

Relation „Technology Leadership – Patent Activity-National Digital Competitiveness“ – Methodological Overview And Good Examples

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Based on series of authored articles in the field of competitiveness focused on intellectual property (IP) rights ‘Company competitiveness through intellectual property’ (Markova, 2018) and „The company digital competitiveness focused on intellectual property rights–concept, assessment and strategy“ (Markova, 2022), published in ‘Economic studies’, followed by a monograph “Economic dimensions of intellectual property–approach, characteristics and management models” (Markova, 2024), with revealed IP portfolio of a company as elements and characteristics as a complex factor for obtaining and sustaining the company competitiveness, the aim of this article is to present the author’s scientific thesis of relation between technology leadership and national digital competitiveness focused on intellectual property rights (IPR).

In this article, the author presents definitions, content and measurement aspects for the terms „technology leadership“ and

„national digital competitiveness; the place and the importance of intellectual property rights for obtaining national digital competitiveness based on technology innovations and patent activity, and a method for an assessment the „technology leadership“ and „national digital competitiveness‘ focused on intellectual property rights, especially on patent rights is developed.

Initially, the author discusses her perspective on the key concepts of „technology leadership“ and „national digital competitiveness,’ examining their direct link to intellectual property rights. She emphasizes the significance of patent rights as a vital element influencing an organization’s digital competitiveness and intellectual property portfolio, focusing on their content, structure, and evaluation methodologies. In the concluding section, the article presents examples of intellectual property rights held by successful companies, regarded as exemplary practices acknowledged globally. The main argument is that technology leadership and national digital competitiveness are interconnected and can be achieved and

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sustained through a company's patent rights in leading technological fields.

Keywords: intellectual property, patents, digital competitiveness, technology leadership

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I. Introduction

Since the beginning of the 21st century, the digital world of business is already a fact - the use of networks, smartphones, tablets, information and communication technologies /ICT/ based tools is a convenience and a necessity that brings benefits, contacts, and profit for the company. ICT-based innovations optimize business processes, increase efficiency, and improve business decision-making. ICT-based innovation is a necessity in the present and a good investment in the future for the business and the environment, for consumers, and for society as a whole. Nowadays, the business discusses and plans its digital competitiveness as an actual business strategy focused on new products and technologies protected with IP rights.

A key factor in the national digital competitiveness is the company's IP portfolio, especially patented innovations for products and technologies, such as inventions and utility models. Thanks to the protection of innovations through intellectual property, the national economy may achieve a technology leadership position on the competitive market and receive income by the exclusive right using such patented inventions and utility models in business, which. realized

the competitive advantages in the market, the business indicates lower costs, higher productivity, better profitability, and overall competitiveness¹. The significance of the problem lies both in the response to the digital business environment and in the need for the acting business to know and use the objects of intellectual property in its activities to achieve and maintain competitiveness as an economic interest and to maintain stability through protection under intellectual property rights. on new technologies protected with IP rights, especially with patents for new technologies, classified in „B“ in the international patent classification system /IPC/².

II. Research methodology

1. Approach, goal and literature review

1.1. Approach and goal

The scientific paradigm /approach, methods for analysis and model for assessment the „technology leadership“ and „national digital competitiveness focused on intellectual property rights“, method for identifying the company digital competitiveness and the importance of intellectual property in it assessment the „technology leadership“ and „national digital competitiveness“ focused on intellectual property rights is based on the proven in science and business the world known M. Porter (2004) approach for international, national and company competitiveness and the author's methodological framework,

¹ This matter is revealed in author's articles mentioned in p.1 and in the monography "Economic dimensions of intellectual property—approach, characteristics and management models", pp. 117-208

² IPC - The International Patent Classification (IPC), established by the Strasbourg Agreement 1971, provides for a hierarchical system of language independent symbols. "B" means performing operations, incl. the physical state of the matter to be separated; the principle of the process used; particular kinds of apparatus, etc. For more information may visit <https://ipcpub.wipo.int>

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including a system and indicators for assessment of the digital competitiveness focused on company’s IP. The main goal is to study and demonstrate the importance of intellectual property in achieving and maintaining national digital competitiveness through technology leadership. The targeted framework is structured as follows:

- To define and to clarify the terms „technology leadership“ and „national digital competitiveness‘.
- To identify patent rights in leading technical fields at the national level and determine the country’s position on the digital competitiveness chart, the patent portfolio, the Global Innovation Index (GII) (WIPO, 2023), and the International Institute for Management Development (IMD) (IMD, 2024) methods were used. The main points of the scientific paradigm for digital competitiveness include basic conceptual terms and working definitions, the author’s understanding of the company’s competitiveness and related terms, and the author’s statement on “national digital competitiveness”.

1.2. General review of literature related to the research area

Many research papers identify leadership in various fields—such as education (Flanagan & Jacobsen, 2003), business technology (Vlok, Ungerer, & Malan, 2019) (Adjei, 2013) (Kurzahls & Graf-Vlachy, 2020) (Hunter, Cushenbery, & Ginther, 2014), healthcare (Cortellazzo, Bruni, & Zampieri, 2019), and other research areas—as a crucial factor in a global digital society with social influences. Possibly for the first time in a political context, the question of leadership as the forefront of the social revolution was raised in the 19th century. There are studies

on technology leadership related to patent licenses (Teece, 2021), but no publications focus specifically on technological leadership achieved through patent rights within the top 10 technical fields, aiming to enhance national competitiveness. This is the main thesis of this article. The Oxford English Dictionary (Oxford University Press, 2025) traces the word “leadership” in English only as „the practice of developing important new ways of thinking that influence others,” linked to innovation practices. MIT offers a technology leadership program that presents technology leadership as the tools needed to develop an innovative, strategic approach to creating business models and solving problems. The Technology Leadership Program from MIT Professional Education helps you drive growth within your organization. It provides the necessary tools to cultivate an innovative and strategic approach to business modeling and problem-solving (Massachusetts Institute of Technology, 2025). Some articles also discuss the dynamic relationship between leadership and successful business strategies.

2. Author’s definitions and research approach

2.1. Main terms definitions

Technology leadership

This discussion examines how technology leadership serves as a crucial factor in achieving national competitiveness, which is defined as a country’s dominance in patent-protected technological innovations. Technology leadership is briefly described as a country’s leading position in patent-protected innovations within the top 10 technical fields identified by the European Patent Office (EPO). A broad perspective on technology leadership is reflected through

patent activity, highlighting countries' leading roles in patent-protected innovations over the past five years in areas³ such as digital transformation—including AI, robotics, and autonomous vehicles—medical technology, and biotechnology, which covers medical devices, treatments for specific diseases, bio foods, and bio robots. The author primarily focuses on IPR, especially patent activities like patent applications, granted patents, and utility models (UMs). Other types of intellectual property are not included in this research due to their indirect contribution to leadership.

National digital competitiveness

We examine fundamental concepts of competitiveness, specifically in terms of company and product competitiveness, as discussed in various authors' publications. The definition and structured components of the term „company digital competitiveness“⁴ constitute a complex economic indicator that reflects the company's performance, including goods, services, and reputation. It also assesses its competitive position and advantages by comparing it with the closest competitors within the business segment, taking into account the conditions and parameters of the digital business environment.

Digital competitiveness refers to a company's ability to develop and deliver competitive products (goods and services) within a digital market environment. The core idea of "digital competitiveness of the company" relates to the company's capacity to compete effectively in a digital business setting, while "intellectual property in the

digital competitiveness of the company" involves the following aspects:

- Innovations of the company based on digital technologies (ICT);
- Digital business identifiers of the company;
- Organizational and technological infrastructure of the company based on digital technologies (ICT);
- Organizational and technological infrastructure of the business environment based on digital technologies (ICT), in which the company operates.

The key term here is “**product competitiveness**” which is a complex economic measure indicating a product's ability to stand out—whether through real or perceived competitive advantages—and, consequently, be preferred by consumers.

National competitiveness is a complex measure of a country's position on the competitiveness map, assessed through sub-indicators such as technology, human resources, and innovation capabilities. It also encompasses the competitiveness of the national economy, which is the aggregate of innovative companies' competitiveness in leading technical fields. These indicators are not contradictory but rather complementary.

The metrics above are based on a mix of common analytical tools, such as GII – published annually by the World Intellectual Property Organization (WIPO), the IMD digital competitiveness ranking, and the author's patent research review, combined with the methods mentioned earlier.

In a digital business ecosystem, national competitiveness should be recognized as

³ These areas are summarized and identified by the author after tracking trends in technological innovations and patents over a period of more than 15 years.

⁴ The author uses the terms “digital competitiveness of the company” as equal to the term “company digital competitiveness”

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digital competitiveness and assessed through a comprehensive indicator of a country's position on the competitiveness map. This evaluation includes sub-indicators such as technology, human resources, and innovation capabilities in key areas like science and technology research and patent activities in digital transformation domains (digital technology, computer technology, AI, robots, and self-driving vehicles/ as well as in medical and biotechnology fields /bio foods, medical equipment, and medicine in specific human threat areas). The author's thesis is that new technologies, including inventions and utility models in high-tech digital transformation and biotechnology, protected by patents, applications, granted patents, and utility models, are a vital factor in the competitiveness of every national economic system.

2.2. Approach to enhance national digital competitiveness

The approach is interdisciplinary and represents a complex set of knowledge and skills, accumulated research, and consulting experience of the author in economics and law, following the line science – business – national economy. The approach systematically examines the nation's digital competitiveness as a result of utilizing patented inventions and utility models for technology and products in a digital business environment; it includes both theoretical and practical knowledge and skills in academic research. A key factor for achieving and maintaining sustainable national digital competitiveness is protecting intellectual property rights for high-level innovations in areas such as digital transformation/AI, computer and digital technologies, robots, and self-driving vehicles, as well as in medical and biotechnology sectors—such as biofoods, medical equipment, and medicine in specific

human threat areas. This serves as the focus of the current scientific research paradigm on the relationship between “technology leadership” and “national digital competitiveness,” with intellectual property rights in patents as a crucial element.

2.3. Methods of research: “technology leadership” and “national digital competitiveness”.

The research methods are categorized into standard analysis techniques and specialized approaches for examining patent activity, which include the following:

2.3.1. Conventional methods of analysis:

- scientific systematization of existing concepts;
- content and comparative analysis;
- historical-logical analysis;
- induction and deduction;
- selection and ranging of data.

2.3.2. Specific methods of analysis:

- expert evaluation;
- analysis of the database on Espacenet of the EPO;
- derivation of quantitative and structured trends by indicators;
- conclusions for the past period;
- expert assessments for the next period.

III. Research results

1. Research findings on technology leadership

The annually published statistics and report of the European Patent Office show that European patent applications related to the top areas of innovation, such as digital transformations including artificial intelligence

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(AI), robotics, quantum computing, wireless technologies (5G), 3D printing, and fully autonomous vehicles, as well as the Internet of Things, biotechnology, specific medical technologies, and medicines, continue to grow. General patent statistics indicate that more than 17,700 patents/applications, issued patents, and utility models for inventions related to digital transformation were identified in the world statistics reported by the EPO over the last five years. The presented results are for 2023 and 2024.

EPO statistics revealed the top 10 areas of patent activity over the past five years (2023/2024) in terms of patent applications filed, patents issued, and utility models registered at the EPO.

The study is based on indicators such as overall activity in the top three innovation areas: digital transformation, medical technologies, and biotechnology; patent activity of the two countries leading in the field of high-tech patents—China and the USA—according to WIPO reports; other countries involved in patent activities within these relevant research fields; and Bulgaria's performance in the three designated top technical patent areas.

A general review based on patent research conducted at the beginning of 2025 shows that more than 17,700 patents, applications, issued patents, and UMIs related to inventions in the digital communications field were identified in global statistics from the EPO for 2023 and 2024. The majority of the filed

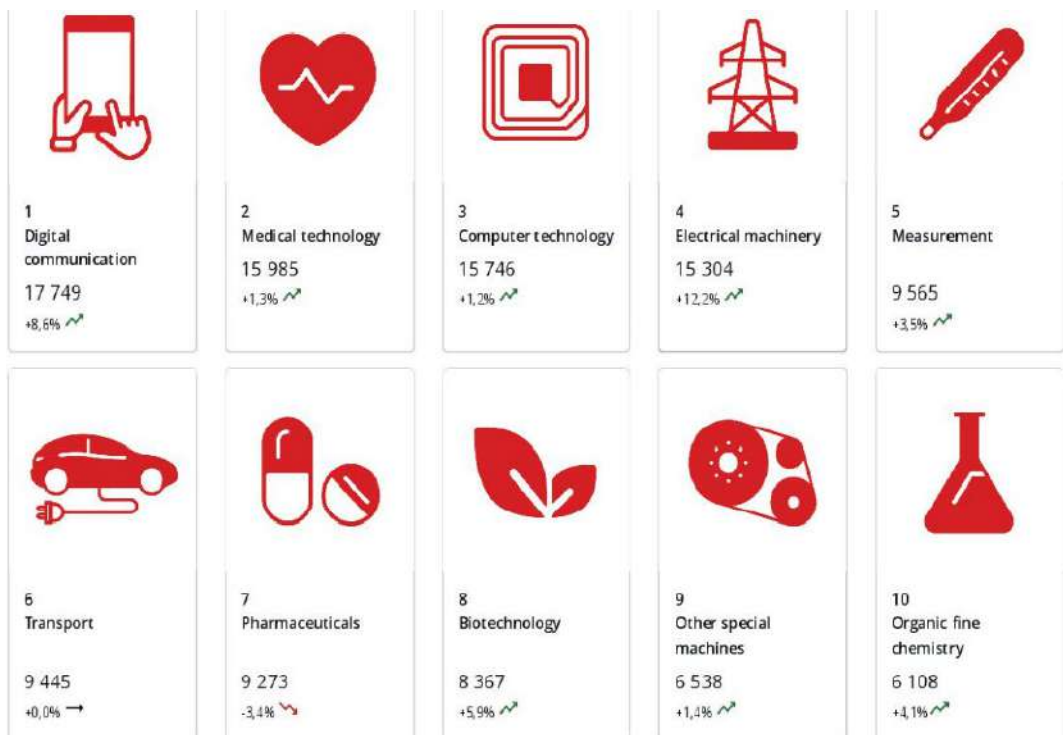


Figure 1. Top 10 technical fields, source: EPO

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inventions concern new developments in AI, robotics, and 5G communications. About 15,500 patents and applications, including issued patents and utility models for inventions related to medical technology, were recorded in the world statistics in the EPO in 2023 and 2024. Most of the filed inventions involve new equipment and specific methods for treating rare and significant diseases. Over 8,300 patents/applications, issued patents, and utility models for inventions related to biotechnology were identified in the world statistics from the EPO in 2023 and 2024. The majority of the inventions filed focus on new genetically based biological methods and tools.

The specific numbers are listed below in descending chronological order, including the names of inventors, applicants, IPC index, publication details with the patent status as application, issued patent, or registered utility model, and a priority date.

The number of patents in particular fields is shown below:

A. Digital transformation area

- **digital communication**

There are over 10,000 patents in total. China has obtained over 2800, and the USA over 2300. The latest patent titled “Vehicle digital key communication method and device, terminal equipment, and storage medium” was submitted by applicants from China: ZHEJIANG ZEEKR INTELLIGENT TECH CO LTD and GEELY HOLDING GROUP CO LTD, with a priority date of 19.08.2024. For more details, see fig. 1, Patent application in digital communication, presented in Appendices.

- **artificial intelligence patents**

There are over 4,300 patents in total. China holds more than 3,100 of these; the USA has over 287. The most recent patent is titled “Artificial Intelligence and Content Delivery During Charging”, submitted by applicants TOYOTAMOTOR NORTH AMERICA INC [US] and TOYOTA MOTOR CO LTD [JP], with a priority date of 02.02.2024. For more details, see fig. 2, Patent application in AI, presented in the Appendices.

In the field of generative AI, there are 363 patents. The most recent patent is titled “Document creation with guided generative artificial intelligence of the patent holder SERVICENOWINC [US], US12254014 (B1), with a priority date of 23.02.2024. For more details, see fig. 3 Patent application in generative AI presented in Appendices.

The USA and China have leading positions with 215 and 73 patents, respectively. Biographical and technical details are presented in Appendices, fig. 4 - patent appl. in AI of USA and fig. 5 - patent appl. in AI of China.

- **computer technologies**

There are over 3,000 patents in total. Of these, China has obtained over 2400; the USA has over 200. The latest one is titled ‘System and method configured to trace changes in applied’.

“Computer technology” from applicant MORGAN STANLEY SERVICESGROUP INC [US], with a priority date of 07/13/2023. For more details, see fig. 6 of the patent application in computer technologies presented in the Appendices.

- **self-driving vehicles**

There are over 677 patents in total. The USA accounts for over 230, while China has

over 158. There has been no application activity in 2024. One of the latest published applications in this field has a title “Self-driving-vehicle control method and system, and electronic device and storage medium” of the applicant BEIJING EACONTECH CO LTD [CN] with a priority date 06.06.2023. For more details fig. 7 Patent appl. in self-driving vehicles presented in Appendices. This trend occurs amid steady activity in the overall vehicle sector, with top applicants from the US, Japan, and China, each holding over 10,000 patents in the field. For more details, see fig. 8 Patent applications in transport means in the Appendices.

B. Medical and biotechnological area

- **medical technologies**

There are over 1300 patents in total. China holds more than 1000 of them, and the USA has over 80. The most recent one is titled “Medical Internet of Things Ecological Integration Method Based on Interface Fusion Technology and Dynamic Database Switching” filed by China’s applicant XIAMEN WORLDLINKING TECH CO LTD with a priority date of 09.08.2024. For more details, see fig. 9 of patent applications in medical technologies presented in the Appendices.

- **pharmaceutical products:**

There are over 7600 patents in total. The USA holds more than 1200, and China has over 700. One of the latest is titled “CDK Inhibitors and Their Use as Pharmaceuticals” from the USA applicant PRELUDE THERAPEUTICS INC [US], with a priority date of 04/14/2023. For more details, see fig. 10, Patent application in pharmaceuticals, presented in Appendices.

- **biotechnology**

There are over 1600 patents in total. China holds more than 1,390 of these, while the USA has over 48. The most recent patent is titled “Biotechnology Extracting and Filtering Device “ from the Chinese applicant SHANGHAI RANMOBIOLOGICAL TECH COLTD, with a priority date of 07.04.2024. For more details, see fig. 11, Patent application in biotechnologies, presented in Appendices.

- **biorobots**

There are only three patent applications from Chinese applicants. One of them is titled “Biorobot robust motion prediction method incorporating adversarial training of applicant.” UNIV DALIAN TECH [CN], with a priority date of 07.09.2023. For more details, see fig. 12, Patent appl. in biotechnologies, presented in the Appendices.

The author’s comprehensive patent research and summarized results highlight the leading countries and their patent activities in two main high-tech fields: ‘Digital transformation’ and ‘Medical and biotechnologies.’ China, with over 9,040 patents, and the USA, with more than 4,300 patents, hold undisputed top positions. This is confirmed by a publication from IMD presented in fig.2, “High tech patent grants”.

On the map of high technologies, the countries with the most patents are China, the USA, Japan, Korea, and Germany - each with over 25,000 patents, whether applications or already issued and active, from 2015 to 2022. China’s and the USA’s leadership is clear. Korea and Japan show remarkable progress as a percentage of all patents. Research results of ‘national digital competitiveness’

High-tech patent grants, total and 3-year average

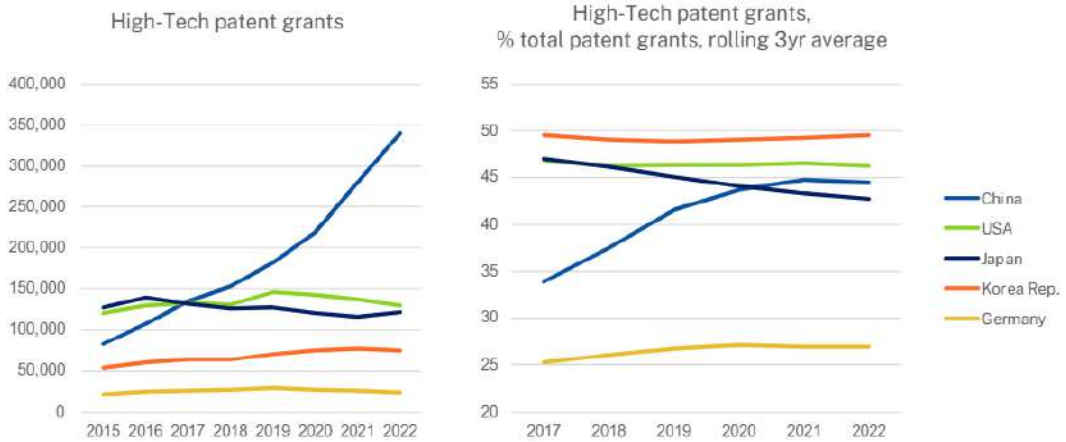


Figure 1
Source: IMD World Competitiveness Center (2024)

Figure 2. High-tech patent grands, source IMD

2. Research findings on national digital competitiveness

As shown in the methodology matrix, the assessment methods and metrics for ‘national digital competitiveness’ are based on a combination of commonly available analytical tools, such as the IMD digital competitiveness ranking and GII, which is published annually by WIPO.

According to the comprehensive IMD research, which includes 57 indicators and sub-indicators grouped as shown above, covering areas such as new technologies, knowledge, readiness for future changes, human resource provision, computer and internet connectivity, and others, the top 15 countries out of a total of 136 surveyed are Singapore, Switzerland, Denmark, the USA, Sweden, Korea, Hong Kong, the Netherlands, Taiwan, Norway, Finland, the UAE, Canada, China, Australia, Israel, Germany, and France.

The annual publications of WIPO - the Global Innovation Index for 2023 and 2024, along with data statistics, show that, when broken down by geographical regions, the leading countries are the USA and China, with Switzerland and Sweden also holding top positions in continental Europe. “The top 100 S&T clusters continue to be mainly located in three regions: North America, Europe, and Asia, with a notable concentration in two major economies: China and the United States. China, for the second consecutive year, leads with the most clusters (26) in the top 100. Followed by the United States (20), Germany (8), India, and the Republic of Korea, each with 4 clusters.” (WIPO, 2024).

The GII Innovation Ecosystem for 2024 report shows the USA in 3rd position and China in 11th position according to selected summary indicators related to innovation

What is the IMD World Digital Competitiveness Ranking?

Digital Competitiveness Factors and Sub-factors



Computing the Rankings



Figure 3. Digital competitiveness factors/ sub-factors, source: IMD

activity and technological capability of the economies of 133 countries worldwide. The sub-indicators consider population and R&D spending.

In summary: The innovation and technology stimulation systems of the USA and China lead to their top positions in advanced technology fields, respectively, resulting in competitiveness

and undisputed technological leadership. This is demonstrated through the study of patent activity, market position as a global innovation index, and the contribution of patent rights to GDP in these countries. This proves the direct link between technological leadership based on patent rights and market leadership and national competitiveness. Meanwhile, the top

The 2024 IMD World Digital Competitiveness Ranking

			Score	
01	Singapore		100.00	↗ 2
02	Switzerland		93.15	↗ 3
03	Denmark		91.99	↗ 1
04	USA		91.31	↗ 3
05	Sweden		90.42	↗ 2
06	Korea Rep.		88.62	-
07	Hong Kong SAR		88.11	↗ 3
08	Netherlands		87.03	↗ 6
09	Taiwan (Chinese Taipei)		86.33	-
10	Norway		84.58	↗ 4
11	UAE		84.06	↗ 1
12	Finland		83.57	↗ 4
13	Canada		83.16	↗ 2
14	China		82.09	↗ 5
15	Australia		81.24	↗ 1
16	Israel		80.75	↗ 3
17	Ireland		80.34	↗ 4
18	United Kingdom		78.21	↗ 2
19	Iceland		78.18	↗ 2
20	France		76.58	↗ 7
21	Belgium		75.61	↗ 6
22	Lithuania		75.56	↗ 6
23	Germany		75.32	-
24	Estonia		73.09	↗ 6
25	Austria		72.87	↗ 3
26	Qatar		72.17	↗ 3
27	Saudi Arabia		71.60	↗ 3
28	Spain		70.96	↗ 3
29	Luxembourg		69.46	↗ 3
30	Bahrain		68.85	↗ 8

The IMD World Digital Competitiveness Ranking presents the 2024 overall ranking for the 67 economies covered by the Center. The economies are ranked from the most to the least competitive. The Scores shown to the right are actually indices (0 to 100) generated for the unique purpose of constructing charts and graphics. The final column shows the improvement or decline from the previous year

Figure 4. Digital competitiveness ranking, source: IMD

companies in high technology fields include China Mobile Communications, China Post Group, Huawei, State Grid, etc., from USA, and Apple, Amazon, Google, etc., from the USA.

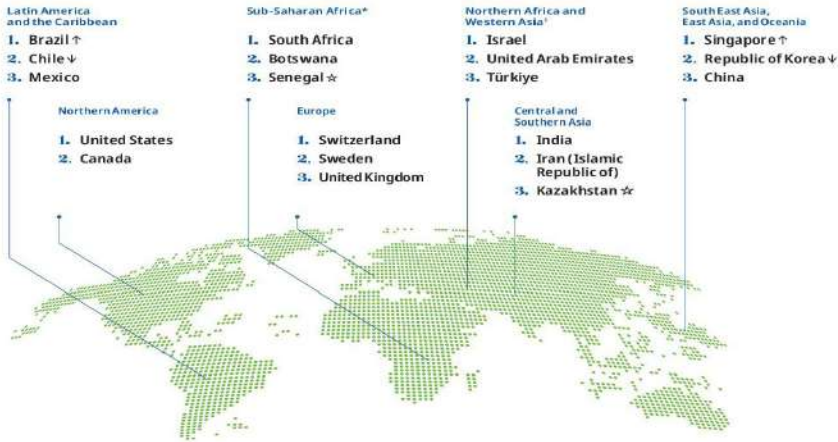
We pose a significant question for Bulgaria: Where does Bulgaria stand on the global map of national competitiveness, GII, and patent activity in the leading technical sectors? The purpose is not to compare with technological leaders and neighboring countries.

On the IMD world ranking map, Bulgaria has been steadily losing ground over the past five years, and in 2024 it is in 56th place, behind Greece, Romania, Hungary, Turkey, and other neighboring countries in Europe, with less than 50% performance on the IMD's researched indicators.

The technological state of our country is rapidly declining — including capital, human resources, and innovations, as shown by the IMD assessment of the three main indicators.

Global leaders in innovation, 2023

Top three innovation economies by region



☆ Indicates a new entrant into the top three in 2023.
 ↑↓ Indicates movement in ranking (up or down) within the top three, relative to 2022.
 * Top three in Sub-Saharan Africa (SSA) – excluding island economies. The top five within the region, including all economies, comprise Mauritius (1st), South Africa (2nd), Botswana (3rd), Cabo Verde (4th) and Senegal (5th).
 † Top three in Northern Africa and Western Asia (NAWA) – excluding island economies. The top four within the region, including all economies, comprise Israel (1st), Cyprus (2nd), United Arab Emirates (3rd) and Türkiye (4th).

Top three innovation economies by income group



Source: Global Innovation Index Database, WIPO, 2023.
 Notes: World Bank Income Group Classification (July 2022). Year-on-year changes in GI3 rank are influenced by performance and methodological considerations. Some economy data are incomplete (see Appendix I).

Figure 5. Global Innovation Index, source: WIPO, 2024

Similarly, our country has a poor position in the specialized analysis of 133 countries in the WIPO Global Innovation Index. Exceptionally low values for investments, including foreign investments reduced to 50%, and less than '1' score for implemented intellectual property rights and technology transfer, reflect a deteriorated business environment.

Despite a decline in application activity over the past five years, Espacenet shows that in 2024 there are more than 580 patents/applications, issued patents, and UM, as seen in Appendix II. Most of these patents are in

the fields of machinery, electrical equipment, and construction. Some of these patents are in high-technology fields. The three most recent examples are as follows: 'Intelligent helicopter detection system' by Akuis EOOD [BG]; 'System for initiation of nuclear fusion reactions in the decay of helium nuclei to helium isotopes and deuterium nuclei, and subsequent fusion reactions with application to a laser fusion reactor' by the Bulgarian Academy of Science; and 'Mechanical cutting device of fixed guide columns of a Francis turbine helical chamber' by Tehnichal

University Sofia. For more details, see Figures 13 and 14 in the Appendices.

In addition to the results of a comprehensive author's study in high technology—covering artificial intelligence, robotics, and biotechnology—the following findings are also important:

- In the field of "Robotics," the current situation is as follows: there are 6 active patents and 8 utility models, most of which are owned by the Institute of Robotics of the Bulgarian Academy of Sciences. Here are some of their names: "Disinfection robot", "UV disinfection robot", "Floor cleaning robot".

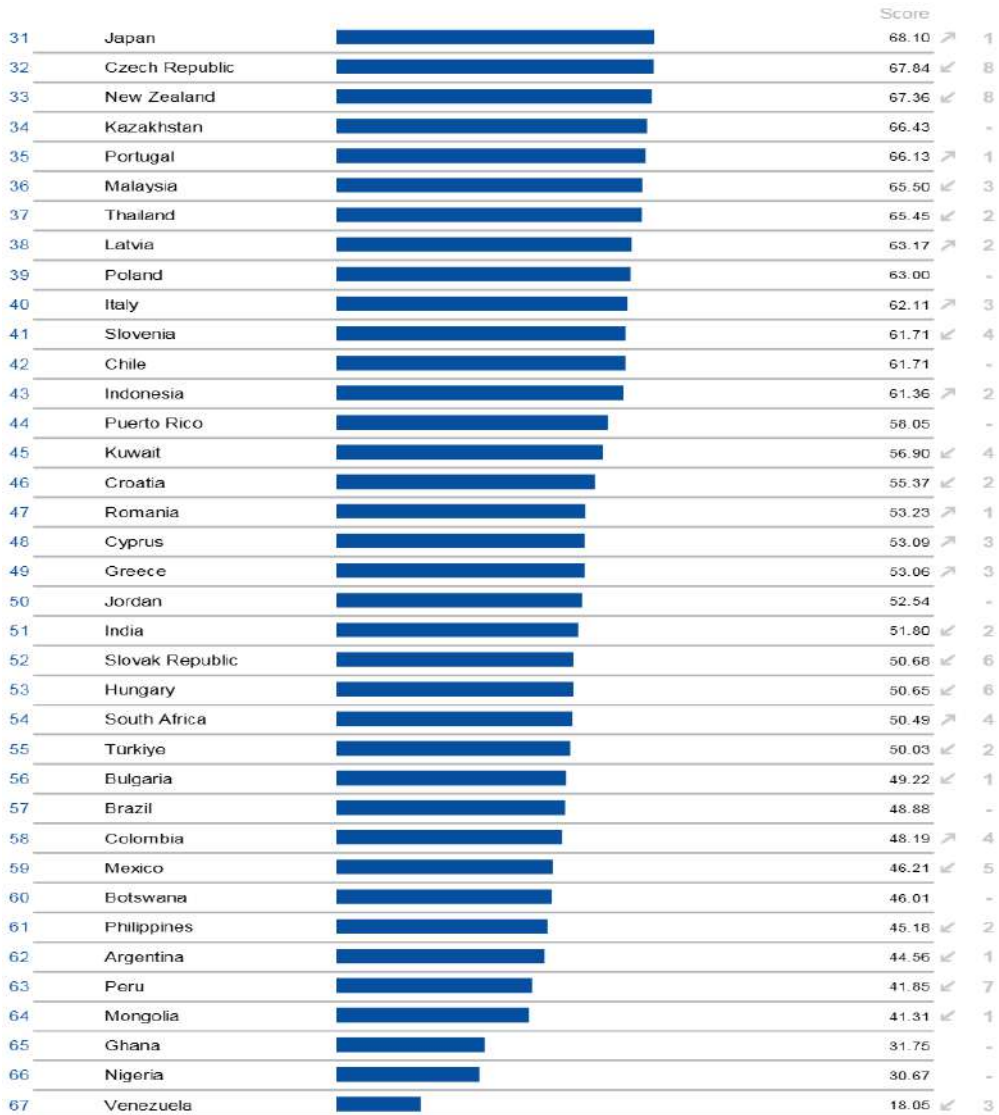


Figure 6. Competitiveness place of Bulgaria, source: IMD

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- In the field of artificial intelligence, there are no patents; there are six UMs, the latest of which include: 'System for managing the flow of information in clusters of large databases using artificial intelligence' from the University of National and World Economy, and 'Artificial Intelligence Facial Modeling System' by Luchano International Ltd., as well as 'Artificial Intelligence Learning Platform' by Advance Human Capital Ltd.
- In the field of measuring instruments, two applications have appeared in the last five years out of a total of 98. They are from the Institute of Robotics of the Bulgarian Academy of Sciences and the Tsvetan Lazarov Institute of Defense.
- In the field of pharmaceutical products, the trend in patent activity appears unfavorable, mainly reflected by the activity of foreign companies within Bulgaria, with the last patent registration in 2000. It is necessary to conclude that there is no innovative activity from either Bulgarian or foreign companies in the manufacturing sector based on patents.
- In the field of biotechnology, over 60 active UMs are identified, owned primarily by individual inventors, such as biologically active compositions, biologically active products containing lactic acid bacteria, and other beneficial substances. Over 90% of all registrations are maintained for their maximum 10-year period of protection.

In the past five years, UMs in the field of biotechnology have been owned by institutes, universities, and other academic and legal entities, which is a positive trend considering their potential for production implementation and market launch.

Based on the trends of patent activity in Bulgaria over the past five years, the author proposes the following short-term and medium-term initiatives aimed at stopping the negative trends in our country's technological status and development and enhancing our position on the world map for digital competitiveness:

- to develop the national strategy for structured technological and industry growth in alignment with the national competitiveness policy;
- to prioritize funding and create favorable conditions for technological innovations in key sectors of the national economy, such as agriculture, food industry, general mechanical engineering, biotechnology in functional foods, and others;
- to provide regulatory and institutional incentives for inventors in higher education institutions and research institutes to commercialize their work, encouraging the creation of spin-off companies with personal capital participation from researchers, with ownership shares linked to the value of the IPR;
- to establish a special favorable policy for Bulgarian companies implementing innovations, particularly patents and utility models in high-tech sectors, through tax and other financial incentives;
- to offer training to develop management knowledge and skills at the national level in the areas of intellectual property rights, entrepreneurship, and technology transfer.

IV. Conclusion

Based on the literature review and data presented over a five-year period, the author identifies a strong link between

technology leadership and national digital competitiveness. The author clarifies the terms „technology leadership“ and „national digital competitiveness,‘ and explains the role and importance of intellectual property rights in achieving national digital competitiveness. This may serve as a methodological foundation for conducting periodic comprehensive analyses to identify leading technology sectors, patent statuses, top countries, and prominent patent holders in these advanced technological areas. The developed and applied methodology for assessing “technology leadership” and “national digital competitiveness,” focused on patent rights, supports the author’s thesis that technology leadership and national digital competitiveness are interconnected and can be achieved and maintained through innovations with patent exclusivity rights in the leading high-tech fields, using EPO statistics.

In the new business environment—characterized by high technological advancement and increasing digitalization of every aspect of life—a comprehensive analysis at the national and company levels should include new metrics such as those presented in this article—patent analysis, GII index, and IMD competitiveness metrics. This way, national economic policymakers and company management can develop well-informed future plans for the development of new research areas, emerging technologies, production fields, and the overall economic system.

The author is committed to continuing analyses within the specified methodological framework and publishing the results for the purposes of economic theory and practice.

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Articles

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Appendices

I. Patents in high technology fields in 2 main areas: A. Digital transformation and B. Medical and biotechnologies

A. Digital transformation area

- digital communication

Total over 10 000 patents; the latest were submitted to applicants from China
China – over 2800; USA – over 2300.



Espacenet

Result list

More than 10,000 results found in the Worldwide database for:

digital communication in the title

Only the first 500 results are displayed.

26. Vehicle digital key communication method and device, terminal equipment and storage medium					
Inventor:	Applicant:	CPC:	IPC:	Publication info:	Priority date:
BAO WENCHAO JIANG ZHE	ZHEJIANG ZEEKR INTELLIGENT TECH CO LTD GEELY HOLDING GROUP CO LTD		G07C9/00 H04L67/12 H04L69/00 (+1)	CN119052351 (A) 2024-11-29	2024- 08-19
27. GSM-R voice unit for realizing analog-to-digital audio conversion, communication method and medium					
Inventor:	Applicant:	CPC:	IPC:	Publication info:	Priority date:
XIAO ZHENGJIE SUN DI (+2)	CRSC COMMUNICATION & INFORMATION GROUP SHANGHAI COMPANY LTD		H04M11/02 H04M7/00 H04W4/16 (+1)	CN119052381 (A) 2024-11-29	2024- 08-27
28. Airborne digital audio communication system and method					
Inventor:	Applicant:	CPC:	IPC:	Publication info:	Priority date:
LUO JIA JING XINCHUN (+3)	CETC AVIONICS CO LTD	<u>Y02D30/70</u>	H04L65/10 H04L65/1016 H04L65/1059 (+2)	CN119052212 (A) 2024-11-29	2024- 07-30
29. Digital signal optical covert communication system and method based on logical operation encryption					

Figure A1. Patent appl. in digital communication, descending order, source: EPO

Articles

- artificial intelligence patents

Total over 4 300 Patents; the latest were submitted to applicants from USA.
China – over 3100; USA – over 2300, KR – over 300.



Espacenet

Result list

Approximately 4,366 results found in the Worldwide database for:
artificial intelligence in the title AND **B** as the IPC classification
Only the first 500 results are displayed.

1. Artificial intelligence and content delivery during charging					
Inventor: YANG CHRISTOPHER E [US] GAITHER GEOFFREY DAVID [US] (+3)	Applicant: TOYOTA MOTOR NORTH AMERICA INC [US] TOYOTA MOTOR CO LTD [JP]	CPC: <u>B60W2040/0881</u> <u>B60W40/08</u> <u>G06F16/9535</u>	IPC: B60W40/08 G06F16/9535	Publication info: US12216721 (B1) 2025-02-04	Priority date: 2024- 02-02
2. Artificial intelligence system for generating action tendency considering emotion and mood according to external information recognition and method thereof					
Inventor: PARK SUNG KEE HWANG JUNG GYU	Applicant: KOREA INSTITUTE OF SCIENCE AND TECH [KR]	CPC: <u>G06N5/022</u>	IPC: B25J11/00 B25J13/08 B25J9/16 (+1)	Publication info: KR20250011435 (A) 2025-01-21	Priority date: 2023- 07-14
3. Air purification control system of paint booth using artificial intelligence technology					
Inventor: JEON HYUN JOONG [KR]	Applicant: W SOLUTION CO LTD [KR]	CPC:	IPC: B01D47/06 B01D53/14 B01D53/34 (+1)	Publication info: KR20250010253 (A) 2025-01-21	Priority date: 2023- 07-12
4. Data Collection and Utilization System for Drones Using Artificial Intelligence and Method using thereof					
Inventor: KIM KYEONGTAG [US]	Applicant: SUCCESS CODE CO LTD [KR]	CPC:	IPC: G06F16/901 G06F16/9032 G06F16/9038 (+6)	Publication info: KR102758440 (B1) 2025-01-21	Priority date: 2024- 08-19

Figure A2. Patent appl. in AI, descending order, source: EPO

In the area of generative AI are indicated 363 patents, the latest application is from Korea.



Espacenet

Result list

Approximately 363 results found in the Worldwide database for:

Generative artificial intelligence in the title

1. METHOD AND SYSTEM FOR PROVIDING LEARNING SUPPORT SERVICE USING GENERATIVE ARTIFICIAL INTELLIGENCE TECHNOLOGY					
Inventor:	Applicant:	CPC:	IPC:	Publication info:	Priority date:
안성환, 서명석	주식회사 코드넷		G06F16/33 G06F16/332 G06F16/338 (+3)	KR20250033462 (A) 2025-03-10	2023-08-30
2. METHOD AND SYSTEM FOR PROVIDING SEARCH SERVICE BASED ON GENERATIVE ARTIFICIAL INTELLIGENCE					
Inventor:	Applicant:	CPC:	IPC:	Publication info:	Priority date:
이근수, 김지민	네이버 주식회사		G06F16/332 G06F16/338 G06F16/34 (+4)	KR20250029467 (A) 2025-03-05	2023-08-23
3. Document creation with guided generative artificial intelligence					
Inventor:	Applicant:	CPC:	IPC:	Publication info:	Priority date:
EL HATTAMI AMINE [CH] BELKOWSKI THOMAS [CH]	SERVICENOW INC [US]	G06F16/24535 G06F16/24575	G06F16/20 G06F16/2453 G06F16/2457	US12254014 (B1) 2025-03-18	2024-02-23
4. BRAND-BASED DESIGN TEMPLATE SERVICE SYSTEM AND METHOD USING GENERATIVE ARTIFICIAL INTELLIGENCE					
Inventor:	Applicant:	CPC:	IPC:	Publication info:	Priority date:
김덕인, 장종화	타이디비 주식회사		G06N3/0475 G06Q30/02 G06Q30/0241 (+2)	KR102776196 (B1) 2025-03-06	2024-09-13
5. SYNTHETIC TEST DATA GENERATION USING GENERATIVE ARTIFICIAL INTELLIGENCE					

Figure A3. Patent appl. in generative AI, descending order, source: EPO

USA and China have leading positions with 215 and 73 patents respectively.



Result list

Approximately 215 results found in the Worldwide database for:

Generative artificial intelligence in the title AND **US** as the priority number

1. Document creation with guided generative artificial intelligence					
Inventor: EL HATTAMI AMINE [CH] BELKOWSKI THOMAS [CH]	Applicant: SERVICENOW INC [US]	CPC: G06F16/24535 G06F16/24575	IPC: G06F16/20 G06F16/2453 G06F16/2457	Publication info: US12254014 (B1) 2025-03-18	Priority date: 2024-02-23
2. SYNTHETIC TEST DATA GENERATION USING GENERATIVE ARTIFICIAL INTELLIGENCE					
Inventor: WUEST CANDID [CH] BELL SERG [SG] (+1)	Applicant: ACRONIS INT GMBH [CH]	CPC: G06F11/3684 G06F11/3688 G06F11/3692	IPC: G06F11/36	Publication info: US2025094325 (A1) 2025-03-20	Priority date: 2023-09-19
3. METHOD AND SYSTEM FOR PERFORMING GENERATIVE ARTIFICIAL INTELLIGENCE AND FINE TUNING THE DATA MODEL					
Inventor: FANG MING [US] LIN SIMO [US] (+2)	Applicant: ORACLE INT CORPORATION [US]	CPC: G06F2209/503 G06F9/5011 G06F9/5044 (+6)	IPC: G06F9/50 H04L9/08	Publication info: US2025094223 (A1) 2025-03-20	Priority date: 2023-09-15
4. GENERATING AND PRESENTING CONTENT USING A GENERATIVE ARTIFICIAL INTELLIGENCE MODEL					
Inventor: SUGDEN GLENN E [US]	Applicant: AUDIOTROCITIES LLC [US]	CPC: G06F16/5866 G06F3/0482 G06T11/00	IPC: G06F3/0482 G06T11/00	Publication info: US2025095222 (A1) 2025-03-20	Priority date: 2023-09-15
5. CROSS-RELEVANT REFINEMENT OF GENERATIVE ARTIFICIAL INTELLIGENCE MODELS FOR CREATIVE CONTENT ACROSS MULTIPLE PLATFORMS					

Figure A4. Patent appl. in AI of USA, descending order, source: EPO



Espacenet

Result list

Approximately 73 results found in the Worldwide database for:
Generative artificial intelligence in the title AND CN as the priority number

1. PROCESSING SYSTEM BASED ON GENERATIVE ARTIFICIAL INTELLIGENCE LARGE LANGUAGE MODEL, USE PERMISSION ACQUISITION METHOD, AND SMART TERMINAL					
Inventor: YU CHI SUM [CN] MOK YAT SHING [CN] (+2)	Applicant: SOLOS TECH SHENZHEN LIMITED [CN]	CPC: <u>G06F21/1015</u> <u>G06F3/167</u> <u>G06N3/0455</u> (+5)	IPC: G06F16/958 H04W12/33	Publication info: WO2025039795 (A1) 2025-02-27	Priority date: 2023-08-24
2. Image denoising method and device based on generative artificial intelligence technology					
Inventor: FENG CONG HUANG SAI	Applicant: THE FIRST MEDICAL CENTER OF PLA GENERAL HOSPITAL	CPC:	IPC: G06N3/045 G06N3/0475 G06N3/094 (+3)	Publication info: CN119379556 (A) 2025-01-28	Priority date: 2024-12-24
3. Method for reasoning text content through generative artificial intelligence video based on time axis					
Inventor: WU LEI ZHANG HAN (+4)	Applicant: SHANGHAI WEETGO TECH CO LTD	CPC:	IPC: G06N5/04 G10L15/26 H04N21/231 (+10)	Publication info: CN119364050 (A) 2025-01-24	Priority date: 2024-09-10
4. Urban power transmission line fault diagnosis method and system based on generative artificial intelligence					
Inventor: ZHOU KAILE LIU YING (+2)	Applicant: HEFEI UNIV OF TECHNOLOGY	CPC:	IPC: G06N3/045 G06N3/0455 G06N3/0475 (+6)	Publication info: CN119313955 (A) 2025-01-14	Priority date: 2024-09-27
5. Extreme rainstorm weather rendering method based on generative artificial intelligence					

Figure A5. Patent appl. in AI of China, descending order, source: EPO

Articles

- **computer technologies**

Total over 3 000 patents; the latest were submitted of applicants from China
China – over 2400; USA – over 200.



Espacenet

Result list

Approximately **3,097** results found in the Worldwide database for:

computer technology in the title

Only the first **500** results are displayed.

1. A COMPUTER-IMPLEMENTED SYSTEM FOR DIGITAL IDENTITY VERIFICATION THROUGH BLOCKCHAIN TECHNOLOGY					
Inventor: AGUDA HENRY RHOEL R [PH] DUARTE RAMON G [PH] (+3)	Applicant: UBX PHILIPPINES CORP [PH]	CPC:	IPC: G06F21/00 G06F21/30 H04L29/06	Publication info: PH22021050907 (U1) 2021-08-27	Priority date: 2021-07-05
2. Video editing method and device, computer-readable recording medium allowing a user to set interference areas related to eye-tracking technology in a video					
Inventor: YANG YING- YING [TW] HUANG XIAO- XIAN [TW] (+1)	Applicant: TAIPEI VETERANS GENERAL HOSPITAL [TW]	CPC:	IPC: H04N21/234 H04N21/458 H04N21/4728 (+1)	Publication info: TW202444104 (A) 2024-11-01	Priority date: 2023-04-19
3. SYSTEM AND METHOD CONFIGURED TO TRACE CHANGES IN APPLIED COMPUTER TECHNOLOGY					
Inventor: KOTA HARIKRISHNA [IN] KUMAR YATINDER [US] (+1)	Applicant: MORGAN STANLEY SERVICES GROUP INC [US]	CPC: <u>G06F8/71</u> <u>G06Q10/20</u>	IPC: G06Q10/20	Publication info: US2025021944 (A1) 2025-01-16	Priority date: 2023-07-13
4. METHOD AND SYSTEM OF INTEGRATING BLOCKCHAIN TECHNOLOGY WITH EXISTING COMPUTER ARCHITECTURE					

Figure A6. Patent appl. in computer technologies, descending order, source: EPO

Articles

- self-driving vehicles

Total over 677 patents, the last of which are from applicants from the US, China and Germany.

Selfdriving vehicles patents – US – over 230, China – 158. No applicant activity in 2024.



Espacenet

Result list

Approximately 677 results found in the Worldwide database for:

self-driving vehicle in the title

Only the first 500 results are displayed.

1. SELF-DRIVING VEHICLE SYSTEMS AND METHODS					
Inventor: WENGREEN ERIC JOHN [US] SCHWIE WESLEY EDWARD [US]	Applicant: DRIVENT LLC [US]	CPC: <u>B60W2420/40</u> <u>B60W2510/246</u> <u>B60W2720/106</u> (+11)	IPC: B60W30/18 G01K13/00 G05D1/00	Publication info: US2025036121 (A1) 2025-01-30	Priority date: 2019- 11-08
2. Method and Apparatus for Generating at Least One Training Travel Trajectory for Training a Driving Mode of a Self Driving Vehicle					
Inventor: STOLL MARTIN [DE] MAZZOLA MARKUS [DE] (+1)	Applicant: BOSCH GMBH ROBERT [DE]	CPC: <u>B60W2520/10</u> <u>B60W2554/80</u> <u>B60W30/095</u> (+5)	IPC: B60W40/04 B60W60/00	Publication info: US2024425081 (A1) 2024-12-26	Priority date: 2023- 06-26
3. SELF-DRIVING-BASED VEHICLE NAVIGATION METHOD AND APPARATUS, DEVICE, STORAGE MEDIUM, AND PROGRAM PRODUCT					
Inventor: FAN JINGBO [CN]	Applicant: TENCENT TECH SHENZHEN CO LTD [CN]	CPC: <u>B60W2050/146</u> <u>B60W50/14</u> <u>B60W60/00</u> (+4)	IPC: B60W50/14 B60W60/00	Publication info: US2024416969 (A1) 2024-12-19	Priority date: 2022- 08-01
4. SELF-DRIVING-VEHICLE CONTROL METHOD AND SYSTEM, AND ELECTRONIC DEVICE AND STORAGE MEDIUM					
Inventor: ZHOU LIYAN [CN] HUANG JIAYONG [CN]	Applicant: BEIJING EACON TECH CO LTD [CN]	CPC: <u>B60W10/10</u> <u>B60W10/18</u> <u>B60W2552/15</u> (+5)	IPC: B60W10/18	Publication info: WO2024251218 (A1) 2024-12-12	Priority date: 2023- 06-06
5. VIRTUAL REALITY GAME EXPERIENCE IN SELF-DRIVING VEHICLE					

Figure A7. Patent appl. in self-driving vehicles, descending order, source: EPO

This is against the backdrop of stable activity in the general vehicle class with leading applicants from the US, Japan and China, each of which holds more than 10,000 patents in the field.



Result list

More than **10,000** results found in the Worldwide database for:

transport in the title

Only the first **500** results are displayed.

1. LIQUEFIED GAS TRANSPORT VESSEL					
Inventor: KAWASAKI SHUJI KOMIYA HIDEAKI (+1)	Applicant: KAWASAKI JUKOGYO KK [JP]	CPC:	IPC: B63B25/16 B63B29/02 B63J99/00	Publication info: WO2025033029 (A1) 2025-02-13	Priority date: 2023-08-04
2. ARTICLE TRANSPORT FACILITY					
Inventor: KIMURA KAZUNARI [JP] KAMIKAWA YUJI [JP]	Applicant: DAIFUKU CO LTD [JP]	CPC:	IPC: G05D1/43	Publication info: WO2025032883 (A1) 2025-02-13	Priority date: 2023-08-10
3. ELECTRICALLY CONDUCTIVE RAIL AND RAIL TRANSPORT SYSTEM					
Inventor: ZHANG ANQING [CN] MAO GUANGBING [CN] (+2)	Applicant: BYD COMPANY LTD [CN]	CPC: B60M1/30 B60S3/006	IPC: B60M1/30 B60M5/00 B60S3/00 (+1)	Publication info: WO2025030867 (A1) 2025-02-13	Priority date: 2023-08-04
4. OPEN WAGON FOR CONTAINER TRANSPORT					
Inventor: ZHOU JIONG [CN] GU MEINA [CN] (+12)	Applicant: CRRC MEISHAN CO LTD [CN]	CPC: B61D3/20 B61D45/007	IPC: B61D3/20 B61D45/00	Publication info: WO2025030716 (A1) 2025-02-13	Priority date: 2023-08-05
5. STAR-LIKE MICROMOLECULAR CROSS-LINKED HOLE TRANSPORT MATERIAL, AND PREPARATION METHOD THEREFOR AND USE THEREOF					

Figure A8. Patent appl. in transport means, descending order, source: EPO

B. Medical and biotechnologies area

- medical technologies

total – over 1300 patents, China – over 1000, USA – over 80, the latest of which is by applicants from USA.



Espacenet

Result list

Approximately 1,342 results found in the Worldwide database for:

medical technology in the title

Only the first 500 results are displayed.

1. METHOD AND SYSTEM FOR MONITORING A ROOM HAVING A MEDICAL TECHNOLOGY APPARATUS					
Inventor:	Applicant:	CPC:	IPC:	Publication info:	Priority date:
ROSER PHILIPP [DE] PFISTER MARCUS [DE]	SIEMENS HEALTHINEERS AG [DE]	G16H40/20 G16H40/40	G16H40/20 G16H40/40	US2025029712 (A1) 2025-01-23	2023- 07-21
2. Method for detecting content of semi-volatile unknown substances in leaching liquor of medical apparatus and instruments based on dispersive liquid-liquid microextraction technology					
Inventor:	Applicant:	CPC:	IPC:	Publication info:	Priority date:
CHENG YUXING TAN JIAN (+6)	WUXI APPTec SUZHOU CO LTD		G01N30/02 G01N30/04 G01N30/06 (+1)	CN118980759 (A) 2024-11-19	2024- 08-07
3. Method for detecting content of non-volatile unknown substances in leaching liquor of medical equipment based on dispersive liquid-liquid microextraction technology					
Inventor:	Applicant:	CPC:	IPC:	Publication info:	Priority date:
TAN JIAN CHENG YUXING (+7)	WUXI APPTec SUZHOU CO LTD		G01N30/02 G01N30/04 G01N30/06 (+3)	CN118961983 (A) 2024-11-15	2024- 08-07
4. Medical internet of things ecological integration method based on interface fusion technology and dynamic database switching					
Inventor:	Applicant:	CPC:	IPC:	Publication info:	Priority date:
HUANG JIE LAI CHUANJU	XIAMEN WORLD LINKING TECH CO LTD		G06F16/25 G06F16/27 G16H40/67 (+1)	CN118942666 (A) 2024-11-12	2024- 08-09

Figure A9. Patent appl. in medical technologies, descending order, source: EPO

Articles

- **pharmaceutical products:**

total of over 7600 patents, USA – over 1200, China – over 700, latest patent applications are from applicants from the USA, applicants from Philippines and Korea are presented as patents in the areas of meeting human needs.



Espacenet

Result list

Approximately **7,686** results found in the Worldwide database for:

pharmaceuticals in the title

Only the first 500 results are displayed.

1. DRY POWDER INHALATION DELIVERY OF PHARMACEUTICALS					
Inventor: BEVERLIN II BRYCE CALVIN [US]	Applicant: QUENCH MEDICAL INC [US]	CPC: A61K31/7068 A61K47/183 A61K47/26 (+5)	IPC: A61K31/7068 A61K9/00 A61K9/14 (+1)	Publication info: US2025041224 (A1) 2025-02-06	Priority date: 2022-04-22
2. BLISTER PACKAGING FOR PHARMACEUTICALS					
Inventor: HUBER THOMAS [US] NAIK HETAL [US]	Applicant: PFIZER [US]	CPC: A61J1/035 A61J2205/30 B65B11/52 (+4)	IPC: A61J1/03 B65D75/36	Publication info: US2025041159 (A1) 2025-02-06	Priority date: 2021-12-20
3. STABLE BACTERIAL EXTRACTS AS PHARMACEUTICALS					
Inventor: BAUER JACQUES [CH] PASQUALI CHRISTIAN [CH]	Applicant: OM PHARMA SA [CH]	CPC: A61K2039/55594 A61K35/74 A61K35/742 (+16)	IPC: A61K35/74 A61K39/02 A61K9/00 (+6)	Publication info: PH12021552089 (A1) 2022-05-23	Priority date: 2019-03-14
4. Automatic Multiple Dispenser for Radioactive Pharmaceuticals					
Inventor: KWAK CHANHYO	Applicant: UNITEKO [KR]	CPC:	IPC: A61J1/20 A61M5/178 G01T1/161	Publication info: KR20250009130 (A) 2025-01-17	Priority date: 2023-07-10
5. COMPOUNDS, PHARMACEUTICALS, FORMULATIONS, AND METHODS FOR TREATING AND PREVENTING RNA VIRUS INFECTIONS AND ASSOCIATED DISEASES					

Figure A10. Patent appl. in pharmaceuticals, descending order, source: EPO

Articles

- **biotechnology:** total over 1600; China – over 1390; USA – over 48, Germany – over 88



Espacenet

Result list

Approximately **1,692** results found in the Worldwide database for:

Biotechnology in the title

Only the first **500** results are displayed.

1. Biotechnology extracting and filtering device					
Inventor:	Applicant:	CPC:	IPC:	Publication info:	Priority date:
CHEN LIANG WANG XIN (+3)	SHANGHAI RANMO BIOLOGICAL TECH CO LTD		B01D29/01 B01D29/64 B01D29/94	CN222056495 (U) 2024-11-26	2024-04-07
2. Reagent tube drying device for biotechnology					
Inventor:	Applicant:	CPC:	IPC:	Publication info:	Priority date:
WANG XINZHEN YANG LIMIN (+2)	HENAN DINGHAN BIOTECHNOLOGY CO LTD	<u>Y02P70/10</u>	F26B11/18 F26B21/02 F26B25/00 (+3)	CN222048415 (U) 2024-11-22	2024-01-26
3. Production of collagen and bacterial collagen-like proteins by recombinant microbial biotechnology					
Inventor:	Applicant:	CPC:	IPC:	Publication info:	Priority date:
SCHAFFER STEFFEN WESSEL MIRJA (+1)	EVONIK ROEHM GMBH	<u>C07K14/315</u> <u>C07K14/34</u> <u>C07K14/78</u> (+2)	C07K14/195	CN118974074 (A) 2024-11-15	2022-03-01
4. Biotechnology breeding method of functional rice rich in ginsenoside					
Inventor:	Applicant:	CPC:	IPC:	Publication info:	Priority date:
LIU XIAOMIN	LIU XIAOMIN		A01H1/00 A01H1/04	CN118923523 (A) 2024-11-12	2024-09-19
5. Biotechnology sealed fermentation device					

Figure A11. Patent appl. in biotechnology, descending order, source: EPO

Articles

- biorobot – only 3 patent applications by applicants from China



Espacenet

Result list

3 results found in the Worldwide database for:
biorobot in the title

1. BIOROBOT ROBUST MOTION PREDICTION METHOD INCORPORATING ADVERSARIAL TRAINING					
Inventor: LIU RISHENG [CN] LIU YAOHUA [CN] (+2)	Applicant: UNIV DALIAN TECH [CN]	CPC:	IPC: B25J9/16 G06N3/08	Publication info: WO2025050351 (A1) 2025-03-13	Priority date: 2023-09-07
2. YEAST IMMUNE MICRO-NANO BIOROBOT LOADED WITH BLOOD COAGULATION DRUGS, PREPARATION THEREOF AND APPLICATION THEREOF					
Inventor: CAI LINTAO [CN] ZHANG BAOZHEN [CN] (+3)	Applicant: SHENZHEN INST ADV TECH [CN]	CPC: <u>A61K45/00</u> <u>A61K47/46</u> <u>A61K47/52</u> (+9)	IPC: A61K45/00 A61K47/46 A61K47/52 (+5)	Publication info: WO2023104027 (A1) 2023-06-15	Priority date: 2021-12-08
3. Deep-water submersible biorobot of cuttlefish imitation type mollush					
Inventor: WANG ZHENLONG CAO [CN]	Applicant: UNIV HARBIN POLYTECHNIQUE [CN]	CPC:	IPC: A63H11/18 B63H1/30	Publication info: CN1743044 (A) 2006-03-08 CN100347040 (C) 2007-11-07	Priority date: 2005-10-14

Figure A12. Patent appl. in biorobot, descending order, source: EPO

II. Patents in high technology fields of BG applicant/ with a BG priority number



Espacenet

Result list

Approximately 594 results found in the Worldwide database for:
BG as the application number AND **2024** as the publication date
 Only the first 500 results are displayed.

1. INTELLIGENT HELICOPTER DETECTION SYSTEM					
Inventor: KAMILOV GEORGI IVANOV [BG] HADZHITODOROV YASEN PAVLINOV [BG] (+5)	Applicant: AKUIS EOOD [BG]	CPC: <u>G06N20/00</u> <u>G08G5/00</u>	IPC: G05D1/00 G06N20/00 G08G5/00	Publication info: BG4977 (U1) 2024-12-16	Priority date: 2024- 09-11
2. SYSTEM FOR INITIATION OF NUCLEAR FUSION REACTIONS IN THE DECAY OF HELIUM NUCLEI TO HELIUM ISOTOPES AND DEUTERIUM NUCLEI AND SUBSEQUENT FUSION REACTIONS WITH APPLICATION TO A LASER FUSION REACTOR					
Inventor: KOVACHEV LYUBOMIR MILCHEV [BG] YORDANOVA EKATERINA IVANOVA [BG] (+2)	Applicant: INST PO ELEKTRONIKA AKAD EMIL DZHAKOV BAN [BG] INST PO FIZIKA NA TVAROTO TYALO AKADEMIK GEORGI NADZHAKOV BAN [BG]	CPC: <u>G21B1/00</u> <u>G21B1/19</u>	IPC: G21B1/00 G21B1/19	Publication info: BG4982 (U1) 2024-12-31	Priority date: 2024- 05-22
3. MECHANICAL CUTTING DEVICE OF FIXED GUIDE COLUMNS OF A FRANCIS TURBINE HELICAL CHAMBER					
Inventor: TODOROV GEORGI DIMITROV [BG] KRALOV IVAN MLADENOV [BG] (+4)	Applicant: TEHNICHESKI UNIV SOFIA [BG]	CPC: <u>B23D35/001</u> <u>B23Q9/00</u> <u>F01D25/28</u> (+1)	IPC: B23D35/00 B23Q9/00 F01D25/28 (+1)	Publication info: BG4985 (U1) 2024-12-31	Priority date: 2024- 09-20
4. ANTICARIES COMPOSITION					

Figure A13. Patent appl. in 2024 BG priority number source: EPO



Result list

Approximately 98 results found in the Worldwide database for:
measurement in the title AND BG as the application number

1. SYSTEM FOR DYNAMIC CONTROL OF LASER RANGE MEASUREMENT PARAMETERS					
Inventor: HUTOV ILIAN DOBREV [BG] LAZAROV KOSTADIN VASILEV [BG]	Applicant: INST PO OTBRANA PROF TSVETAN LAZAROV [BG] HUTOV ILIAN DOBREV [BG] (+1)	CPC: G01S17/06 G01S17/08	IPC: G01S17/06 G01S17/08	Publication info: BG4859 (U1) 2024-04-30	Priority date: 2023- 12-18
2. ADAPTIVE MODULAR STATION FOR DYNAMIC MEASUREMENT OF THE CONCENTRATION OF RADON IN SOIL GASES					
Inventor: TERZIYSKI ATANAS [BG] TENEV STOYAN [BG]	Applicant: TENEV STOYAN [BG] TERZIYSKI ATANAS [BG] (+1)	CPC:	IPC: G01N33/00 G01N33/24 G01N7/10	Publication info: BG4452 (U1) 2023-06-15	Priority date: 2023- 03-16
3. MAGNETIC FIELD MICROSENSOR ELEMENT					
Inventor: LOZANOVA SIA	Applicant: INST PO ROBOTIKA BAN [BG]	CPC:	IPC: G01R33/06 H10N52/00	Publication info: BG113273 (A) 2022-05-31 BG67557 (B1) 2023-08-15	Priority date: 2020- 11-26
4. DEVIATION MEASUREMENT SYSTEM OF THE SHAPE AND LOCATION OF THE SURFACES AND AXES OF ROTARY DETAILS RELATIVE TO A VIRTUAL OUTPUT BASE					
Inventor: DYAKOV DIMITAR [BG] RADEV HRISTO [BG] (+3)	Applicant: RADEV HRISTO [BG] DYAKOV DIMITAR [BG] (+3)	CPC:	IPC: B23Q1/76 B23Q17/20 G01B21/20 (+1)	Publication info: BG113041 (A) 2021-06-15	Priority date: 2019- 12-04

Figure A14. Patent appl. in measurements, BG priority number, source: EPO