

STRUCTURE AND DYNAMICS OF THE PATENT ACTIVITY OF THE EUROPEAN PATENT OFFICE FOR THE PERIOD 2015-2024

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Abstract

In this report, we focus on analysing the structure and dynamics of patents applied for and granted by European Patent Office (EPO) Member States to outline existing trends in inventive activity. The purpose of this study is to identify and highlight the leading countries in which the inventive capacity is concentrated, analyzing their innovative performance in the period 2015-2024.

Keywords: innovation, patent activity, European Patent Office (EPO).

INTRODUCTION

The rapid modern development of society and the wide variety of technologies used by people daily is undoubtedly related to and depends on the innovative activity of inventors. Regardless of the specific sector in which the innovation is created and applied, its type and nature [1]-[5], the main goal of the innovation process is not only to achieve technological development, but also to *"successfully solve social problems. economic, political, and environmental problems and challenges"* [5, p.53].

In this regard, with this study, we **aim** to analyze the structure and dynamics of the patents applied for and granted by EPO Member States, which are a direct measure of the innovation activity of inventors.

The object of the study is the European Patent Office, and **the subject** of the study is patent activity conducted by the Member States.

Using mathematical and statistical analysis of the data extracted from the Statistics and Trade Centre [6] of the EPO, we have revealed the leading countries in which inventive capacity and their

participation in the process of technological development are concentrated.

A limitation in this study is the number of countries in respect of which the analysis will be carried out – the scope of the study includes the 39 Member States: Albania (AL), Austria (AT), Belgium (BE), Bulgaria (BG), Czech Republic (CZ), Estonia (EE), Germany (DE), France (FR), Luxembourg (LU), Netherlands (NL), Switzerland (CH), United Kingdom (GB), Sweden (SE), Italy (IT), Liechtenstein (LI), Greece (GR), Spain (ES), Denmark (DK), Monaco (MC), Portugal (PT), Ireland (IE), Finland (FI), Cyprus (CY), Türkiye (TR), Slovakia (SK), Slovenia (SI), Hungary (HU), Romania (RO), Poland (PL), Iceland (IS), Lithuania (LT), Latvia (LV), Malta (MT), Croatia (HR), Norway (NO), North Macedonia (MK), San Marino, (SM), Serbia (RS), Montenegro (ME).

The contribution of the study is to outline the trends in patent activity of the leading patent holder countries, which have manifested themselves during the analyzed period.

EUROPEAN PATENT OFFICE

The European Patent Organization and the European Patent Office were founded by sixteen countries through the signing of the European Patent Convention (EPC) in Munich on 5 October 1973. Their effect began at the end of 1977, when it became possible to achieve patent effect on the territory of all the Member States chosen by the applicant by filing a single application for patenting an invention.

In the following decades, the EPO continued not only its expansion by including additional territories in its scope but also acted towards harmonization of legislation and cooperation with other international organizations and patent offices. At the end of the 20th century, the electronic database Espacenet [7] was introduced, allowing free access to about 30 million people. patent records [8].

The beginning of the 21st century was marked by the first online patent application and the opening of the European Patent Academy, training specialists and stakeholders in the field of patent policy. In the following years, cooperation between individual patent offices deepened, with the introduction of the Cooperative Patent Classification (CPC) in 2010 [9], jointly managed by the EPO and the US Patent and Trademark Office [8]. Legislative changes have been initiated for the establishment of a unitary patent system and a unitary patent court (2012-2013) [8].

In the coming years, the EPO will increase its commitment to achieving sustainable development by adopting a new environmental policy, as well as promoting clean energy and green technology research, drawing up strategies for future development, intensifying innovation, and economic development [8].

The policy of enlargement of the EPO has resulted in 39 Member States [10], one extension state (Bosnia and Herzegovina) and six validated territories (Morocco, Republic of Moldova, Tunisia, Cambodia, Georgia, Lao People's Democratic Republic) [11] (see Figure 1).

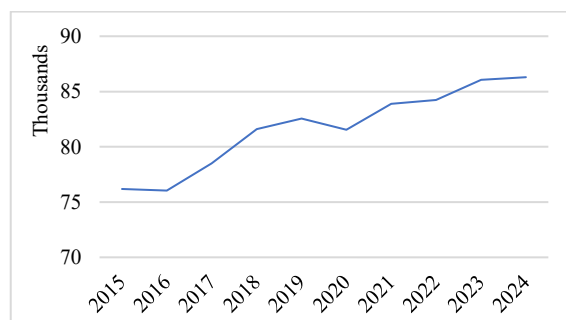
As a result of the EPO's activities, millions of patent holders have received legal protection for their inventions over the years, with the focus of this study on the patent activity conducted by the 39 Member States in the period 2015-2024.



Fig. 1. Coverage of EPO [11]

APPLICATION ACTIVITY OF THE EPO MEMBER STATES

From January 2015 to December 2024, EEA Member States filed a total of 816,885 patent applications for inventions. The total dynamics of this activity are presented in Figure 2.



Source: own calculations based on data from [6]

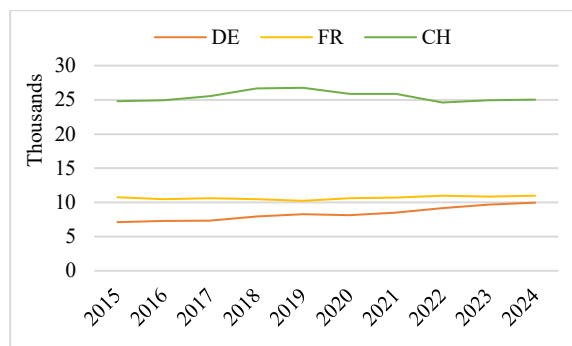
Fig. 2. Dynamics of patent application activity (total for EPO Member States)

From the data presented in Figure 2 we find a positive trend of development, expressed in growth, on average by 1.41% per year. In 2024, the total number of applications exceeds by more than 10,000 applications submitted in 2015. For the entire period of the study, we find a slight decrease in the number of applications submitted in 2016 compared to 2015 (0.2%) and in 2020 compared to 2019 (1.24%),

which does not affect the sustainable development of application activity in the long term.

The participation of individual countries in the application activity thus outlined is presented by grouping them according to the relative share of the contribution to the formation of the total patent activity during the study period (number of patent applications filed).

The first group (Top 3) includes Germany, France, and Switzerland (see Figure 3), which together account for 54.5% of the patent application activity of the EPO Member States.



Source: own calculations based on data from [6]

Fig. 3. Dynamics of patent application activity (first group)

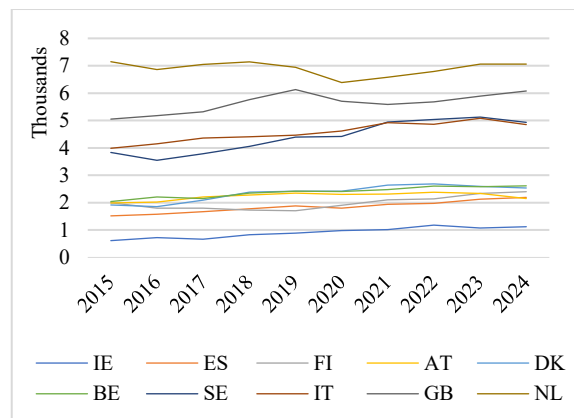
Applicants from Germany filed a total of 255,063 patent applications through the EPO, with relative stability in their application activity throughout the period, contributing to an increase of 0.1% on average annual.

The observed dynamics in the activity of applicants from France are similar. For the period 2015-2024, they submitted 106,698 applications, 2.4 times less than Germany, and their annual expression is between 10,233 and 10,983.

In contrast to the first two countries, which did not show a significant development of their innovation activity during the period analysed, Switzerland's application activity increased by an average

of 3.9% annually, with the number of applications submitted in 2024 (9,966) being 1.4 times higher than that measured in 2015 (7,116).

The second group of applicants (IE, ES, FI, AT, DK, BE, SE, IT, GB, NL) accounted for a total of 40.69% of the activity, with the individual contribution of each country being between 1.1% and 8.5%. The dynamics in this activity are presented in Figure 4.

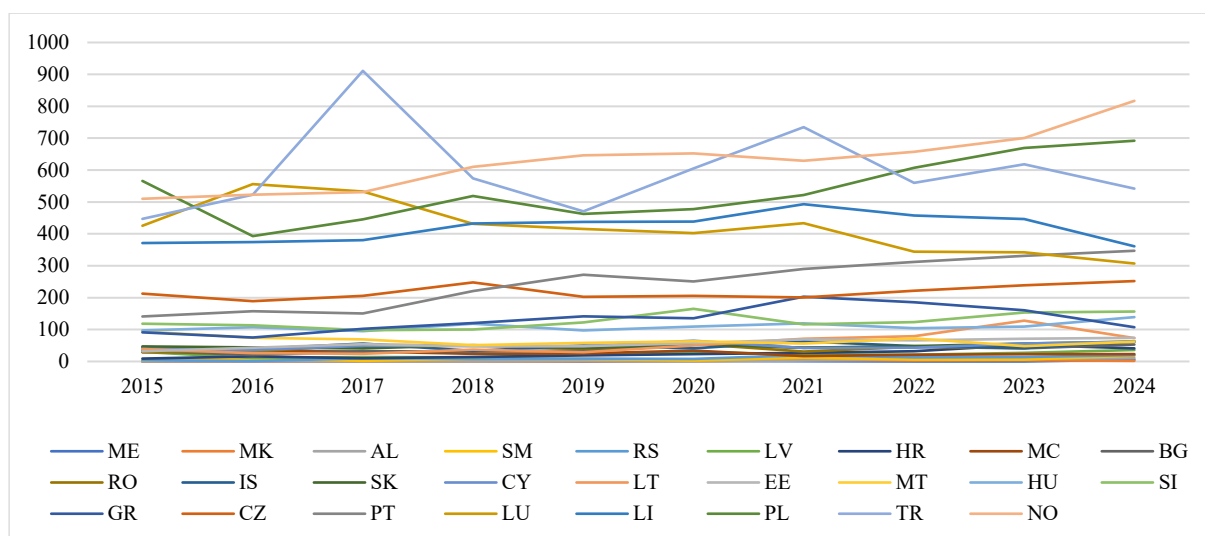


Source: own calculations based on data from [6]

Fig. 4. Dynamics of patent application activity (second group)

From the data on the annual change in the number of patent applications filed, we find that in nine out of ten countries the application activity increased during the study period. The most significant growth in this group is reported in Ireland, with an average annual rate of 7.5%. Although applicants from the Netherlands make the largest contribution to the formation of the total application activity in this group, the dynamics express a negative downward trend, by an average of 0.07% per year.

The latter group of countries (ME, MK, AL, SM, RS, LV, HR, MC, BG, RO, IS, SK, CY, LT, EE, MT, HU, SI, GR, CZ, PT, LU, LI, PL, TR, NO) contributes to only 4.82 % (39,351 applications) of the total activity of EPO Member States. Their individual contribution is between 0.002% and 0.77%.

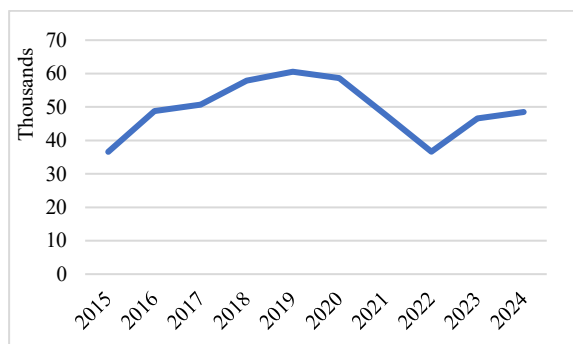


Source: own calculations based on data from [6]

Fig. 5. Dynamics of patent application activity (third group)

PATENTS GRANTED TO MEMBER STATES IN THE EPO

For the period analysed (January 2015 – December 2024), applicants from the thirty-nine EPO Member States were granted rights in a total of 492,594 inventions (see Figure 6).



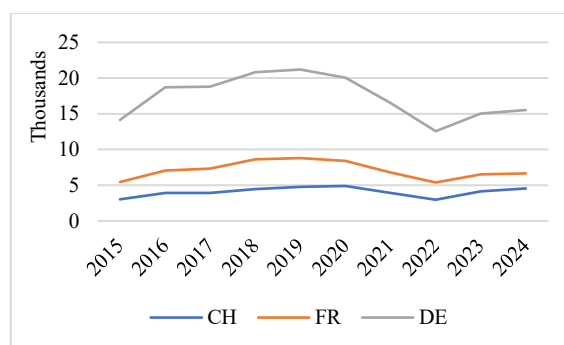
Source: own calculations based on data from [6]

Fig. 6. Dynamics of granted patents total for EPO Member States)

The general dynamics of the granted patents show an increase in the acquired rights to inventions until 2019, on average by 14.01% per year. This is followed by a period of decline from 2020 to 2022 inclusive, with an average annual rate of 15.02%. At the end of the period analyzed, there was again an increase in the number of protected inventions, which had a positive impact on the reported trend of patent activity for the entire period, expressed in an

increase of 4.72% on average per year.

The highest contribution to patent holder activity was made by natural and legal persons from Germany, acquiring a total of 173,314 patents (35.18% share) from 2015 to 2024 (see Figure 7).



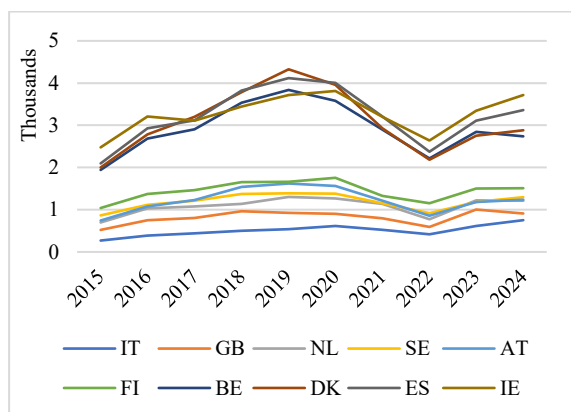
Source: own calculations based on data from [6]

Fig. 7. Dynamics of granted patents (first group)

The granted patents to applicants from Germany are 2.44 times higher than those granted to the second most active country, France (71,001 patents, 14.41% share). The third country is Switzerland (40,597, 8.24% share), whose activity is 1.75 times weaker than that of France and 4.27 times weaker than that of Germany.

Of interest to this analysis is the fact that the identified negative trend of decline in the granted patents in the three leading countries (see Figure 7) is a direct reflection of the

observed decline in the overall activity of the EEA Member States (see Figure 6). This expresses the influence of the three strong economies on the overall development of the patent activity of the European member states of the EPO and raises concerns about the impact of individual countries on the technological development of the Old Continent.



Source: own calculations based on data from [6]

Fig. 8. Dynamics of granted patents (second group)

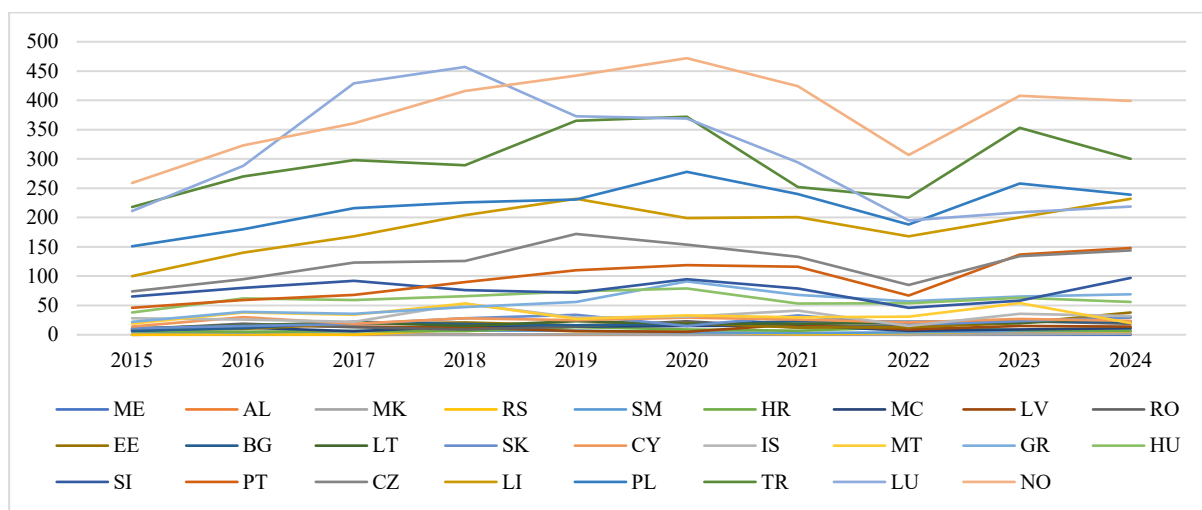
The second group of countries (see Figure 8) achieved 178,470 patents or 38.06% of

the total granted patents. Here we highlight the performance of Ireland, Spain, Denmark, and Belgium, which together form 25.33% of the activity in the group.

We should consider that the negative trends in patent activity in Germany, identified in the period 2020-2022, also have a stronger impact on the number of patents granted by applicants from Austria, Ireland, Spain, Denmark and Belgium, which expresses the dependence of these on the technological changes and trends identified in the leading countries.

The third group of EPO Member States (Figure 9) accounted for 4.1% of the granted patents (20,212 patents). The most significant contribution in this group is made by Norway (3,811 patents, 0.77%), Luxembourg (3,044; 0.62%), Turkey (2,951; 0.6%), and at the bottom of the ranking are Albania (5 patents; 0.001%), North Macedonia (7; 0.001%) and Montenegro (1, 0.0002%).

Despite the weaker patent activity that we report in this group, it also falls under the influence of the negative trends identified by the leaders in the period 2020-2022.



Source: own calculations based on data from [6]

Fig. 9. Dynamics of granted patents (third group)

CONCLUSION

As a result of the analysis of the patent activity conducted by the EPO Member States, we found the following trends:

First. The application activity increased in the analysis period, on average by 1.41% per year. The total number of applications submitted at the end of the period (2024)

exceeded by more than 10,000 applications submitted in 2015.

Second. Patents granted in the period 2024-2025 increase by an average annual rate of 4.72%.

Third. Germany has the most significant contribution to the formation of the patent activity of the EPO member states. The patents applied for and granted for the protection of innovative inventions are 2.4 times more than those of the second country in the ranking – France. Structurally, Germany's application activity is 31.22% of the total activity, and the granted patents account for 35.2% of all patented inventions.

To conclude, we must also note the established negative trend of deepening the technological backwardness of the third group of EPO member states and the insufficient investment in research and inventive activities, which limits the innovative potential of these economies.

In contrast is the strong patent performance of Germany, France, and Switzerland. We should not ignore the fact that the ongoing negative trends in these countries have an impact on the development of other countries, which can undoubtedly lead to strong shocks and a slowdown in the technological development of the whole of Europe.

Highlighting the Member States with the highest activity, we present the leading innovators who set the direction of technological development and from whom rights can be acquired to use the latest achievements of human creativity, which can support the development of technologically lagging countries in the EPO.

The study can be used as a reference point for the changes in the number of applied and patented inventions due to changes in the environment of enterprises, as well as for the period required to restore or adapt innovation activity to the newly created conditions for development.

The proposed analyses can be continued in future studies, in which we deepen our research into specific technological areas and areas where there is the strongest concentration of patent rights, to establish the technological specialisation of the

Member States, and to highlight the technological areas that are most strongly influenced by negative environmental factors.

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