURE 35. RESEARCHERS IN THE PUBLIC AND HIGHER EDUCATION SECTORS, BY AGE GROUP 2023, %



Source: NSI, 2024.

opportunities far exceed its current achievements.

Data on progress toward the EU's 2030 digitalization goals **highlights significant gaps:**

- **Basic digital skills:** Only 36% of Bulgaria's population has basic digital literacy, ahead only of Romania (28%). By contrast, Finland leads at 83%, with the EU average at 56%.
- **Above-basic digital skills:** Just 8% of Bulgarians possess advanced digital skills, ranking last in the EU, behind Romania (9%). The Netherlands leads at 55%, with the EU average at 27%.
- **E-government users:** Bulgaria ranks second to last (35%), ahead of only Romania (25%). Denmark leads at 99%, while the EU average is 75%.
- **ICT training in enterprises:** Bulgaria and Romania share the last place (9%), compared to Finland's 40% and the EU average of 22%.

- **SMEs with basic digital intensity:** Bulgaria (28%) is again just ahead of Romania (27%), while Finland leads at 86%, demonstrating how stronger digital skills correlate with higher business competitiveness.
- **A more positive development** is Bulgaria's position in ICT graduates and ICT specialists, where it aligns with the EU average of 5%.

Bulgaria **dropped three places** in the **IMD World Talent Ranking (61st out of 67 countries)**, making it **the lowest-ranked EU member state**, nearly **10 positions** below the next-lowest country. The ranking assesses talent in **three key areas:**

1. Investment & Development

(Public investment in education, workforce development, apprenticeships, and healthcare quality)

- Bulgaria saw its largest decline in this category, dropping five positions to 47th.

- Strengths: Female employment, Weaknesses: Lack of apprenticeships, limited on-the-job training.

2. Attraction

(Ability to attract and retain high-skilled talent, impact of brain drain, business investment in talent, worker motivation, security, and property rights)

- Bulgaria fell three places to 63rd.
- Weaknesses: Talent attraction strategies, employee motivation, brain drain, quality of life, perceptions of fairness.

3. Development

(Education system's ability to meet labor market demands, workforce skills, language proficiency, and student mobility)

- Bulgaria ranks 66th, second-to-last globally, with a four-position drop.
- Weaknesses: Low education quality, inadequate workforce skills, poor alignment of education with economic needs, lack of qualified professionals.

Information and communication technologies and artificial intelligence

Information and communication technologies (ICT) and artificial intelligence (AI) are key drivers of innovation and economic growth. Over the past two decades, the scope of ICT has expanded significantly, now encompassing automation, integration of manufacturing processes, and enhancements in cognitive capabilities for both employees and customers. AI is rapidly evolving from a specialized technology to a general-purpose tool—increasingly accessible and affordable. It is now embedded in a wide range of software-as-a-service (SaaS) solutions, enabling its application across various sectors, industries, and management levels. As a result, “digital technologies” is increasingly used as a broader, overarching concept.

Digitisation

In the **Digital Decade policy programme** dashboard, which evaluates Europe’s performance across four key digital dimensions, **Bulgaria ranks seventh** in the development of **public digital services for businesses**. This places it **ahead of many traditionally stronger economies**, including Germany, France, Austria, Spain, the Netherlands, Greece, Romania, and Hungary.

While **Bulgaria’s digital services are more mobile-friendly** than the EU average, its **performance is weaker in user assistance, transparency, and personal data protection**—ranking seventh from the bottom. Additionally, in the **development of**

public services for citizens, Bulgaria lags behind most EU countries, ranking only ahead of Croatia, Poland, and Romania.

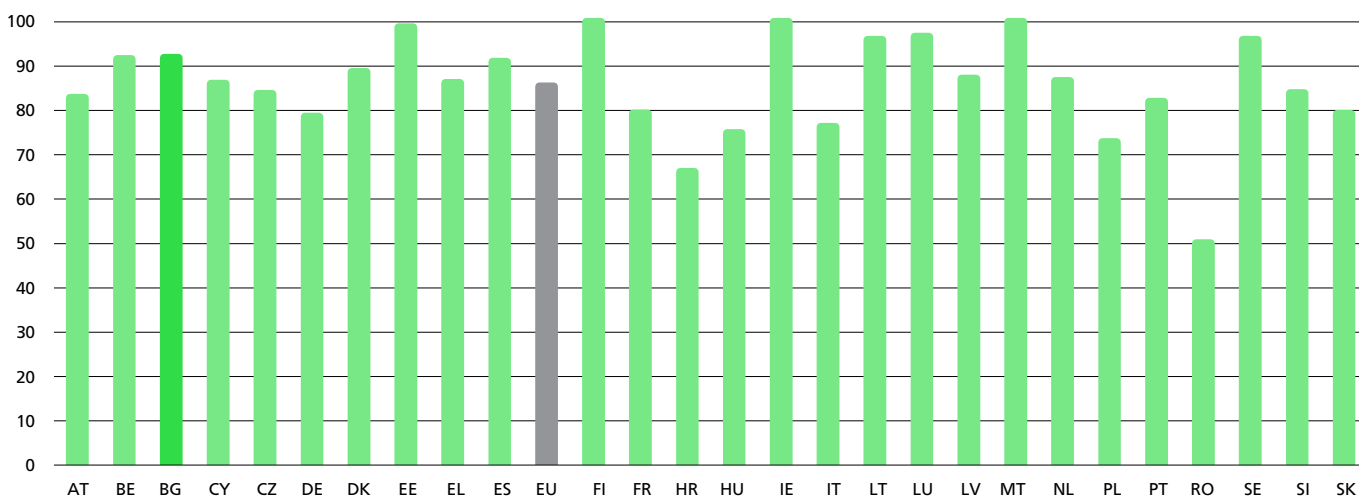
Although **qualified electronic signatures** enable access to public digital services for citizens across all sub-areas of the assessment dashboard, **service availability remains uneven**. For instance, **cross-border access**—allowing non-residents or foreign citizens with residence rights to use e-services—**rarely functions effectively**. Additionally, **smaller municipalities often do not offer electronic services at all**. Moreover, **relocating between administrative areas**, a key consideration in foresight exercises like the ForeTech project, still **requires**

significant in-person interactions, limiting the effectiveness of digital services in streamlining public administration.

Banks play a key role in accelerating the development of public digital services by offering non-banking services that require user identification. For example, many banks have adopted Eurotrust Technologies JSC’s technology, which enables **remote digital identification** through ID card verification and facial recognition.

One of the main reasons why **digital services for businesses are more advanced** than those for citizens is that most business-related services are provided by

FIGURE 36. LEVEL OF DEVELOPMENT OF PUBLIC DIGITAL SERVICES FOR BUSINESS



Source: DESI 2024.

Box 4. EARLY FORECASTING OF THE DEVELOPMENT OF PUBLIC DIGITAL SERVICES IN BULGARIA THROUGH FORESIGHT

The **Applied Research and Communications Fund** pioneered the **foresight methodology** in Bulgaria through the **ForeTech project in 2002**. This initiative developed **scenarios for the future of public administration services** at both the central and local levels, with a 2015 horizon.

Key stakeholders from various sectors participated in shaping these scenarios, **fostering consensus and confidence** in the **development of public digital services**. The **strong IT sector** played a crucial role in driving the **most impactful digital services for businesses and citizens**.

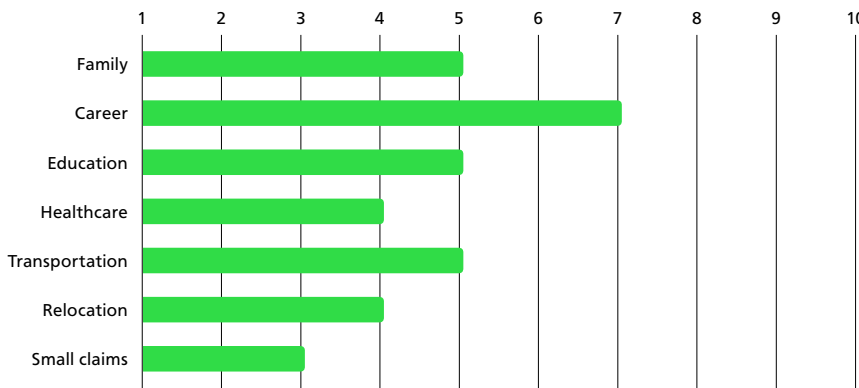
Additionally, **anti-corruption reforms**, regulatory innovations related to **electronic documents and signatures**, and the **registry reform**—actively supported by **ARC Fund**—further accelerated the expansion of **e-services**.

Source: Applied Research and Communications Fund.

central administrations at the national level. In contrast, smaller local administrations, which primarily serve citizens, often lack the expertise and financial capacity to develop and maintain digital services. Additionally, **citizen services tend to be more complex**, requiring **coordination across multiple institutions**. For example, recognizing a foreign diploma involves several entities, including a public university, a sworn translator, a notary, the National Centre for Information and Documentation, the Ministry of Education and Science, and a consulate or embassy. This complexity makes digitization far more challenging compared to business services.

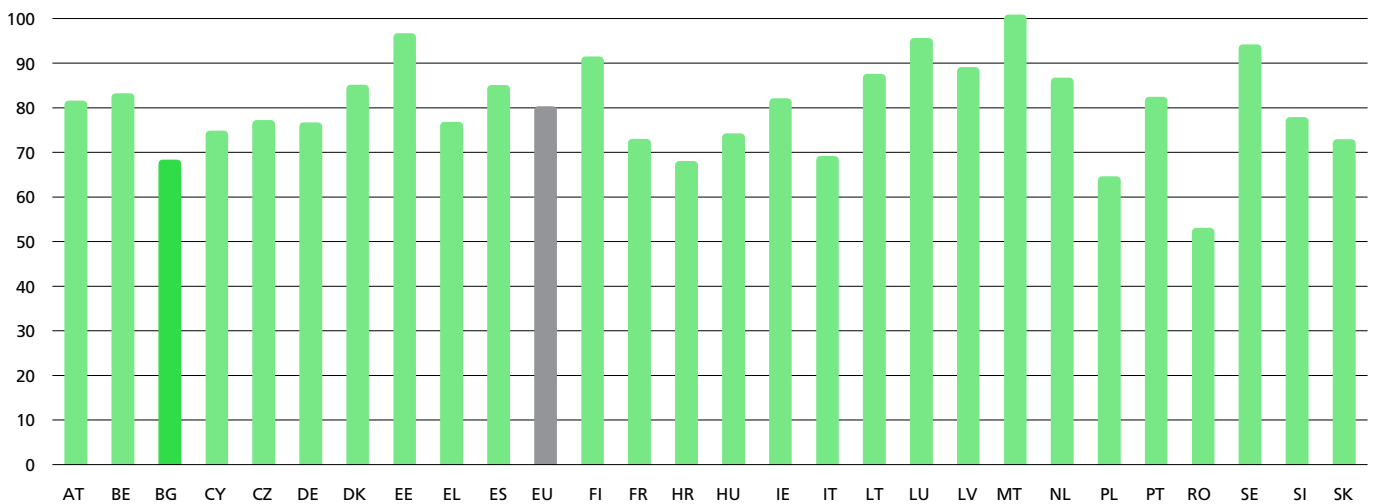
Like other EU citizens, **Bulgarians rank public technologies as the second most important aspect of digitalization**, after socializing (maintaining connections with family, friends, and professional networks). However, **transportation** is the only area where EU citizens, on average, value digitalization more than Bulgarians—likely due to better-developed transport links and higher mobility in smaller settlements across the EU.

FIGURE 37. COMPONENTS OF PUBLIC DIGITAL SERVICES FOR CITIZENS



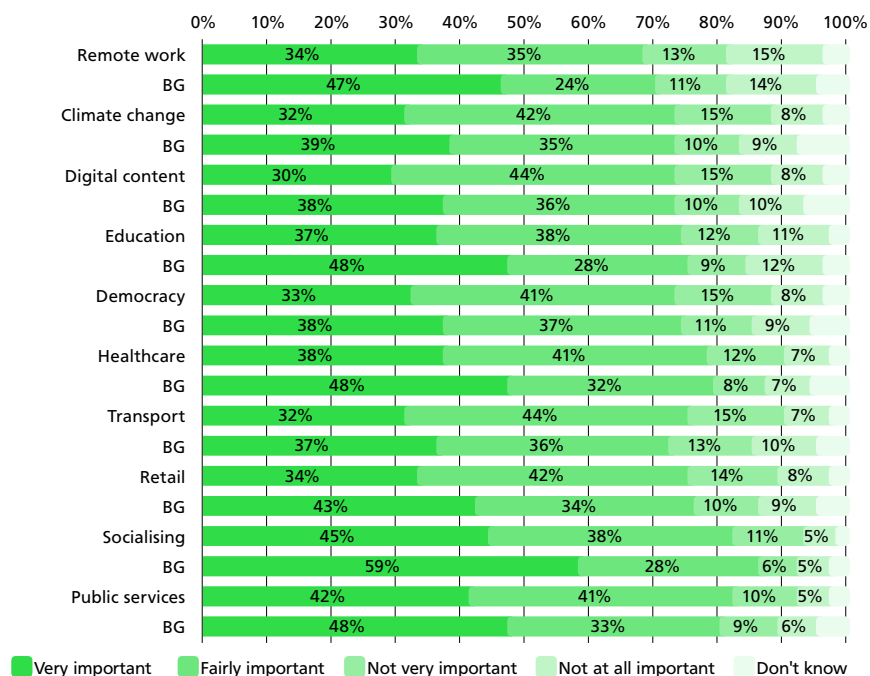
Source: Expert assessment, Applied Research and Communications Fund.

FIGURE 38. LEVEL OF DEVELOPMENT OF PUBLIC DIGITAL SERVICES FOR CITIZENS



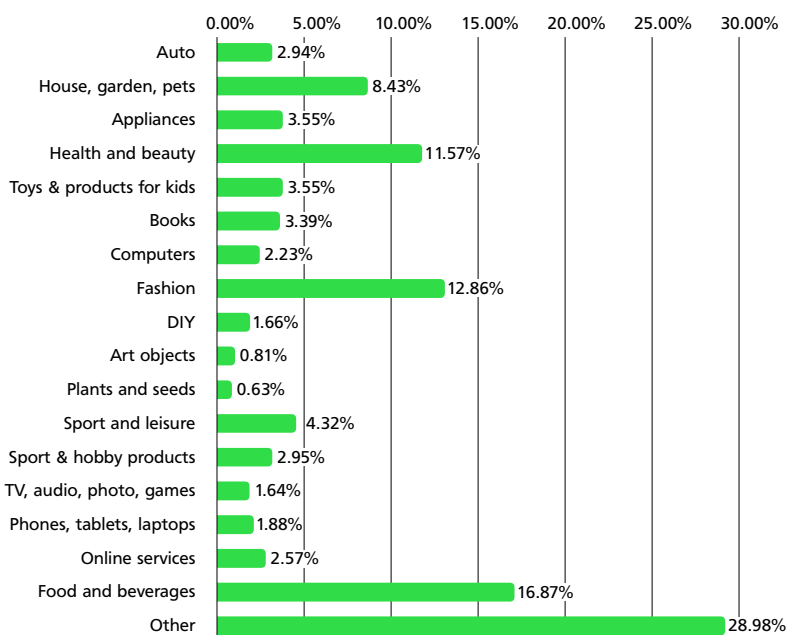
Source: DESI 2024.

FIGURE 39. COMPARISON OF THE IMPORTANCE TO BULGARIANS OF DIGITAL TECHNOLOGIES IN 2030 COMPARED TO THE EU AVERAGE²⁸



Source: Digital Decade, 2024. Fieldwork was done during the period March-April 2024.

FIGURE 40. SHARE OF E-STORES THAT SELL RESPECTIVE GROUPS OF GOODS/SERVICES



Source: NRA Register, October 2024.

While the majority of Bulgarians view digitalization as a convenience, 16% believe it has made their lives more difficult. Encouragingly, this figure is lower than the EU average of 23%. Countries with the highest share of people struggling with digitalization include Romania (34%), France (32%), Italy (26%), Germany (25%; rising to 30% in eastern Germany), and Austria (25%).

Electronic commerce

Approximately 31,000 electronic stores registered with the National Revenue Agency (NRA) operate in Bulgaria. Registration is mandatory for all retailers (both legal entities and individuals) who are required to issue receipts, regardless of whether they sell through their own website, domain, or IP address, or via platforms like Amazon, eBay, eMag, or social networks such as Facebook and Instagram. The only exception applies to sellers who exclusively accept payments via bank transfer or cash on delivery through a licensed postal operator, such as a postal money order.

These 31,000 electronic stores are operated by approximately 19,500 legal entities and 160 individuals. Around 20 retailers have 20 or more registered stores, primarily hotels, villas, and tour operators. However, the NRA registry appears to lack verification for errors or proper store links. Some stores list only their hosting provider or e-commerce platform (software-as-a-service), while others consistently misreport their domain information.

Most e-commerce stores (29%) fall under the "other" category, which includes accommodations and retailers selling via Amazon, eBay, Etsy, and similar platforms. Accommodation services (Booking, Airbnb, etc.) accounted for 36% of online purchases in 2023, with transactions from about 1,700 registered retailers (NSI data).

²⁸ Data for the average values for the EU, including Bulgaria, are given in the row with the area of impact, and the values for Bulgaria are given below them and marked with BG.

Food and beverages rank among the most popular e-commerce categories (17% of online stores), including orders through Glovo, Takeaway, Amazon, or direct-to-consumer sales via their own websites. In 2023, 27% of consumers placed at least one order in this category. **Clothing and footwear** lead in purchase frequency (78% of consumers, per NSI data for 2023), followed by cosmetics, beauty, and health products (over 30%). Some 12–13% of online stores specialize in **fashion (clothing and accessories), health, and beauty**.

According to public statements by eMag, the platform works with approximately **9,000 retailers in Bulgaria**.²⁶ However, only **1,300 sellers** are officially registered in the **NRA database** as using eMag. Some retailers, whose stores are built with integration-friendly technologies like Seliton, list the other platform instead—Seliton alone has registered 200 stores. The most popular sales platform is Grabo, with 1,900 sellers, while similar platforms like Rio, deals.bg, and others are also gaining traction.

The number of **Bulgarian stores targeting international B2C markets** is steadily increasing:

- **Etsy:** Around 500 merchants, many of whom have another primary job (including as employees).
- **Amazon & eBay:** A comparable number of Bulgarian sellers, with some strong dropshipping businesses,²⁷ but the majority focus on exporting local products.

Bulgarian businesses responded to COVID-19 by introducing **organizational innovations** such as **remote work, online sales, and deliveries**.

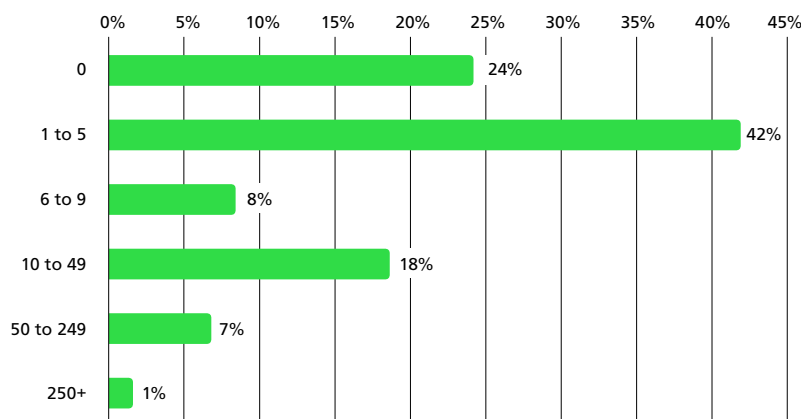


²⁶ Razvan Blanita, "eMAG Marketplace sellers in three countries registered 23% more orders than last year," *Dnevnik*, 28 June 2024.

²⁷ An e-commerce business model in which the merchant does not keep stock – neither in his own nor in a fulfilment centre (a delivery fulfilment centre supported by freight forwarders) at his expense, and when he receives an order and payment through the e-store, he in turn orders at manufacturer or wholesaler who ships the order directly to the customer and labels the order on behalf of the merchant who received the order.

²⁸ Pergelova, A., & Yordanova, D. (2024). The human element in digital transformation: The role of talent management for SMEs. *Journal of the International Council for Small Business*, 1-15. <https://doi.org/10.1080/26437015.2024.240417>.

FIGURE 41. SHARE OF E-SHOPS IN RELATION TO THE SIZE OF THE COMPANIES – OWNERS/OPERATORS



Source: Register of the NRA, October 2024 and NSSI, average for the first three quarters.

The **rise of generative AI** has further pushed many SMEs to develop digital transformation strategies and adopt new information and communication technologies (ICT).

The **government has allocated EU funding for smart digital transformation**, supporting businesses through:

- **Voucher schemes** to improve staff digital skills.
- **IT solutions for competitiveness**, including development and localization.

However, a digital strategy alone is not enough for improved organizational performance.²⁸ Without **integrated talent management practices**, SMEs struggle to enhance **agility and long-term competitiveness**.

Artificial intelligence is being integrated into businesses **through various channels and for diverse purposes**:

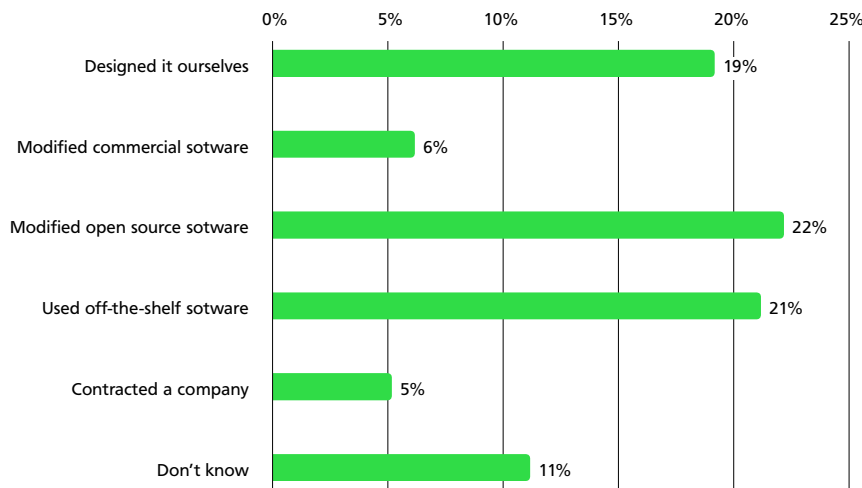
- **AI Software & Services:** About **21% of companies** have adopted AI-powered software or services, including:
- **Directly recognizable AI:** ChatGPT, Copilot, IBM Watson, Midjourney, Suno.
- **Indirect AI integration:** Canva, Adobe Creative Cloud.
- **Embedded AI solutions:** Releva.ai (used by large Bulgarian e-stores like ebag and Ardes).
- **AI E-commerce Integrations:** Available for platforms like Magento, OpenCart, Shopify, as well as Bulgarian solutions Gombashop and Cloudcart.

The growing penetration of **generative AI** is **transforming business operations** by enabling:

- **AI-mediated communication:** Employees increasingly rely on ChatGPT for writing emails or gauging mood analysis to adjust their communication approach.
- **Automated administrative processes:** AI is frequently used for drafting documents, including public procurement applications.

Some 22% of Bulgarian companies have **modified open-source software**, mainly through AI-enhanced

FIGURE 42. AI ENTRY CHANNELS INTO BULGARIAN ENTERPRISES



Source: Ma (2024).

how their company uses AI.²⁹

Understanding of what AI is, how it is implemented, and its impact remains uncertain and often confused. Many businesses still see AI as a trendy concept rather than a strategic necessity. Given these **varying perceptions**, future research should focus on qualitative studies exploring different AI applications rather than relying solely on standard surveys measuring technology adoption.

A relatively high **19% of companies** reported that they **“designed AI themselves”** (Figure 42). However, this does not indicate that small businesses are competing with major AI developers. Instead, it reflects the **custom development of data analysis algorithms** using tools like Jupyter, R, or Python.³⁰ These tools offer:

- A **user-friendly environment for testing machine-learning algorithms**—even for students in economics, rather than computer science.
- Interactive dashboards for better **data visualization and decision-making**.
- The ability to **apply self-learning algorithms to real business data** for more informed decision-making.

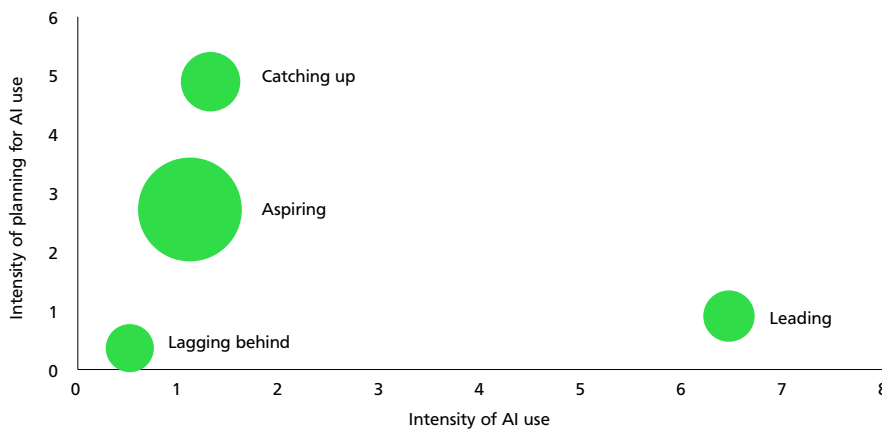
plugins as part of their digital transformation. A common case is **AI-powered SEO optimization**, where WordPress-based websites and e-shops integrate plugins to analyze content, user behavior, and improve **search rankings, recommendation systems, and chatbot functionality**.

At the end of 2023 and early 2024, many Bulgarian businesses

experimented with **AI-generated content plugins** (for blogs and product descriptions). However, with Google’s upcoming crackdown on low-quality AI-generated content, this trend is expected to shift toward higher-quality AI-powered software and services.

A survey revealed that **one in ten respondents (10%) did not know**

FIGURE 43. UNDERSTANDING, USING, AND PLANNING FOR AI IN BUSINESS*



* The size of the circles illustrates the degree of understanding of AI as self-reported by firms. The abscissa and ordinate are the index of AI use and planning (number of different types and functions). The centres of the circles are the average values for the firms in the cluster.

Source: Ma (2024).

Bulgarian companies can be grouped into four categories based on their **AI usage and planning intensity**. The *leading group* demonstrates **significantly higher AI adoption**, integrating AI across **various functions and tasks** while seamlessly connecting it with other information systems. These companies have **dedicated budgets, structured business pro-**

²⁹ See Ma, 2024.

³⁰ jupyter.org is a desktop web-based programming environment with languages such as Julia, Python, and R. Python is a programming language created in 1991 and is now often recommended as a suitable first programming language, incl. for children/students. R, which is often taught in economics departments as a more powerful tool for big data visualisation and analysis, also appeared at the same time. All of these are commonly used for machine learning algorithms and various language models.

cesses, and an organizational mindset geared toward innovation—not just in AI but across all emerging technologies. As a result, they are also the **most innovative firms**. Approximately **14% of companies** fall into this category. Their **relatively lower planning intensity** is explained by the fact that they have **already implemented** what other businesses are still planning to adopt in the **short to medium term**.

Catching-up companies (23%) are **eager to implement multiple AI tools quickly** and are the most frequent **experimenters with AI (90% of the group)**, likely through trial and error until they find the right applications. Their innovation level is slightly below that of AI leaders (84% of the leaders' innovation index) but higher than the other two groups. A prime example is warehouse automation in large manufacturing and logistics companies, where machine learning and robotic data are integrated into management algorithms.

The *laggards* (41%) are the **largest group** of companies. It has the **weakest understanding of AI**, rarely uses it, and has **little to no plans for adoption**. They are the **least innovative** and often experiment with AI **out of personal curiosity rather than strategic intent**. Laggards tend to **imitate AI leaders** but with **delayed adoption of outdated technologies**. A current example is the use of rule-based chatbots (such as ChatFuel), which were popular in 2017–2018, despite the industry shift toward generative AI.

Ironically, **rushing to adopt AI can sometimes backfire**, trapping companies in obsolete technologies. A notable case is Jumpido Ltd., which won the Innovative Enterprise of the Year award in 2014 for its Kinect-based educational services. The company thrived in 2015, with sales in the US, Bulgaria, and Europe, but after Microsoft discontinued Kinect

Box 5. LEADERSHIP IN AI IN TRADITIONAL INDUSTRIES

The AI leader group also includes companies from traditional industries, such as cement production. **Zlatna Panega Cement (Titan)** played a key role in a **joint development project** with the Israeli technology company Samson Group, focusing on **AI-powered predictive maintenance** for cement plants. The resulting solution, **CemAI**, is now one of the **world's leading AI-driven maintenance systems** for the industry.

The **modelling and AI strategy** were developed entirely by the Bulgarian enterprise and its team, while Samson Group programmed and enhanced an existing business intelligence solution to meet the specific needs of the cement plant.³¹ Following its success, the solution was deployed across 13 Titan locations worldwide and implemented in four independent cement plants across Europe, Africa, the US, and Brazil.

in 2017, Jumpido was forced to shut down in 2019.

The group of *aspiring companies* (22%) is similar in size to the catching-up companies but differs in approach:

- More likely to have a dedicated development budget (27% vs. 19%).
- Less likely to have invested in data management (44% vs. 37%).

- Less likely to have the necessary processes for AI implementation (13% vs. 19%).

A key characteristic of this group is the **gap between their high confidence in AI understanding and their lack of practical applications**. However, unlike laggards, they are significantly more innovative.

AI Implementation Models by Company Type

- **Leaders:** Develop AI solutions in-house, often with **external technical assistance**, but remain the **primary drivers of innovation**.
- **Catchers-Up:** Modify **existing AI solutions** or experiment with **new, unproven services**, taking **higher risks that often pay off**.
- **Laggards & Aspiring Companies:** Prefer **off-the-shelf AI solutions** at **low cost** to minimize risk.
- **Aspiring Companies:** Will **take risks** only if a solution is **widely adopted within their professional network**, even if its **direct business benefits are unclear**.



³¹ Business intelligence is a class of software and systems for managing information (and sometimes knowledge) in enterprises. It is an upgrade over management information systems and before the development of new artificial intelligence systems. They usually connect and visualise information from different subsystems when they are not integrated into a common one – accounting, customer relationship management, marketing data, etc.



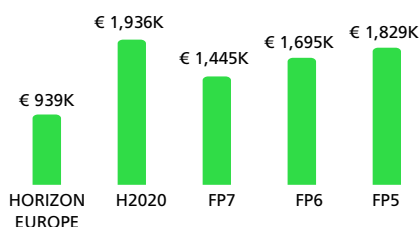
**APPLIED RESEARCH AND
COMMUNICATIONS FUND**
Innovation leader at
national and European level

The Applied Research and Communications Fund (ARC Fund) is the **premier Bulgarian research think-tank in the area of information society, innovation and technology transfer**, established in 1991. ARC Fund is one of the most successful Bulgarian organisations on the international scene in terms of fundraising and impact. It is an early adopter of technology and methodologies, and an innovator both methodologically and socially. ARC Fund attracts diverse talent who champion innovation and the safe use of new technologies (internet and mobile phones).

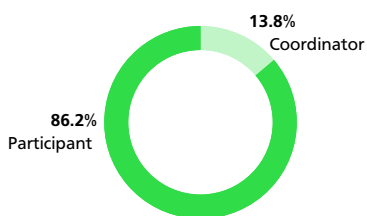
It is a pioneer in a range of fields, from internet provision and developing radio networks, to piloting foresight and technology assessments, recognised as a good practice in the EU framework programmes. The Fund has been the launchpad of many successful entrepreneurs. Through the National Innovation Forum, the European Enterprise Network, ECAbit and other initiatives, ARC Fund has helped a number of Bulgarian businesses win awards, reputation and new customers. Its activities with children have a high social value. For more than a quarter of a century, the ARC Fund has accumulated a wealth of knowledge, experience and international standing.

ARC Fund has coordinated and carried out the first pilot foresight study in Bulgaria and Romania, including in the area of e-government. Its flagship policy initiative are the *Innovation.bg* reports, which have provided for the past 20 years annual assessment of the innovation performance of the Bulgarian economy and of the current conditions and development opportunities of the national innovation system. The reports provide recommendations on the improvement of the public policy on innovation.

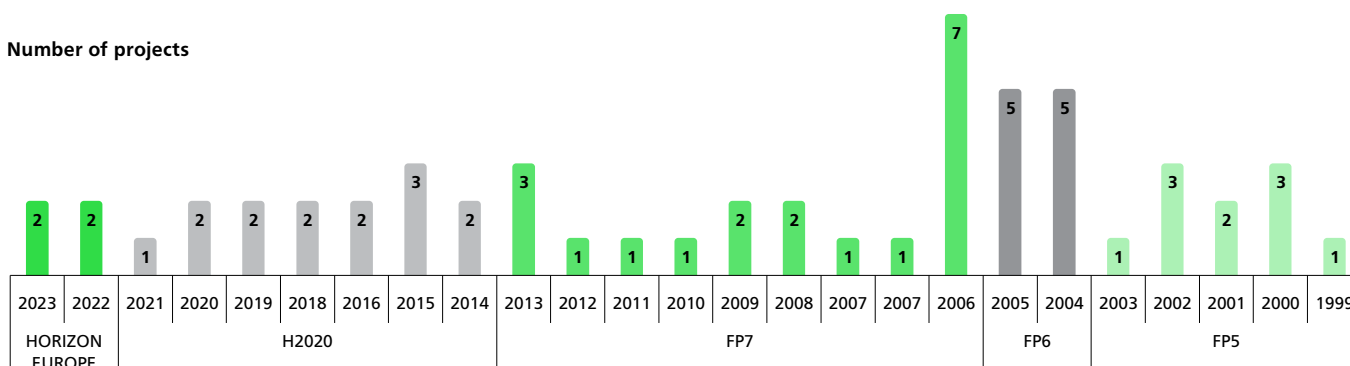
Net EU Contribution (thousands €)



Role in projects (number)



Number of projects

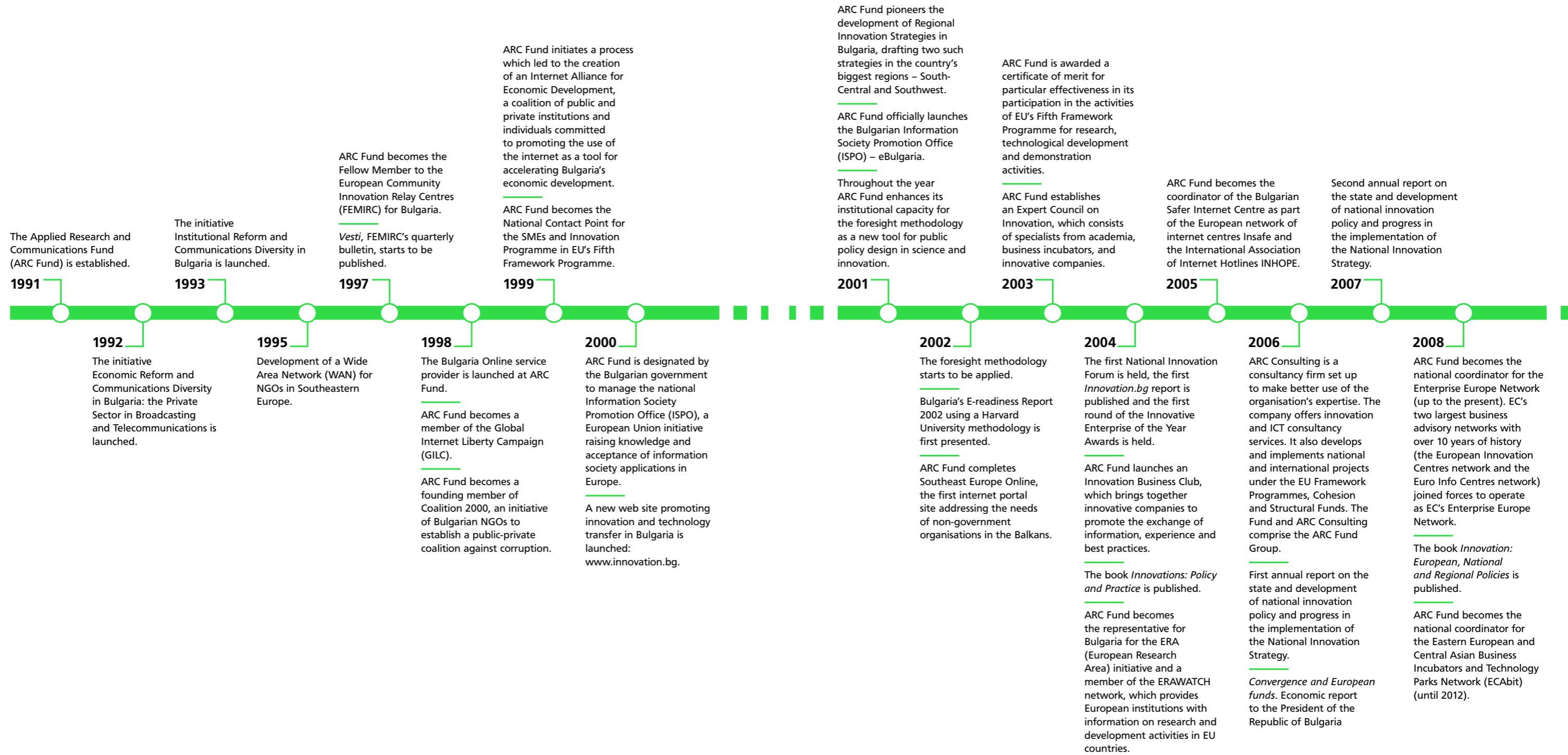


Since its creation ARC Fund has worked with a number of institutions:

- The **Bulgarian government** in developing the country's annual report assessing the progress of the national innovation policy and drafting the 2011 Innovations Act, the Promotion of Research and Innovations Act, the National plan for broadband access, the Innovation Strategy for Smart Specialisation, the National Research Strategy and others.
- **European Commission** (DG Research and Innovation, DG JRC and DG Enterprise and Industry) on ICT sector and national innovation policy developments, the contribution of European regions to the realisation of the European Research Area, preparing country reports for the ERAWATCH/TrendChart joint inventory of research and innovation policy measures in EU, the elaboration of the smart specialisation strategies (S3) of Bulgaria, Romania and Croatia, and others.
- The **World Bank** on performing technology assessment of the Bulgarian innovation policy and capacity to absorb EU funds and on stimulating business incubation and internationalization of companies in the region of Europe and Central Asia.
- **Multinational consulting companies** implementing projects funded by the European Commission and other contracts.

Timeline of Major ARC Fund Achievements

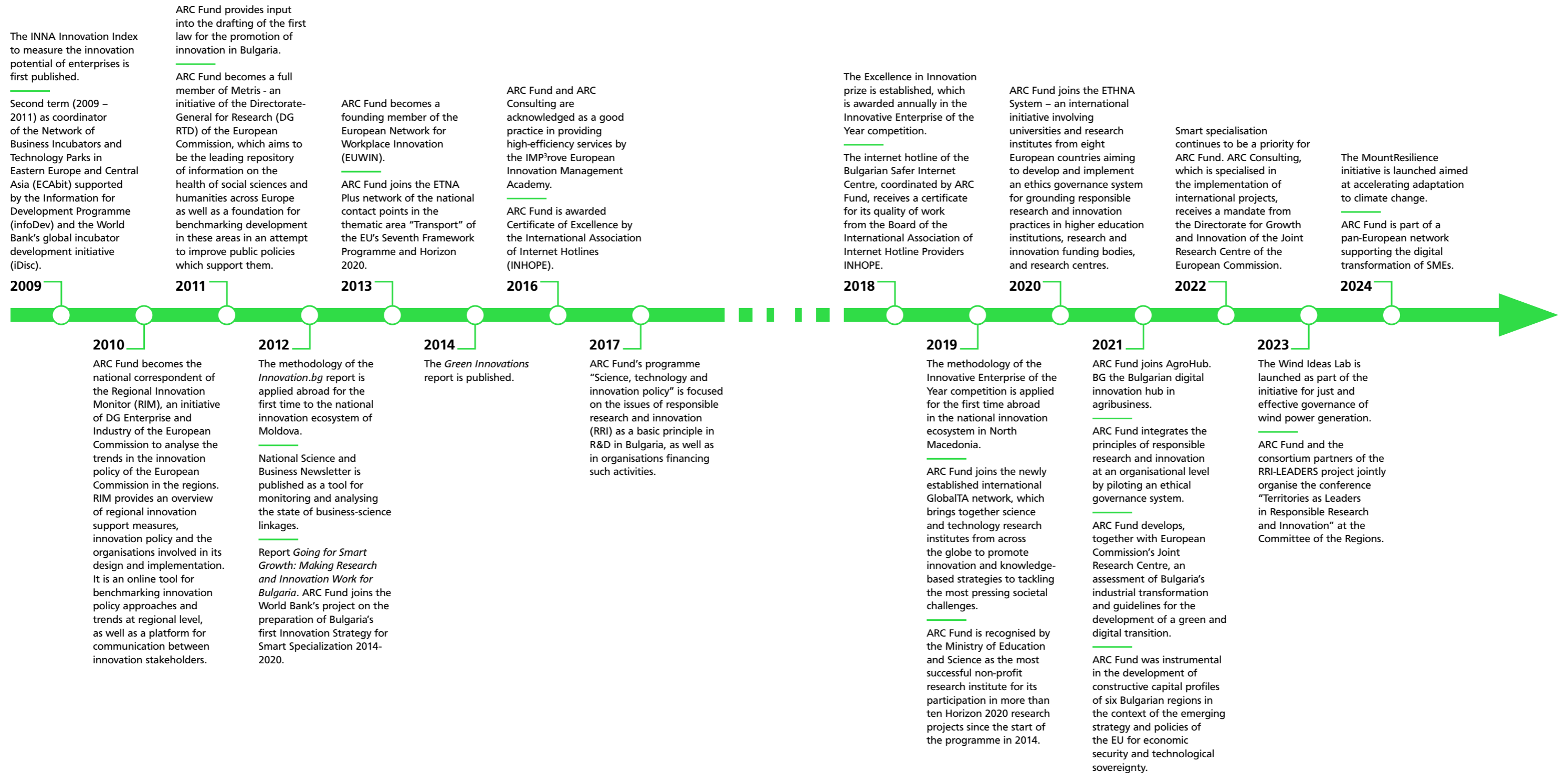
2003: The Council advises the relevant institutions in Bulgaria on innovation and research issues and is the peer review body for the *Innovation.bg* report. It designs the evaluation methodology under which the Innovative Enterprise of the Year Award is presented and performs the expert evaluation of shortlisted companies. The Council acts as an advisory board on shaping Bulgaria's R&D policies.



1997: FEMIRC is part of a Europe-wide network of 53 Innovation Relay Centres (IRCs) operating in the EU member states, Iceland, Norway, Switzerland and Israel, and ten Fellow Members in the candidate countries of Central and Eastern Europe. The goal of the IRC network is to promote innovation and encourage the exchange of the scientific research results among organizations across Europe.

2001: The Fund performs in-depth regional innovation audits to assess their needs in terms of innovation and technology development. ARC Fund is instrumental in the development of the Smart Specialisation Strategies of Bulgaria, Romania and Croatia, for which it provided expertise on the industrial and innovation environment at macro and micro level in Southeast Europe.

Timeline of Major ARC Fund Achievements



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APPLIED RESEARCH AND COMMUNICATIONS FUND

The Applied Research and Communication Fund (ARC Fund) is a European think-and-action tank focused on innovation, business support, and knowledge and technology transfer, established in 1991. For this purpose, ARC Fund:

- Develops **policies and strategies** in areas crucial for advancing innovations;
- Analyses development trends and policy options for supporting **entrepreneurship and innovation** for smart specialization and industrial transformation.

The Applied Research and Communication Fund is part of the **Enterprise Europe Network (EEN)** – the largest EU network for supporting SMEs, and coordinates EEN's activities in Bulgaria for technology transfer and facilitating internationalization.

ARC Consulting EOOD is the consulting arm of the Applied Research and Communications Fund, specializing in the implementation of international projects.

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