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BULGARIAN AND FOREIGN PATENT ACTIVITY IN BULGARIA AND BULGARIAN PATENT ACTIVITY ABROAD BY TECHNOLOGICAL AREAS AND FIELDS FOR THE PERIOD 2010-2021[2]

As an indicator of technological changes in the economy, patents also express the inventive potential of a specific country to use knowledge and transform it into potential economic benefits. In this regard, the main goal of the study is: to determine the state and dynamics of patent activity through an analysis of Bulgarian and foreign patent activity in Bulgaria and Bulgarian patent activity abroad for the period 2010-2021. The trends of technological development are revealed – by certain technological areas and fields and by patent-holder countries. Some of the existing trends in patent research and their role as an indicator of the rate and technological change in the economy are also considered. The significance of the study is to consider the role of patents in revealing trends of technological development and to lay the foundations for future in-depth research on the issue.
Keywords: patent activity; patent applications; patent grants; technology areas; technology fields
JEL: O32; O34; O55

1. Introduction

Inventive activity has accompanied human history for thousands of years and has given impetus to the development of society. As an active factor for achieving progress, the invention is a cornerstone around which the legal system in the field of industrial, and subsequently – in the field of intellectual property was born and developed. The patent system was established.

Patents grant the owner of the patentable invention exclusive rights for a period (most often 20 years from the filing date) within the territory of the country that granted the patent. A patent can be granted for an invention that meets the criteria: novelty, non-obviously, industrial applicability. It should be noted that the legislation of the individual countries also set additional requirements that an invention must meet to be patented, i.e., those inventions

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that do not qualify for patentability are determined even if they meet the criteria for patentability.

Patents are often used to measure the results of science and technology activity (OECD Oslo Manual, 1997). They are not only an indicator of technological change in the economy but express the inventive potential of a particular country to use knowledge and transform it into potential economic benefits. Patenting beyond the national borders of the patentee on the other hand, indicates export, investment intentions or willingness to grant licenses for the patented invention, as well as the technological specialization and orientation of a specific country or firm towards certain technological areas and technological fields.

The research interest of the author in the study of this issue is dictated not only by its relevance and the growing importance of intellectual property rights in modern times, but also by the fact that patents provide an opportunity to reveal the trends of technological change in the economy.

The object of this study is the development of individual technological areas and technological fields.

The subject of the study is the Bulgarian and foreign patent activity in Bulgaria and the Bulgarian patent activity abroad for the period 2010-2021.

In this regard, the **purpose** of the study is to: through an analysis of the Bulgarian and foreign patent activity in Bulgaria and the Bulgarian patent activity abroad for the period 2010-2021, to investigate the state and dynamics of patent activity; reveal the trends of technological development – in certain technological areas and technological field and by patentee countries.

The analysis of patent activity in Bulgaria (national and foreign) will allow us to draw conclusions and forecasts for the technological opportunities open both to Bulgarian and foreign companies and to the country.

To achieve the formulated objective, the following tasks have been derived:

1. Analysis of the patent application activity for the period 2010-2021 of Bulgarian and foreign applicants.
2. Tracking the dynamics of the granted patents for the period 2010-2021.
3. Revealing the trends of technological development by analyzing the number of patents applied for and granted by technological areas and fields.

The questions to which this study seeks an answer are reduced to: What are the state and dynamics of patent activity in Bulgaria? What are the most dynamically developing technology areas in Bulgaria? Which are the fields with the strongest concentration of Bulgarian and foreign patents? Which countries demonstrate the highest patent activity in Bulgaria?

The limitations in the present study are reduced to:

- The research period is limited in time from 2010 to 2021 due to the specifics of data collection and submission by the World Intellectual Property Organization (WIPO) through the *WIPO Statistic Data Center* and the lack of data for 2022.
- The survey does not include data on patents applied for and granted that are not classified according to the International Patent Classification (IPC).
- The scope of the analysis covers only patents with assigned classes under the *IPC*, included in the *New Concept of Technology Classification of WIPO* (see Table 2).
- The analyzed patent activity includes patents applied for and granted through Bulgarian Patent Office and the Patent Cooperation Treaty (PCT). The activity of foreign applicants conducted through the European Patent Office and other regional patent organizations remains outside the scope of the study.

The presented research and the scientific results achieved will enrich the research in the field of industrial property. The significance of the study is to consider the role of patents in revealing trends of technological development and to lay the foundations for future in-depth research on the issue.

2. Literature Review

Patents are a significant indicator of the innovativeness of an economy and the degree of development of research. In recent years, they have become a powerful technological competitive advantage. Patent statistics are therefore a useful tool for revealing technological development trends.

Among the first researchers to raise the question of using patent statistics as an economic indicator are Scherer (1965a, 1965b), Muller (1966), Schmookler (1966), Faust & Schedl (1983), Faust (1990), Grilitches (1990, 1992), Dernis, Guellec & van Pottelsberghe (2001). They examine the possibility of using patent data as an indicator of technological change and a predictor of long-term trends of technological development.

Of significant importance for highlighting the possibilities for using patent data is the study of Oltra, Kemp & de Vries (2010), which outlines five essential innovation activities that can be assessed through patent data: The level of inventive activity; Types of innovation and technological competencies of organizations; Source of invention; Technological spillovers and knowledge relatedness; The novelty of inventions. The listed innovation activities allow researchers to study different directions of the innovation process.

The following years were marked by an increase in research interest in the use of patent-based indicators for economic research. Karvonen & Kässi (2011) use patent analysis to reveal the trends of changes in the direction of overlap of technology areas and the convergence of industries. De Rassenfosse, Dernis, Guellec, Picci, & van Pottelsberghe de la Potterie (2013) propose a methodology for building a patent-based indicator based on the priority of patent applications, regardless of the patent office with which they are filed. In this way, the "ingenuity" of countries is measured, and the origins of emerging technologies are traced. Haščič, Silva and Johnstone (2015) outline the growing interest in patent analysis

and use patent statistics to measure innovation in narrow technological fields, as well as to compare the achievements of individual countries. Kim & Bae (2017) propose a methodology for predicting promising innovative technologies by applying patent analysis, and Igami & Subrahmanyam (2019) analyzed the hard drive industry in the period 1976-1998 using patent statistics as a direct measure of innovation and found that patents are a predictor of innovation.

Increasing interest in recent years has been observed in research on patent activity in particular the role of patent data as an indicator of the creation and spreading of environmentally friendly technologies. Oltra, Kemp and de Vries (2010) apply patent data analysis to measure eco-innovation and its aspects and find that patent statistics are an adequate tool in measuring environmentally motivated innovations. Dechezleprêtre, Glachant, Haščič, Johnstone & Ménière (2011) examined patent applications filed at the EPO from thirteen technology directions with significant potential to reduce greenhouse gas emissions, and it was found that the transfer of these technologies occurs primarily between developed countries. Cecere, Corrocher, Gossart and Ozman (2014) analyze the patterns of innovative activity in green information and communication technologies through the patent applications filed with the European Patent Office (EPO) for the period 1987-2006. Haščič & Migotto (2015) use patent statistics to compile three indicators (Technology Development Indicator, International Technology Development Cooperation Indicator, and Technology Diffusion Indicator) through which they assess the innovative performance of countries and their policies. Dechezleprêtre, Haščič and Johnstone (2015) analyzed more than 50,000 patents for technologies related to water supplies and found a growth in patenting of these technologies, disproportionately concentrated on water supply technologies, rather than achieving higher consumption efficiency. Scarpellini, Portillo-Tarragona & Marin-Vinuesa (2019) examine the research and development (R&D) intensity of 2,218 firms and their green patents to analyze eco-innovation, proving a positive correlation between firms' eco-innovation activity and R&D intensity. Bretas, Morais, Hora and Filho (2019) use international patent databases to study green patents, and Urbaniec, Tomala & Martinez (2021) analyze the outcome of eco-innovation and measure the trends observed in green technologies through environmental patents. Azis, Rijal, Suhaimi and Abas (2022) outline developments in the waste management process and explore patent statistics to represent trends and technological innovations in the composting process. Nikolova-Minkova (2022a) analyzes the patent activity of EU Member States in the field of environmental technologies and identifies the countries with the highest patent activity in the period 2010-2020. In another study (Nikolova-Minkova, 2022b), the author analyzed the number of applications and the number of patents granted through the EPO in the period 2010-2021 for environmentally friendly technologies for the use of waste heat and identified the leading patentees in the respective technological fields.

There are also many studies using patent-based indicators to consider the efforts and results of moving to a circular economy and achieving sustainable development. Zheng, Aborisade, Liu, Song and Ding (2020) use patent-based indicators to predict the development of the composting process, and Khaertdinova, Maliashova & Gadelshina (2021) use patent activity data in the EU, OECD, and Russia as a tool to analyze innovative technologies in the transition to a circular economy. Marín-Vinuesa, Portillo-Tarragona & Scarpellini (2021) define and evaluate the capabilities of companies to patent waste-related technologies and

their links with the economic performance of business in support of decision-making towards a circular economy. Eppinger, Jain, Vimalnath, Gurtoo, Tietze and Chea (2021) highlight the importance of intellectual property rights as a component to unlock sustainable innovation and the emerging challenges of transformation to a circular economy. Ballardini & Pihlajarinne (2022) analyze the state of the patent system and provide guidance for its further development to stimulate the transition to circular and sustainable innovation and practice. Portillo-Tarragona, Scarpellini & Marín-Vinuesa (2022) investigate the so-called "Circular patents" and they impact on business opportunities. Juchneski & Antunes (2022) analyse the patent applications applicable to the production of electronic equipment and their compliance with the principles of the circular economy. The authors find a significant discrepancy between the prescriptions of the circular economy for recycling and reuse of materials and the actions of patentees, which are aimed at prolonging the useful life of equipment or energy saving.

The state and problems of patent activity are also of interest to Bulgarian authors, and some of the significant empirical studies in this area are those of: Arsenova (1994, 1995, 1999); Monchev (1993, 1997a, 1997b); Georgieva (2010, 2011); Stefanov, Georgieva (2006, 2011); Koleva, Molhova (2010); Ivanova (2017); Georgieva, Nikolova-Minkova (2019, 2020a, 2020b), Pavlov (2020), Molhova (2020, 2021). They analyse various aspects of patent activity, among which: are the possibilities of using patent statistics; the relationship of patents to national innovation potential; the technological orientation of the patents applied for and granted according to the IPC, the structure, and dynamics of patent activity. One of the most in-depth and multifaceted studies in this area is that of Georgieva (2011), who analyzed the links: *"R&D – Bulgarian patent activity in Bulgaria; Bulgarian – foreign patent activity in Bulgaria; foreign patent activity – Foreign direct investment (FDI) in Bulgaria; R&D – patent activity for EU countries; patent activity – competitiveness for EU countries"* Georgieva (2011, p.11) proves the importance of patent activity as an economic indicator and justifies the appropriateness of using patent statistics in conducting economic studies to establish the existence of links between patent and other types of activities.

This analysis does not claim to be exhaustive, and the cited studies present a limited part of the significant and fundamental studies in the field. They express the importance and ability of patent statistics to be used in different contexts to reveal existing links and dependencies and deduce the role of patent statistics as a significant tool for determining trends of technological development. For the purposes of the study, the author's opinions presented so far can be grouped into several main directions for the use of patent statistics (see Table 1).

The directions in the use of patent information are not limited to those mentioned in Table 1, since the complexity and multifaceted nature of patent data allow their wide application. This predetermines the inclusion of some studies in more than one of the separate directions.

In this study, we prioritize the use of patent data to track technological changes in the economy by analyzing the structure and dynamics of patent activity.

3. Method

In the present study patent statistics are used to reveal the trends of technological development – in certain technological fields and by country patentees. To achieve this goal, the research proceeds in the following stages:

Table 1. Directions for the analysis of patent statistics

Directions	Interpretations	References
Measuring the degree of innovation of an economy	Patent statistics are used to comparative the analysis of patent activity of individual countries and the degree of innovativeness of the countries compared.	Arsenova (1999); Archambault (2002); Koleva, Molhova (2010); Stefanov, Georgieva (2011); De Rassenfosse, Dernis, Guellec, Picci, & van Pottelsberghe de la Potterie (2013); Haščič, Silva, Johnstone (2015); Dechezleprêtre, Glachant, Haščič, Johnstone & Ménière (2011); Haščič & Migotto (2015); Pavlov, P. (2020); Nikolova-Minkova (2022a).
Identifying the source of inventive activity	Patent databases provide information on patented technologies, an analysis of which allows disclosure of the source of innovation and inventive activity.	Georgieva (2011); Stefanov, Georgieva (2011); Dechezleprêtre, Glachant, Haščič, Johnstone & Ménière (2011); De Rassenfosse, Dernis, Guellec, Picci, & van Pottelsberghe de la Potterie (2013); Haščič, Silva, Johnstone (2015); Haščič & Migotto (2015); Georgieva, Nikolova-Minkova (2020b).
Tracking technological changes in the economy	The use of patent data as an indicator of technological change allows to produce long-term trends for the technological development of individual areas.	Scherer (1965); Muller (1966); Faust & Schedl (1983); Schmookler (1990); Faust (1990); Grilitches (1990, 1992); Monchev (1993); Dernis, Guellec & van Pottelsberghe (2001); Stefanov, Georgieva (2006); Georgieva (2011); Karvonen & Kässi (2011); Haščič, Silva, Johnstone (2015); Kim & Bae (2017); Ivanova (2017); Georgieva, Nikolova-Minkova (2019); Igami & Subrahmanyam (2019); Zheng, Aborisade, Liu, Song, Ding (2020); Molhova (2020); Georgieva, Nikolova-Minkova (2020a); Khaertdinova, Maliashova & Gadelshina (2021); Urbaniec, Tomala, Martinez (2021); Azis, Rijal, Suhaimi, Abas (2022).
Eco-innovation, circular economy, and sustainable development	Patent statistics is an indicator of innovative technologies in the field of eco-innovation and circular economy and is used as a measure of the transition to the use of environmentally friendly technologies and sustainable development.	Arsenova (1995); Oltra, Kemp & de Vries (2008); Oltra, Kemp, de Vries (2010); Dechezleprêtre, Glachant, Haščič, Johnstone & Ménière (2011); Cecere, Corrocher, Gossart, Ozman (2014); Dechezleprêtre, Haščič, Johnstone (2015); Scarpellini, Portillo-Tarragona & Marin-Vinuesa (2019); Bretas, Morais, Hora, Filho (2019); Zheng, Aborisade, Liu, Song, Ding (2020); Urbaniec, Tomala, Martinez (2021); Khaertdinova, Maliashova & Gadelshina (2021); Eppinger, Jain, Vimalnath, Gurtoo, Tietze, Chea (2021); Azis, Rijal, Suhaimi, Abas (2022); Nikolova-Minkova (2022a, 2022b); Ballardini & Pihlajarinne (2022); Portillo-Tarragona, Scarpellini & Marín-Vinuesa (2022); Juchneski & Antunes (2022).
Company performance	The patents owned by an enterprise are an expression of its innovativeness in a specific technological field.	Ilieva-Naidenova (2012); Scarpellini, Portillo-Tarragona & Marin-Vinuesa (2019); Molhova (2021); Marín-Vinuesa, Portillo-Tarragona & Scarpellini (2021); Nikolova-Minkova (2022b); Portillo-Tarragona, Scarpellini & Marín-Vinuesa (2022).

Source: elaborated by the author.

First. Establishing the dynamics and direction of patent application activity conducted by: Bulgarian citizens in Bulgaria and abroad; foreign citizens in Bulgaria. The indicators used here are:

- Total number of patent applications filed by Bulgarian and foreign citizens with the Bulgarian Patent Office (BPO).
- Total number of patent applications filed by Bulgarian citizens in Bulgaria and abroad.
- Total number of patent applications filed by foreign nationals in BPO (by nationality of the applicant).
- Total number of patent applications filed by Bulgarian applicants in foreign intellectual property offices.

Second. Disclosure of the technological fields in which the patent activity of Bulgarian and foreign applicants is directed. The selected indicators are:

- Number of applications submitted to BPO by technological fields.
- Number of applications submitted to BPO by Bulgarian and foreign citizens in technological fields.
- Number of applications submitted by Bulgarian citizens in technological fields.
- Number of applications submitted by Bulgarian citizens in foreign offices by technological fields.

Third. Establishing the dynamics of the granted patents to: Bulgarian citizens in Bulgaria and abroad; foreign citizens in Bulgaria. The following indicators are used:

- Total number of patents granted filed by Bulgarian and foreign citizens in BPO.
- Total number of patents granted by Bulgarian citizens in Bulgaria and abroad.
- Total number of patents granted filed by foreign citizens in BPO (by nationality of the applicant).
- Total number of patents granted by Bulgarian applicants in foreign intellectual property offices.

Fourth. Disclosure of the technological fields in which the activity of Bulgarian and foreign patentees is directed. The selected indicators are:

- Number of patents granted by BPO by technological fields.
- Number of patents granted by BPO to Bulgarian and foreign citizens in technological fields.
- Number of patents granted to Bulgarian citizens by technological fields.
- Number of patents granted to Bulgarian citizens in foreign offices by technological fields.

For these indicators, it is assumed that the applications are directly filed in the Bulgarian Patent Office or passed in the Patent Cooperation Treaty (PCT) national phase entries.

Fifth. Comparative analysis of the structure of the Bulgarian and foreign patent flow to identify the technological areas and fields with the greatest concentration of patents.

The data used for research and analysis of these indicators are obtained from the WIPO Statistic Database supported by the World Intellectual Property Organization (WIPO). The indicators are designed according to different criteria that provide a variety of analysis capabilities:

- Counting according to the office of filling.
- Counting according to the applicant/patentee's origin[3].
- Counting according to the technological fields (IPC codes) specified in the patent application, etc.

The advantages of using the WIPO patent database are related to easy access to data and their processing, as well as complete information on a country's patent flow by technological area. A major drawback, as pointed out by Kharmova, Meissner and Sagieva (2013), is that the data are generalized and aggregated, which does not allow a deeper analysis of the requested and patented technologies – their future application, tracking their citation or the development of patent families.

To establish the technological areas and fields to which the filed patent applications and granted patents relate, WIPO applies an IPC-Technology Concordance Table, based on the International Patent Classification (see Table 2).

Table 2. WIPO IPC-Technology Concordance Table

No.	Area, field	IPC code
I	Electrical engineering	
1.	Electrical machinery, apparatus, energy	F21#, H01B, H01C, H01F, H01G, H01H, H01J, H01K, H01M, H01R, H01T, H02#, H05B, H05C, H05F, H99Z
2.	Audio-visual technology	G09F, G09G, G11B, H04N-003, H04N-005, H04N-009, H04N013, H04N-015, H04N-017, H04R, H04S, H05K
3.	Telecommunications	G08C, H01P, H01Q, H04B, H04H, H04J, H04K, H04M, H04N001, H04N-007, H04N-011, H04Q
4.	Digital communication	H04L
5.	Basic communication processes	H03#
6.	Computer technology	(G06# not G06Q), G11C, G10L
7.	IT methods for management	G06Q
8.	Semiconductors	H01L
II	Instruments	
9.	Optics	G02#, G03B, G03C, G03D, G03F, G03G, G03H, H01S

[3] It should be considered that the data concerning the applicant's origin are obtained by an "equivalent count" so there is a discrepancy in the total number of applications/patents granted depending on the selected search criterion. In the case of these data, an application or granted patent are equivalent to multiple applications/grants, one in each of the state's member of those offices.

No.	Area, field	IPC code
10.	Measurement	G01B, G01C, G01D, G01F, G01G, G01H, G01J, G01K, G01L, G01M, (G0N not G01N-033), G01P, G01R, G01S, G01V, G01W, G04#, G12B, G99Z
11.	Analysis of biological materials	G01N-033
12.	Control	G05B, G05D, G05F, G07#, G08B, G08G, G09B, G09C, G09D
13.	Medical technology	A61B, A61C, A61D, A61F, A61G, A61H, A61J, A61L, A61M, A61N, H0G
III	Chemistry	
14.	Organic fine chemistry	(C07B, C07C, C07D, C07F, C07H, C07J, C40B) not A61K, A61K008, A6Q
15.	Biotechnology	(C07G, C07K, C12M, C12N, C12P, C12Q, C12R, C12S) not A61K
16.	Pharmaceuticals	A61K not A61K-008
17.	Macromolecular chemistry, polymers	C08B, C08C, C08F, C08G, C08H, C08K, C08L
18.	Food chemistry	A01H, A21D, A23B, A23C, A23D, A23F, A23G, A23J, A23K, A23L, C12C, C12F, C12G, C12H, C12J, C13D, C13F, C13J, C13K
19.	Basic materials chemistry	A01N, A01P, C05#, C06#, C09B, C09C, C09F, C09G, C09H, C09K, C09D, C09J, C10B, C10C, C10F, C10G, C10H, C10J, C10K, C10L, C10M, C10N, C11B, C11C, C11D, C99Z
20.	Materials, metallurgy	C01#, C03C, C04#, C21#, C22#, B22#
21.	Surface technology, coating	B05C, B05D, B32#, C23#, C25#, C30#
22.	Micro-structural and nano-technology	B81#, B82#
23.	Chemical engineering	B01B, B01D-000#, B01D-01##, B01D-02##, B01D-03##, B01D041, B01D-043, B01D-057, B01D-059, B01D-06##, B01D-07##, B01F, B01J, B01L, B02C, B03#, B04#, B05B, B06B, B07#, B08#, D06B, D06C, D06L, F25J, F26#, C14C, H05H
24.	Environmental technology	A62D, B01D-045, B01D-046, B01D-047, B01D-049, B01D-050, B01D-051, B01D-052, B01D-053, B09#, B65F, C02#, F01N, F23G, F23J, G01T, E01F-008, A62C
IV	Mechanical engineering	
25.	Handling	B25J, B65B, B65C, B65D, B65G, B65H, B66#, B67#
26.	Machine tools	B21#, B23#, B24#, B26D, B26F, B27#, B30#, B25B, B25C, B25D, B25F, B25G, B25H, B26B
27.	Engines, pumps, turbines	F01B, F01C, F01D, F01K, F01L, F01M, F01P, F02#, F03#, F04#, F23R, G21#, F99Z
28.	Textile and paper machines	A41H, A43D, A46D, C14B, D01#, D02#, D03#, D04B, D04C, D04G, D04H, D05#, D06G, D06H, D06J, D06M, D06P, D06Q, D99Z, B31#, D21#, B41#
29.	Other special machines	A01B, A01C, A01D, A01F, A01G, A01J, A01K, A01L, A01M, A21B, A21C, A22#, A23N, A23P, B02B, C12L, C13C, C13G, C13H, B28#, B29#, C03B, C08J, B99Z, F41#, F42#
30.	Thermal processes and apparatus	F22#, F23B, F23C, F23D, F23H, F23K, F23L, F23M, F23N, F23Q, F24#, F25B, F25C, F27#, F28#
31.	Mechanical elements	F15#, F16#, F17#, G05G
32.	Transport	B60#, B61#, B62#, B63B, B63C, B63G, B63H, B63J, B64#
V	Other fields	
33.	Furniture, games	A47#, A63#
34.	Other consumer goods	A24#, A41B, A41C, A41D, A41F, A41G, A42#, A43B, A43C, A44#, A45#, A46B, A62B, B42#, B43#, D04D, D07#, G10B, G10C, G10D, G10F, G10G, G10H, G10K, B44#, B68#, D06F, D06N, F25D, A99Z
35.	Civil engineering	E02#, E01B, E01C, E01D, E01F-001, E01F-003, E01F-005, E01F007, E01F-009, E01F-01#, E01H, E03#, E04#, E05#, E06#, E21#, E99Z

Source: Schmoch, 2008, pp. 9-10.

The proposed system for assigning IPC patent codes to a particular technological direction and technological field (see Table 2) was prepared with the aim of providing *a "basic tool for the analysis of country structures and international comparisons, notedly for the determination of specialisation profiles"* (Schmoch, 2008, p. 15). The above allows for the purposes of this paper to use the presented system and the data collected through it to analyze the Bulgarian and foreign patent activity in Bulgaria and the Bulgarian patent activity abroad.

To present the results of the analysis were used:

- *Graphical method* – allows visualization of the studied indicators and reveals the dynamics and trends in their development.
- *Comparative method* – suitable for comparing Bulgarian and foreign patent activity according to quantitative data, as well as for identifying the proportions of individual technological directions.

4. Data and Result

4.1. Patent activity of Bulgarian and foreign applicants

4.1.1. Structure and dynamics of patent application activity

The state and dynamics of the total patent activity of Bulgarian and foreign citizens, measured by the number of patent applications filed in Bulgaria for the period 2010-2021, are presented in Table 3 and Figure 1.

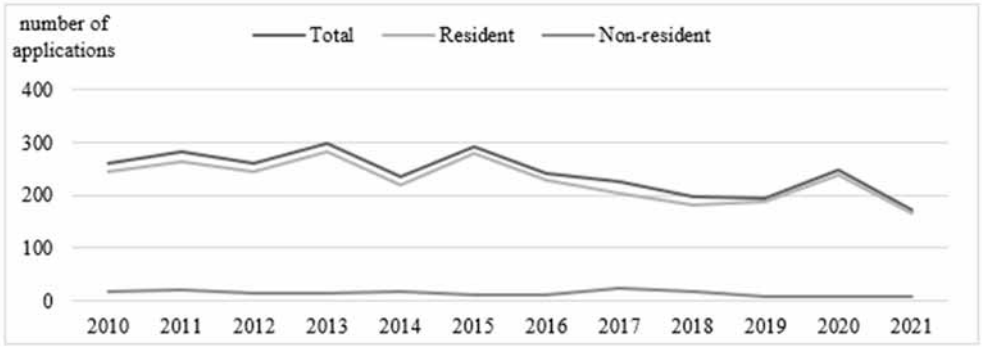
Table 3. General (Bulgarian and foreign) patent application activity in Bulgaria (Number of applications)

Office	Type	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Bulgaria	Total	260	283	259	297	234	291	241	225	198	193	246	171
Bulgaria	Resident	243	262	245	282	218	280	230	202	180	186	239	165
Bulgaria	Non-resident	17	21	14	15	16	11	11	23	18	7	7	6

Source: WIPO Statistic Data Center, Author's calculations.

The data in Table 3 show that the total number of applications during the survey period submitted to BPO is 2,898, with only 5.73% of them from foreign applicants. These data predetermine the total patent application activity in Bulgaria for the period 2010-2021 to be determined by the activity of Bulgarian patent applicants.

Figure 1. Dynamics of the General (Bulgarian and Foreign) Patent Application Activity in Bulgaria (number of applications)



Source: WIPO Statistic Data Center, Author's calculations.

The period analyzed is characterized by instability in the activity of patent applicants, which predetermines a downward trend on average annually by 2.11%.

The activity of Bulgarian patent applicants (see Table 4) can be traced through a number of patent applications filed in Bulgaria and abroad.

Table 4. Patent application activity of Bulgarian citizens in Bulgaria and abroad (number of applications, equivalent count)

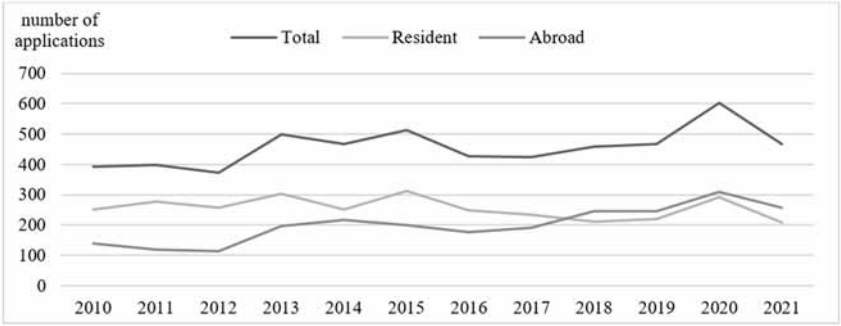
Origin	Type	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Bulgaria	Total	391	397	372	500	467	514	427	425	459	466	602	466
Bulgaria	Resident	252	278	257	304	250	313	249	233	212	220	293	208
Bulgaria	Abroad	139	119	115	196	217	201	178	192	247	246	309	258

Source: WIPO Statistic Data Center, Author's calculations.

The total number of patent applications for the period 2010-2021 increased with an average annual of 2.9%, more influenced by the reported 8.2% average annual growth in patent applications filed by Bulgarian citizens abroad. The patent application activity of Bulgarians directed to the national territory increases by an average annual of only 0.05%.

The dynamics of Bulgarian patent application activity (see Figure 2) outline the relative consistency of applications filed with Bulgaria, despite the measured average annual decrease of 1.7% for the period from 2013 to 2018. Bulgarian application activity abroad increased with some fluctuations throughout the period, with the highest growth in 2013 compared to 2012 (70.4%).

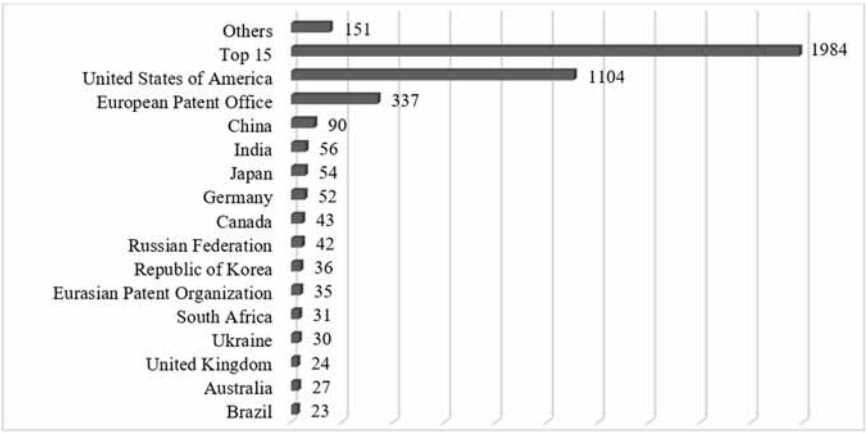
Figure 2. Dynamics of Bulgarian Patent Application Activity in Bulgaria and Abroad (number of applications, equivalent count)



Source: WIPO Statistic Data Center, Author's calculations.

Information about the territories where Bulgarian applicants seek legal protection is presented in Figure 3. It should be noted that the data do not cover all countries in which Bulgarian patent applicants are interested. Out of a total of 53 countries/regional organizations in which for the period 2010-2021 2,135 patent applications have been submitted, data are presented for 15 of them, which form 92.9% share.

Figure 3. Structure of Bulgarian Patent Application Activity Abroad for the Period 2010-2021 (number of applications)

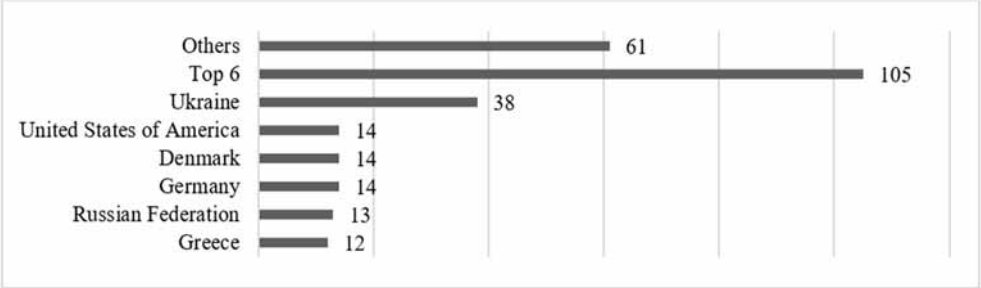


Source: WIPO Statistic Data Center, Author's calculations.

The data testify that Bulgarian patent applicants are targeting highly technologically developed territories. An example is the patent flow to the US, forming a 51.7% share of total activity. Second in terms of applicant interest is the European Patent Office (15.78%) and the third is China (4.21%). Total activity in the top three positions covered a 71.7% share.

The analysis of foreign applicant activity in Bulgaria covers 28 countries, applicants from which seek legal protection in Bulgaria through BPO and the Patent Cooperation Treaty. Information is presented for 6 of them (see Figure 4), the share of patent application activity of which forms 63.25%. The highest contributions are made by applicants from Ukraine (22.89%), followed by the United States, Denmark, and Germany (both 8.43%), the Russian Federation (7.83%) and Greece (7.22%).

Figure 4. Structure of the foreign patent application activity in Bulgaria for the period 2010-2021 (number of applications)



Source: WIPO Statistic Data Center, Author's calculations.

As can be seen, the activity of foreign applicants carried out through BPO, and the Patent Cooperation Treaty is weak. One of the opportunities for low activity may be because foreign patent activity in Bulgaria is conducted through other protection routes, such as those provided by the European Patent Office.

4.1.2. Technological orientation of patent applicant activity

The analysis of the technological focus aims to reveal to which technological areas and fields the patent application activity is addressed.

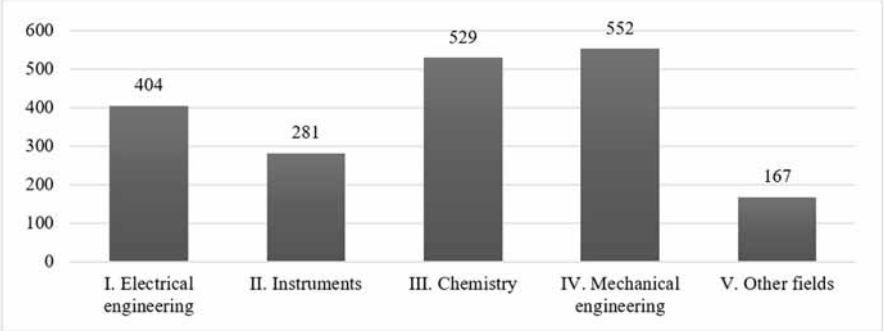
In this regard, Figure 5 presents information on the technological areas targeted by the requesting activity conducted through BPO.

The data prioritize the area of *Mechanical engineering* (28.6% of the total activity of the applicants), followed by: *Chemistry* (27.7%); *Electrical engineering* (20.9%); *Instruments* (14.5%); *Other fields* (8.6%).

Analyzing the distribution of applications filed by Bulgarian and foreign applicants (see Figure 6), there is a divergence in the ranking of technology areas – Bulgarian applicants focus the most patent applications in *Mechanical engineering* (28.64%), while the activity of foreign applicants is focused on the *Chemistry* (50%). Second, are the areas of *Chemistry* (25.2%) for Bulgarian applicants and *Mechanical engineering* (27.8%) for foreign ones. The third position is occupied by *Electrical Engineering* with 22.1% Bulgarian and 8% foreign applicant activity. The fourth most interesting among Bulgarian applicants is *Instruments* (15.3%) and among foreign applicants – *Other fields* (7.4%). The fewest applications,

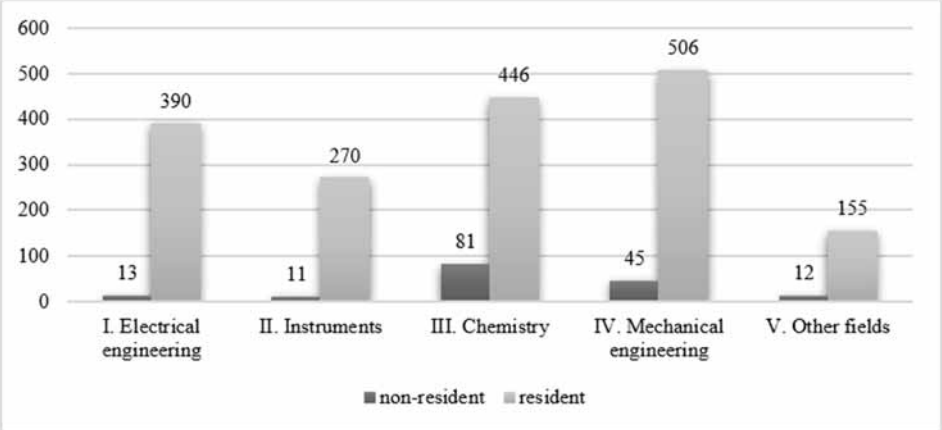
submitted by Bulgarian citizens, are in *Other fields* (8.8%), and foreign applicants show the lowest interest in the *Instruments* (6.8%).

Figure 5. General patent application activity in Bulgaria for the period 2010-2021 by technological fields (number of applications)



Source: WIPO Statistic Data Center, Author's calculations.

Figure 6. Bulgarian and foreign patent application activity in Bulgaria for the period 2010-2021 by technological fields (number of applications)

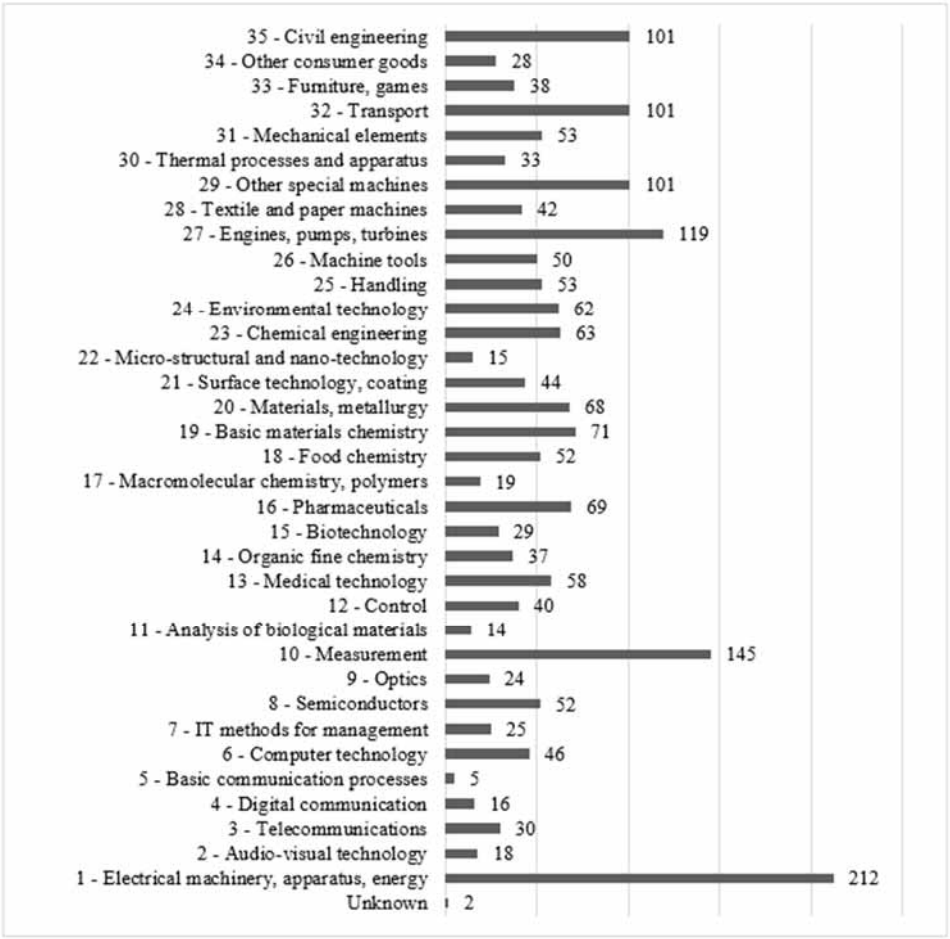


Source: WIPO Statistic Data Center, Author's calculations.

In each of these technological areas, certain fields stand out, in which there is an increased interest in acquiring monopoly positions on the territory of Bulgaria (Figure 7).

It should be noted that with the greatest applicant interest (see Figure 7) are the fields: *Electrical machinery, apparatus, energy* (212); *Measurement* (145); *Engines, pumps, turbines* (119); *Other special machines* (101); *Transport* (101); *Civil engineering* (101). They concentrate 40.3% of the application activity conducted through the Bulgarian Patent Office.

Figure 7. Patent Application Activity in Bulgaria for the Period 2010-2021 by Technological Fields (number of applications)

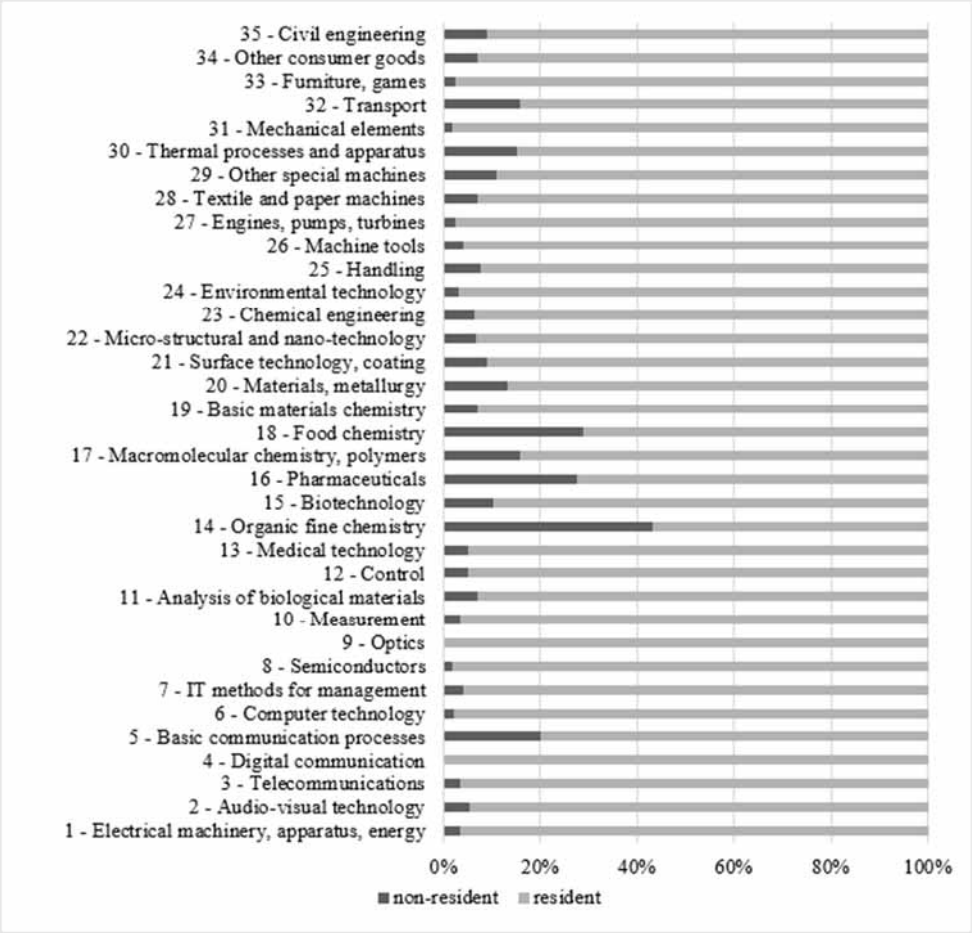


Source: WIPO Statistic Data Center, Author's calculations.

A comparison between the Bulgarian and foreign patent application activity in Bulgaria is presented in Figure 8, which clearly shows the quantitative superiority of the Bulgarian patent application activity over the foreign one.

Information about the Bulgarian patent application activity abroad can be obtained from Figure 9.

Figure 8. Comparison of Bulgarian and foreign patent application activity in Bulgaria for the period 2010-2021 by technological fields (number of applications)

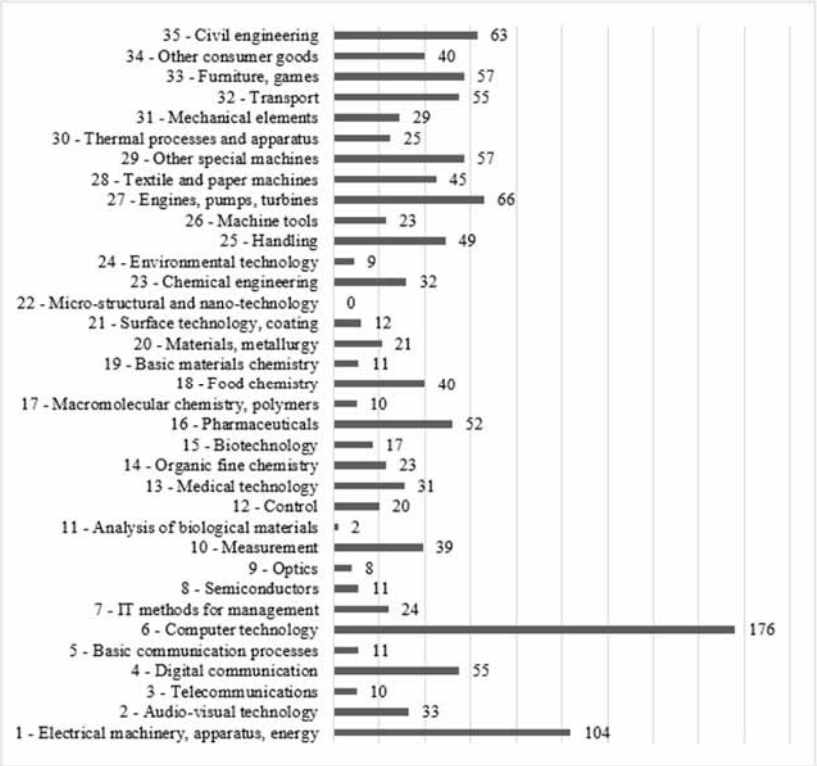


Source: WIPO Statistic Data Center, Author's calculations.

The data are indicative of the striving of Bulgarian applicants to protect their technologies on foreign territories, with the highest share of technological fields: *Computer technology* (13.9%); *Electrical machinery, apparatus, energy* (8.2%); *Engines, pumps, turbines* (5.2%). The applicant activity under the other fields is proportional. An interesting fact is that although there is Bulgarian applicant activity in Bulgaria in the field of *Micro-structural and nano-technology* (see Figure 8), there are still no applications for international protection of the rights over the same technologies.

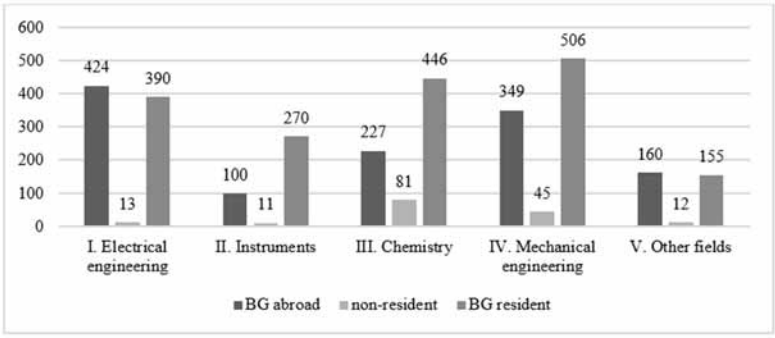
The specialization of Bulgarian applicants abroad by technological fields differs from the reported development trends on national territory (see Figure 10).

Figure 9. Bulgarian patent application activity abroad for the period 2010-2021 by technological fields (number of applications)



Source: WIPO Statistic Data Center, Author's calculations.

Figure 10. Comparison of patent application activity for the period 2010-2021 by technological direction (number of applications)



Source: WIPO Statistic Data Center, Author's calculations.

As can be seen, the highest share of Bulgarian applicant activity abroad is reported by the *Electrical Engineering field* (33.7%), which has a low presence of foreign applications. Second in interest is *Mechanical engineering* (27.7%), and in the third – *Chemistry* (18%). The increased interest of Bulgarian applicants abroad and foreign citizens in Bulgaria in the fields of *Chemistry* and *Mechanical engineering* means that foreign applicants are targeting areas and fields in which Bulgarian applicant activity is higher, therefore they can be said to have a higher local technological level. In the fourth and fifth positions are the *Other fields* (12.7%) and *Instruments* (7.9%), respectively, in which there is less interest than Bulgarian citizens in filing patent applications abroad.

To establish the extent to which the reported trends in patent application activity are also observed with respect to granted patents, the analysis continues with data on the activity of patentees.

4.2. Activity of Bulgarian and foreign patentees

According to the activity data of the patentees, similar measurements and analyses were conducted.

4.2.1. Structure and dynamics of patentees' activity

The state and dynamics of the total patent activity of Bulgarian and foreign citizens, measured by the number of patents granted in Bulgaria for the period 2010-2021, are presented in Table 5 and Figure 11.

The data in Table 5 show that the total number of patents granted by BPO for the period 2010-2021 is 1606, of which 24% belong to foreign patentees. The above-mentioned as well as the reflected dynamics of patent activity (see Figure 11) determine the total activity in Bulgaria for the period 2010-2021 to be determined by the activity of Bulgarian patent holders.

Table 5. General (Bulgarian and foreign) patent activity in Bulgaria (number of grants)

Office	Type	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Bulgaria	Total	251	128	101	125	72	37	42	77	181	195	215	182
Bulgaria	Resident	121	61	57	67	56	28	36	69	171	182	203	169
Bulgaria	Non-resident	130	67	44	58	16	9	6	8	10	13	12	13

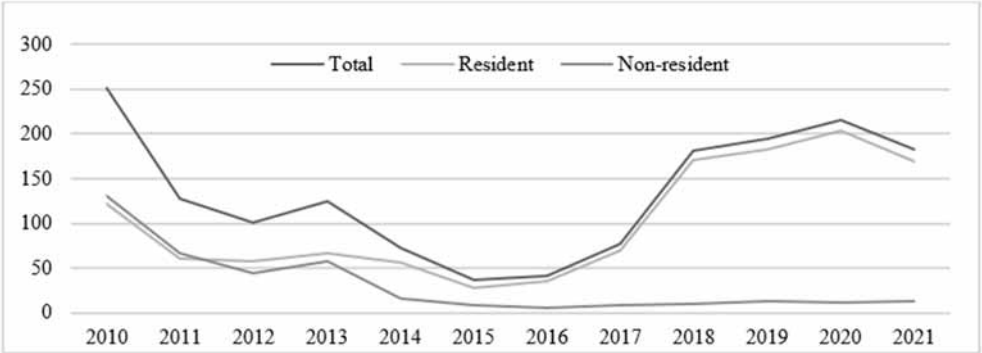
Source: WIPO Statistic Data Center, Author's calculations.

The data (see Figure 11) outline two trends in the activity of patent owners in Bulgaria for the period 2010-2021. The first is the measured decline in the activity of Bulgarian patent owners from 2010 to 2015, an average annual of 21%, the strongest this decline being expressed in 2015 compared to 2014 (50%) and in 2011 compared to 2010 (49.6%). Foreign

patent activity decreased by 33.4% on average annually for the period 2010-2016, most noticeably in 2014 compared to 2013 (72.4%) and in 2011 compared to 2010 (48.5%).

The second trend reported for the study period is an increase in activity, as for Bulgarian patent owners it continues from 2015 to 2020 (annual average of 57.2%), the most pronounced in 2018 compared to 2017 (147.8%). In 2021, there is again a slight decrease in the activity of Bulgarian patent owners (16.7%). An increase in the number of granted patents in the period 2017-2021 is also observed for foreign (an annual average of 17.8%).

Figure 11. Dynamics of the General (Bulgarian and Foreign) Activity of Patent Owners in Bulgaria (number of grants)



Source: WIPO Statistic Data Center, Author's calculations.

The activity of Bulgarian patent owners in Bulgaria and abroad (see Table 6) is characterized by relative comparability – 52.2% of patents have an effect on the territory of Bulgaria and 47.8% are directed abroad.

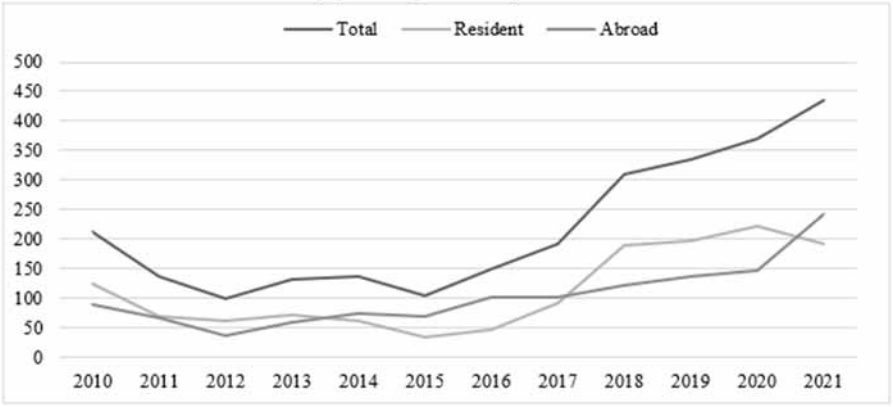
Table 6. Activity of Bulgarian patent owners in Bulgaria and abroad (number of patent grants, equivalent count)

Origin	Type	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Bulgaria	Total	213	136	99	131	138	104	150	192	310	334	369	435
Bulgaria	Resident	124	69	62	72	63	35	47	91	189	198	221	192
Bulgaria	Abroad	89	67	37	59	75	69	103	101	121	136	148	243

Source: WIPO Statistic Data Center, Author's calculations.

The dynamics of the patent activity of Bulgarian patent owners (Figure 12) shows a general trend of growth (annual average of 10.9%) in the granted patents in Bulgaria and abroad for the period 2010-2021, although in some years there is a certain decrease.

Figure 12. Dynamics of the activity of Bulgarian patent owners in Bulgaria and abroad (number of patent grants, equivalent count)

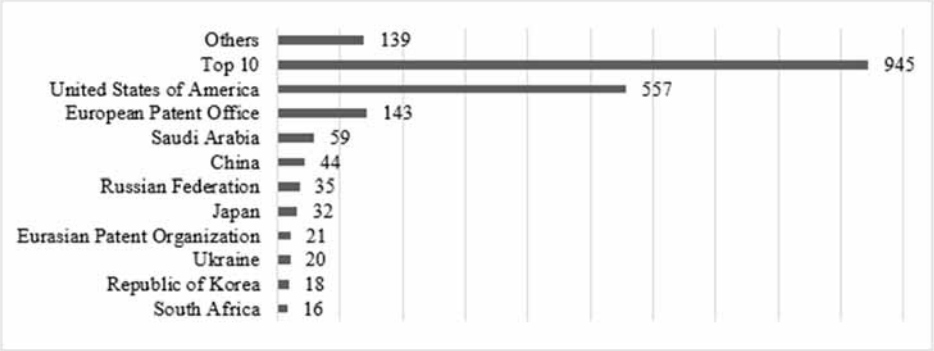


Source: WIPO Statistic Data Center, Author's calculations.

A stronger increase in acquired patent rights is reported in the patents granted abroad (an annual average of 14.7%) than in those with effect on the territory of Bulgaria (13%).

Information about the territories where Bulgarian patent holders have received legal protection for their technological innovations is presented in Figure 13. It includes data for 10 out of 43 countries/regional unions, forming an 87% share.

Figure 13. Structure of the activity of Bulgarian and patent owners abroad for the period 2010-2021 (number of patent grants)

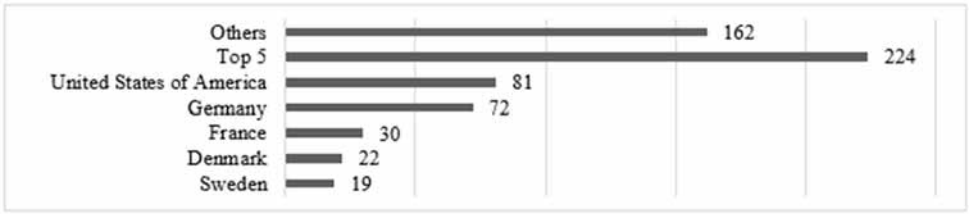


Source: WIPO Statistic Data Center, Author's calculations.

The largest patent flow is reported to the United States, where legal protection was received for 51.4% of the total patents granted to Bulgarian citizens abroad. Second in interest among Bulgarian patent owners is the European patent (13.2%), and third is Saudi Arabia (5.4%). The other territories to which Bulgarians are directed to provide legal protection for their innovative technologies have less than 5% share of the total patent flow abroad.

The analysis of foreign patent activity in Bulgaria covers 39 countries for which BPO has granted patents in the period 2010-2021. Figure 14 presents information on 5 of them, forming 58% of the total foreign patent activity.

Figure 14. Structure of the patents granted by BPO to foreign citizens for the period 2010-2021 (number of grants)



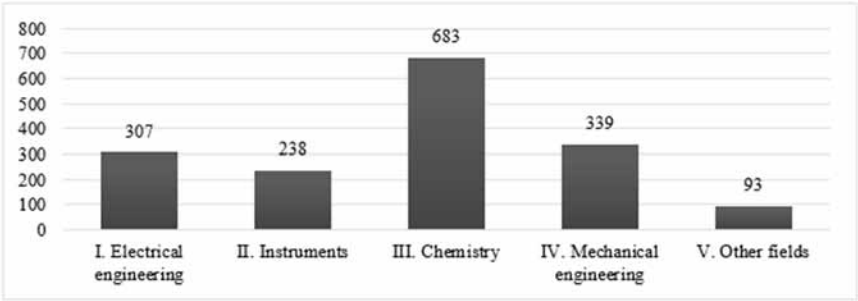
Source: WIPO Statistic Data Center, Author's calculations.

In contrast to the patent application activity in Bulgaria (see Figure 4), the patents granted in the research period (see Figure 14) have shifted the positions of the countries. US patentees rank first in the number of patents granted (21% share), followed by Germany (18.7), France (7.8), Denmark (5.7) and Sweden (4.9). The first applicant country in Bulgaria – Ukraine (38 applications) – has only 5 patents granted in the period 2010-2021. Of course, the extended period of conducting an examination of innovative technologies may delay the issuance of a patent for more than 36 months, which does not preclude obtaining a patent for the requested technologies in future periods.

4.2.2. Technological orientation of granted patents

The technological areas targeted by the granted patents are presented in Figure 15.

Figure 15. Total patents granted in Bulgaria for the period 2010-2021 by technological areas (number of grants)

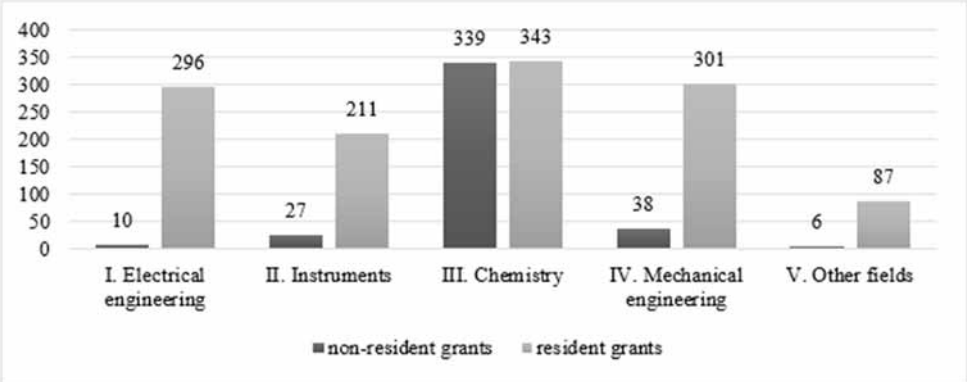


Source: WIPO Statistic Data Center, Author's calculations.

The highest concentration of patent rights is reported in *Chemistry* – 41.1% of the total patent activity. This contrasts with the applicant activity, where the most interesting was the field of *Mechanical engineering*, which in the number of patents granted by BPO falls in second position (20.4%). Third in the number of patents granted is *Electrical engineering* (18.5%), fourth is *Instruments* (14.3%), and fifth is *Other fields* (5.6%), which occupy the same positions in patent application activity.

The analysis of the number of patents granted by technological area according to the nationality of the patentee (see Figure 16) shows a strong development in *Chemistry*. There is a quantitative comparability between the patents obtained from Bulgarian and foreign holders.

Figure 16. Patents granted in Bulgaria for the period 2010-2021 by technological fields and according to the nationality of the patent owner (number of grants)



Source: WIPO Statistic Data Center, Author's calculations.

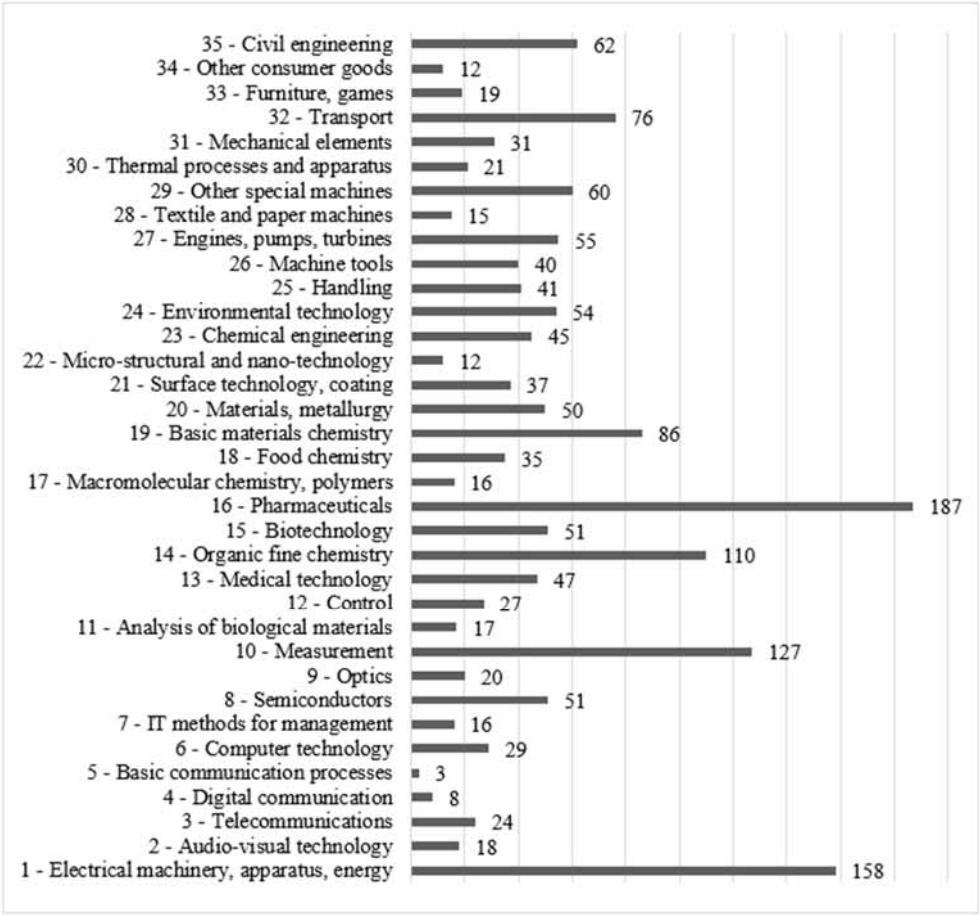
The relative share of foreign patent activity in the areas of *Chemistry* is 80.7% and the Bulgarian activity is 27.7%. Second, in the number of patents granted is *Mechanical Engineering*, with a 24.3% share for Bulgarian patent owners and 9% share for foreign ones. Next for Bulgarian patent owners is *Electrical Engineering* (23.9%), and foreign citizens have patented their technologies in *Instruments* (6.4%). The share of Bulgarian patents in *Instruments* is 17%, while for foreigners the share of patent rights obtained in the fourth most interesting area *Electrical engineering* is 2.4%. The weakest interest is the area of *Other fields* with respectively 7% share of the total patents granted for Bulgarian and a 1.4% share of the patents granted for foreign patentees.

Of interest for the present analysis are also the technological fields in the composition of the technological areas and the distribution of patent rights in them (see Figure 17).

Unlike the applicant activity, the acquired patent rights are characterized by a different ratio in technological fields. The largest number of monopoly rights are granted in the *Pharmaceuticals* (11.3% share of total patent grants), which predetermines the first position of the *Chemistry* area. Second, in the number of patents granted to Bulgarian and foreign owners is *Electrical machinery, apparatus and energy* (9.5%), and a third is *Measurement*

(7.7%). Each of these fields is leading in the respective technological areas. Next positions are occupied by *Organic fine chemistry* (6.6%) and *Basic materials chemistry* (5.2%). The other technological fields have a share of less than 5% of the monopoly rights granted by BPO for the period 2010-2021.

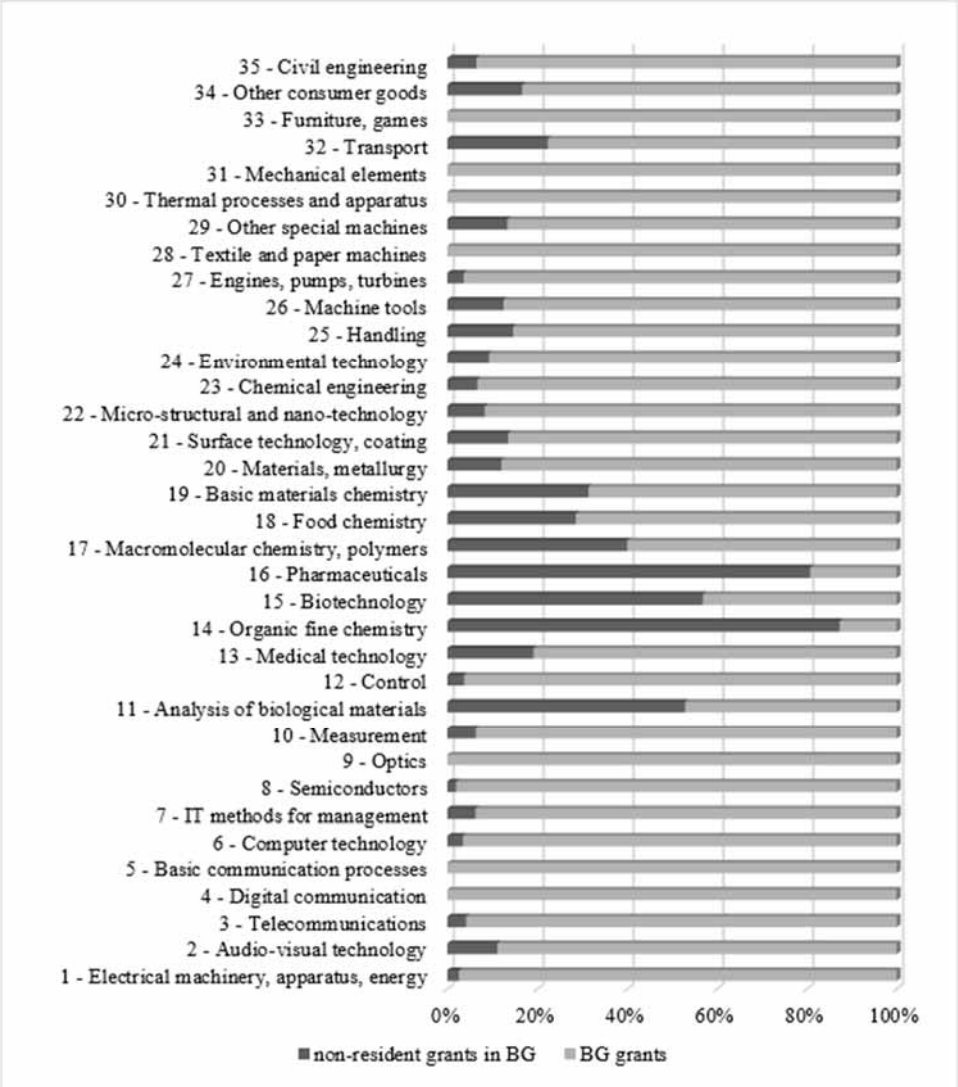
Figure 17. Number of patents granted in Bulgaria for the period 2010-2021 by technological fields (number of grants)



Source: WIPO Statistic Data Center, Author's calculations.

A comparison of the activity of patent owners from Bulgaria and abroad by technological fields is illustrated in Figure 18.

Figure 18. Comparison of the number of patents granted to Bulgarian and foreign owners in Bulgaria by technological fields for the period 2010-2021 (number of grants)

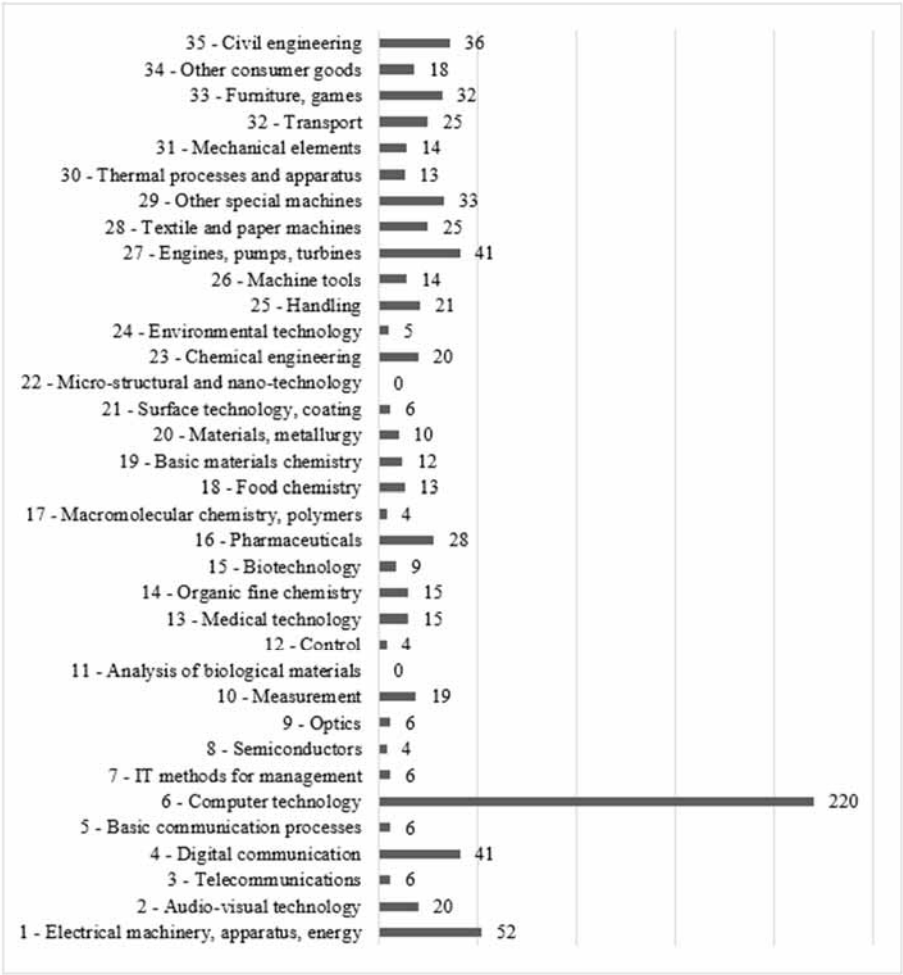


Source: WIPO Statistic Data Center, Author's calculations.

Unlike patent application activity (see Figure 8), where Bulgarian patent applicants are dominant, here (see Figure 18) there is a quantitative superiority of foreign patents rights in the technological area of *Chemistry* and, in the fields of: *Pharmaceuticals* – 34.2% share of total foreign patents granted against 2.9% of Bulgarian patents; *Organic fine chemistry* – 21.8% of foreign ones in 1.1% of Bulgarian patents; *Biotechnology* – 6.6% foreign and 1.8%

Bulgarian patent rights. Bulgarian activity in *Chemistry* is concentrated in other fields, such as: *Basic materials chemistry* (4.8%); *Environmental technology* (4%); *Materials, metallurgy* (3.6%), etc., which contributes to the quantitative comparability between the number of patent rights for Bulgarian and foreign patentees in this field (Figure 16).

Figure 19. Number of patents granted to Bulgarian owners abroad by technological fields for the period 2010-2021 (number of grants)



Source: WIPO Statistic Data Center, Author's calculations.

Bulgarian patent owners are focusing on *Electrical machinery, apparatus, energy* (12.4% share of total patents granted) and *Measurement* (9.6%). The rest of the patents granted to Bulgarian citizens is distributed along the different fields within 5% of the total patents granted.

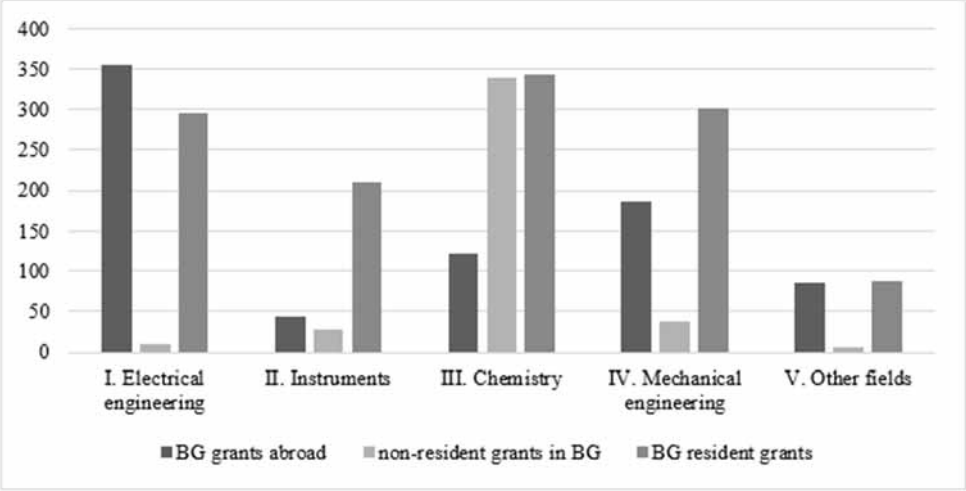
The data are also indicative of the presence of fields entirely dominated by Bulgarian monopoly rights, such as: *Digital communication*; *Basic communication processes*; *Optics*; *Textile and paper machines*; *Thermal processes and apparatus*; *Mechanical elements*; *Furniture, games*.

Looking at the activity of Bulgarian patent owners abroad (Figure 19), we can consider the similarity in the positions of the technological fields in the applied-for (Figure 9) and the obtained patent rights.

The largest share of patents was granted in *Computer technology* (27.7%); *Electrical machinery, apparatus, energy* (6,6%); *Engines, pumps, turbines* (5.2%), and *Digital communication* (5.2%). In the other fields, the obtained patent rights are less than 5% of the total share. In the fields of *Micro-structural and nano-technology* and *Analysis of biological materials* for the research period, there are no protected Bulgarian patent rights abroad.

A comparison of the granted patents of Bulgarian and foreign citizens in Bulgaria and Bulgarian citizens abroad is presented in Figure 20.

Figure 20. Comparison of patent activity by technological areas for the period 2010-2021 (number of grants)



Source: WIPO Statistic Data Center, Author's calculations.

Like the applicant activity, the highest patent activity Bulgarian patent owners demonstrate in *Electrical engineering* – it is concentrated at 44.8% of the total patent activity abroad. The second area in which monopoly positions of Bulgarian patentees abroad are concentrated, is *Mechanical engineering* (23.5%), and a third is *Chemistry* (15.4%). In fourth and fifth

position are respectively – *Other fields* (10.8%) and *Instruments* (5.5%), in which both the applicant activity and the number of patents granted have less interest.

In summary, the Bulgarian activity of patent owners in Bulgaria is transferred abroad – the areas where there is a concentration of patent rights on the national territory are also those where there is the largest share of Bulgarian patents abroad.

5. Conclusions

Although this study presents a limited view of the patent activity of Bulgarian and foreign applicants and patent owners in Bulgaria and the Bulgarian patent activity abroad, the analysis allows us to outline the following conclusions:

First. The analysis of the state and dynamics of Bulgarian and foreign patent activity in Bulgaria and Bulgarian activity abroad allows disclosure of the ongoing technological changes and assessment of the inventive potential in the country. The negative downward trend in the overall (Bulgarian and foreign) applicant activity in Bulgaria for the period 2010-2021 is indicative of a decrease in the interest in protecting the rights to innovative technologies in Bulgaria. At the same time, it is observed an increase in Bulgarian applicant activity abroad, aimed at advanced or technologically developing countries, including the United States, the Member States in the European Patent Office, China, India, Japan, Germany, and others.

The analysis of the state and dynamics of granted patents considers the mentioned trends, with the most noticeable decrease in the number of patents granted to foreign patentees – from 130 patents in 2010 to 13 in 2021. These data, in addition to the outflow of foreign interest in the Bulgarian market and reduced investment activity of foreign companies, may also indicate a transition to the protection of patent rights through the EPO and other regional organizations, data for which are not collected and processed by the WIPO Statistic Data Center.

The data on the number of patents granted to Bulgarian patent owners in Bulgaria and abroad shows an increase in the activity of Bulgarians for the protection of innovative technologies outside the national territory (USA, EPO, China, etc.).

Second. The analysis of the technological areas targeted by Bulgarian applicants in Bulgaria for the period 2010-2021 brings the area of *Mechanical engineering* as the most preferred for patenting. Second in interest for Bulgarian applicants is the area of *Chemistry*, third is *Electrical engineering*, and fourth and fifth place respectively are *Other fields* and *Instruments*. Bulgarian activity abroad for the same period is ranked in a different sequence – the first place is the area of *Electrical engineering*, followed by the areas of *Mechanical engineering*, *Chemistry*, *Other fields*, and *Instruments*.

This testifies to the technological specialization and orientation of the state and companies towards specific technological areas to which future development and inventive potential are directed. Obviously, the aspiration of Bulgarian applicants abroad is focused on *Electrical engineering*, given that in two of the fields in the same area, the highest concentration of

patent applications was measured: *Computer technology* (14% of the total applications filed) and *Electrical machinery, apparatus, energy* (8.2%). On the other hand, the development of technological fields in *Mechanical engineering* (first in the concentration of applications for protection of patent rights in Bulgaria) reflects the domestic specialization of the country.

Third. The structure of the patents granted in Bulgaria brings out the first in important area of *Chemistry* (41.1%). The high degree of quantitative coincidence between the granted Bulgarian (343) and foreign (339) patents in *Chemistry* shows that foreign interest is directed to areas that are characterized by higher local technological level. This is an opportunity for technological exchange and transfer of patented knowledge, granting licenses or implementing a partnership which will contribute to continued technological development and a higher level of competitiveness. Nevertheless, the distribution of patents in different areas in the field of Chemistry testifies to the lagging behind of Bulgarian patent owners compared to foreign patentees in the fields of Organic fine chemistry, Biotechnology and Pharmaceuticals, which are characterized by high added value and higher importance in the context of the concept of sustainable development.

The second area in which there is a strong concentration of Bulgarian and foreign patents is *Mechanical engineering*, reflecting the internal technological specialization of Bulgaria, and the third in the number of patents granted to Bulgarian citizens is the area of *Electrical engineering*, reflecting the external specialization of companies.

Fourth. Low Bulgarian and foreign patent activity in the areas of Instruments and Other fields talk about difficulties and problems related to inventive capacity, low level of R&D spending and lack of incentives and opportunities for development in these technological areas and fields.

The study and the outlined conclusions allow us to confirm the importance of patent statistics as an indicator of technological changes in the economy and an appropriate tool for analyzing the inventive potential in Bulgaria, as well as for revealing the changes and trends taking place during the study period.

The increased interest of Bulgarian citizens in acquiring monopoly positions on the territory of Bulgaria and abroad through patenting of innovative technologies reflects the scientific and technical expansion of Bulgaria to other countries. Similarly, analyzing the nationality of patented inventions by foreign patentees in Bulgaria can determine which country has economic interests in our country, and the data on the classification indices under the IPC and their analysis determines the technological areas and fields in which these interests are expected to be realized.

Analyzing the patent activity of Bulgarian patent applicants and patent owners should also consider the fact that the state of patent activity in Bulgaria is a result of the influence of several factors with a negative impact on the decision of managers to create innovative intellectual developments that will legally protect through intellectual property rights, including:

- *Low level of R&D expenditure* – according to data from the World Economic Forum for 2021 (WEF, Sep 16, 2022), the level of R&D investment in Bulgaria is lower than in

other EU-27 Member States. For this year, in terms of funds from the state budget aimed at R&D, our country occupies the penultimate position, ahead of only Romania.

- *Insufficient level of awareness and motivation of enterprise managers* – in a survey of the non-financial enterprises operating in Bulgaria in the manufacturing industry for the period 2015-2017, Panteleeva, Varamezov & Kostadinova (2018) found the extremely weak patent activity of the included enterprises. Moreover, respondents declare that *"insufficient information and knowledge in this field have prompted a significant share of managers to passive behaviour and the search for other ways to preserve the available company knowledge and assets."* (Panteleeva, Varamezov & Kostadinova, 2018, p.140) A prerequisite for the results obtained can also be found in the scope of the survey, in which the predominant share of respondents (96%) are micro, small, and medium-sized enterprises. Their limited R&D capabilities, in addition to the necessary costs of acquiring and maintaining intellectual property rights, are a significant barrier that negatively affects patent activity in Bulgaria.

- *Stability of the legal system in the protection of patent rights* – one of the reasons discouraging the patent activity of enterprises and independent inventors is the difficulties in proving the abuse of foreign rights. Often, infringers who, instead of putting effort and money into their own developments, prefer to "copy" foreign innovative technologies, especially in cases where it is difficult to establish the unlawful use of someone else's patent rights.

These barriers to the patent activity of enterprises exacerbate their negative impact due to the impact of adverse factors on the surrounding enterprise. With the most pronounced influence can be highlighted, but not limited to, the following problem areas:

- highly dynamic and difficult to predict the functioning environment of enterprises, inability to predict market changes in the long term, difficulties in identifying market opportunities for enterprises, difficulties in entering foreign markets and competing with powerful foreign companies.

- absence of effective legislation stimulating the innovation activity of enterprises.

- lack of financial resources for the development and subsequent management of intellectual property rights.

- lack of potential for creation, acquisition, assimilation, and dissemination of technological knowledge due to the presence in enterprises of obsolete equipment and the lack of highly qualified and motivated researchers.

- ineffective interaction between scientific organizations and business.

The impact of these problems can be reduced by applying various measures and instruments, not only at the level of the enterprise, but also at a national and regional level:

- stimulating inventive activity in areas and directions where there is a lag in global trends, but also directing the efforts of researchers to meet the needs of the Bulgarian market.

- increasing R&D investment for micro, small and medium-sized enterprises, which have the most significant lag in terms of research and innovation activities.
- It is necessary to regularly conduct explanatory events on the importance of intellectual property rights for business.
- Creation of a national program to stimulate inventive activity and cooperation of Bulgarian and foreign scientific organizations.

In summary of what has been stated so far and considering the significant difficulties encountered by companies and independent inventors in providing legal protection for their developments, it should be emphasized that the use of intellectual property rights is a factor in achieving not only corporate growth and sustainability of results, but also contributes to the development of the regions and economies of individual countries. In this regard, patent statistics, as a predictor of technological development and economic change, can contribute to the development of a more flexible and scientifically based patent policy, an integral part of the general economic policy of any country, industry, or company.

The use of patent statistics as a predictor of technological development and economic change can contribute to the elaboration of a more flexible and science-based patent policy, an integral part of the general economic policy of each country, industry, or firm.

As a result of the study, we have achieved the following:

1. We presented existing patent research, showing patent statistics as a significant indicator of technological changes in the economy.
2. We studied and analysed the state and dynamics of patent application activity for the period 2010-2021 of Bulgarian and foreign applicants.
3. We studied and analysed the state and dynamics of patents granted in the period 2010-2021 to Bulgarian and foreign patent owners.
4. We revealed the trends of technological development by technological areas and fields.

Some questions remain that are not included in this paper and would be the subject of future studies: expanding the time scope of the study, establishing the trends and direction of change in the foreign patent flow in Bulgaria; analyzing the application activity and a number of patents granted through the European Patent Office, revealing the possibility of redirecting foreign applicants to the EPO patent procedures; disclosure of the links between the resource provision of enterprises in Bulgaria and their patent activity.

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