

Patents as an indicator of the future development of individual region

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Abstract. In today's world full of changes, whether the advent of new technologies that are authoritative and will be a trend for many economic sectors or impact Covid epidemic whose effects are still unaware can be sure that the changes in consumer preferences and aggregate demand and increasingly more competition between the largest economies in geographical terms, all this puts more importance on research and development. It is expected a new impetus in the field of patents that will respond to new impulses from the market.

Monitor the development of patents over the last year in the broader perspective implies growth or decline in individual industries and economies, are interesting differences in the intensity of new know-how even within different regions of the world.

1 Introduction

The long-term the nature of research and development regarded as an essential element of the economic condition. Patent as an innovative tool is one of the most important elements of creating a competitive advantage in the market. It is protected by legal norms that are implemented in every developed country. The creation of patents is involved in many businesses, such as industrial enterprises, universities, research agencies, technology parks, public research institutes. The issue of patents in individual countries and regions is managed by individual public organizations. These organizations accept individual patents, issue decisions and protect the rights associated with them. They headquarter information on patents, which often offer additional opportunities for their interpretations and may be used for subsequent decisions at different levels of the economy.

1.1 Theoretical starting points related to patents

Competitive advantage and competitive position are used to indicate the company's ability to compete with each other. Dynamic and unexpected environment business environment requires companies to be prepared to use innovative and effective competitive strategy to build a competitive advantage in the market. [1] Then have achieved competitive advantage impact on the competitive position of which can be described by the terms of its

profitability. [2] All these phenomena are under a general term that describes the company's ability to compete in the market. [3]

Investment in intangible assets (patents, know-how, trademarks, designs, software) is still under the pressure of global competition in recent decades, a significant source of competitive advantage. [4]

The term invention is understood to mean a set of activities or processes that lead to a particular discovery. The inventor can register his patent with the Industrial Property Office in each country. A patent is an official document that is awarded by the government of the country. The rights associated with this document allows innovators to prohibit another person to perform certain activities related to the patent without his consent.

What is important is the basic characteristics of the features of a patent or improvement proposal, which include [5,6,7]:

- **Novelty** - is examined using state of the art at the date when the applicant has the Right of Priority. The Right of Priority is understood the date on which the applicant filed the first application for a given invention, regardless of the country in which the application was filed. To this date, it examines the state of the known technology as the novelty is understood to mean the absolute world novelty,
- **Inventiveness** - is understood as an activity of the inventor, which reached an invention that could be patentable. The examination of the application analyzes whether the invention is the result of creative activity. When assessing inventive step at the Industrial Property Office tends apply fictional person "expert" with average qualifications and general overview of the art to which the invention was made,
- **industrial applicability and technical nature** - is understood as the utility of the invention in all areas of the economy, regardless of whether they are industry, agriculture or services.

Due to the historical context of patent law, the issue of intellectual property relatively frequently examined through the collection and processing of statistical data. Patents or inventions are directly regulated by national and international legislative standards are accurately recorded and then the source outputs of varying quality are freely available on the websites of national authorities, such as the Slovak Industrial Property Office of the Slovak Republic or transnational joint authorities, such as a. within the European Union European Patent Office.

There are a large number of studies and surveys in measuring innovation. Along with using the input data, such as spending on research and development and human resources in research, patents have become the most common measure of innovative products in the survey. The aforementioned feature comfortable patents is that they are available relatively exact number of inventions in accordance with various aspects. An addition, patents have been well documented, especially in recent years, thanks to extensive online information that can be conveniently organized into databases. Another advantage of patents that may combine different characteristic indicators. [8,9,10,11]

According to Kucka, *the types of patent searches include*: [12]

- *patent analysis and statistics,*
- *patent monitoring.*

Patent analysis and statistics are methods that address the latest trends in science and technology. Also they allow to identify the possibilities of development in the various fields of science and technology worldwide. These analyzes help to get an overview of the authors and owners patent activity in scientific disciplines for the relevant time period or in the field

of science and technology, where we can monitor the number of registered and published patent applications and also the number of granted patents for individual years.

Patent analysis and statistics provide important information for research institutions, the company management in decision-making and not least investors. All are made from commercial or non-commercial tools. Patent monitoring can be understood as the continuous collection of information about patents, according to certain attributes such as continuous or obtain information about the status of published applications and granted patents.

Start-ups play an important role in innovation in every region, because applied leadership has a decisive influence on the success or failure of a start-up. Team work and leadership in innovation process are necessary for the success of any start-up. [13,14] The general transformation of the global world creates new opportunities for many countries. For example, the role of some of the constraints on the labor market, such as geographical location, underdevelopment and other similar activities, is declining.[15,16]

A successful innovation process is an important part of the business model, which consists of 4 elements, which are interconnected:

- contribution to customer value,
- profit formula,
- key resources
- key processes. [17]

1.2 Patent law

Within the industrial property right it is regarded the protection of inventions as the oldest institute of protection. It was the laws for the protection of inventions and subsequently patents that were among the first to be adopted in modern times.

Patents are the national rights granted by national patent offices. There is no patent, which would be granted protection across the EU. One application for a European patent in the European Patent Office (EPO) provides national protection in European countries chosen by the applicant but must be members of the EPO. International application is simplified under the Patent Cooperation Treaty (PCT). Trademark rights and design can register at national level or at Community level. At Community level, are registered at the Office for Harmonization in the Internal Market, located in Alicante (Spain). These rights are exclusive and apply throughout the EU. [18]

Intellectual property rights are still protected by national laws rather than EU law. Their protection in each EU country separately can be complicated and costly, so further harmonization is needed.

In the Slovak Republic, patents are administered by the Industrial Property Office of the Slovak Republic (Úrad priemyselného vlastníctva Slovenskej republiky). The entire process for patents on their characteristics, the method patenting, use and protection governed by the following legal regulations in force in the Slovak Republic: [5,6,19]

- Act no. 435/2001 Z.z. on patents, supplementary protection certificates and on amendments to certain acts,
- Act no. 402/2002 Z.z., amending and supplementing Act no. 435/2001 Z.z. on patents, supplementary protection certificates and on amendments to certain acts,
- Act no. 84/2007 Z.z., amending and supplementing Act no. 618/2003 Z.z. on copyright and rights related to copyright (copyright act) and on amendments to certain acts,
- Act no. 517/2007 Z.z. on utility models and on amendments to certain acts (Article III),

- Act no. 495/2008 Z.z. on the fee for maintaining the patent, the fee for the maintenance of the European patent with effects for the Slovak Republic and the fee for maintaining the validity of a supplementary protection certificate for medicinal and plant protection products and on amendments to certain laws (Article III)
- Decree no. 223/2002 Z.z., which implements Act no. 435/2001 Z.z. on patents, supplementary protection certificates and on amendment of certain acts.
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2 Objective

The article aims to provide an overview of the current situation in consumer protection with the aim of improving the position and strengthening consumer protection. The priority is to bring together current measures and challenges to strengthen consumers' rights and interests and thus increase their level of protection.

3 Results and discussion

The aim of this section is to present an overview and mapping patents and patent holders in their development and status in the world to compare the differences in the economies of individual regions.

3.1 Global developments in patents

Prediction of future economic developments in individual countries and regions is also dependent on innovation activity in the market. The hallmark of innovation activity is the number of patent applications. The high volume of patents for certain time period makes the hypothesis of a healthy and sustainable growth, macroeconomic indicators and good condition of businesses in the market. It also allows a fall in the amount of time to prepare the properly stimulus measures by public authorities to reverse the condition. It is important to know the structure of the applied patent, its characteristics, to know the holder of the patent application. This information is concentrated in national and multinational organizations, which manage patents and create databases.

The World Intellectual Property Organization (WIPO) owns the world's largest patent database. From its databases it is possible to present developments in this area over the last 40 years. [19]

Region	Patent applications
Africa	9 596
Asia	1 200 024
Europe	1 219 399
Latin America	21 620
North America	1 213 077
Oceania	52 718
Others	4 507
Total	3 720 941

Table 1. Patent applications filed per region, 1978–2018

Source: processed according to [20]

Since 1978 the number of filed patent applications increases year on year and in 2018 it reached 253,000. In 2009, a decrease of total patent applications, when there was a global economic downturn. A similar course is expected in 2020-2021 due to the Covid epidemic, perhaps larger than in 2009. The reason may be a barrier to work, where many companies used home office and researchers did not have access to many of the tools needed for innovation. Yet in 1978, Europe and North America together accounted for about 88% of the total administration of patents. In 1995 there was a turning point, the combined market share is decreasing in favor of Asia. In 2009, Asia had a larger volume of patent applications than North America, and in 2010 it overtook Europe, becoming the world's largest patent-pending region. In 2018, more than half of the total number of applications came from a single region - Asia (50.5%). [20,21,22]

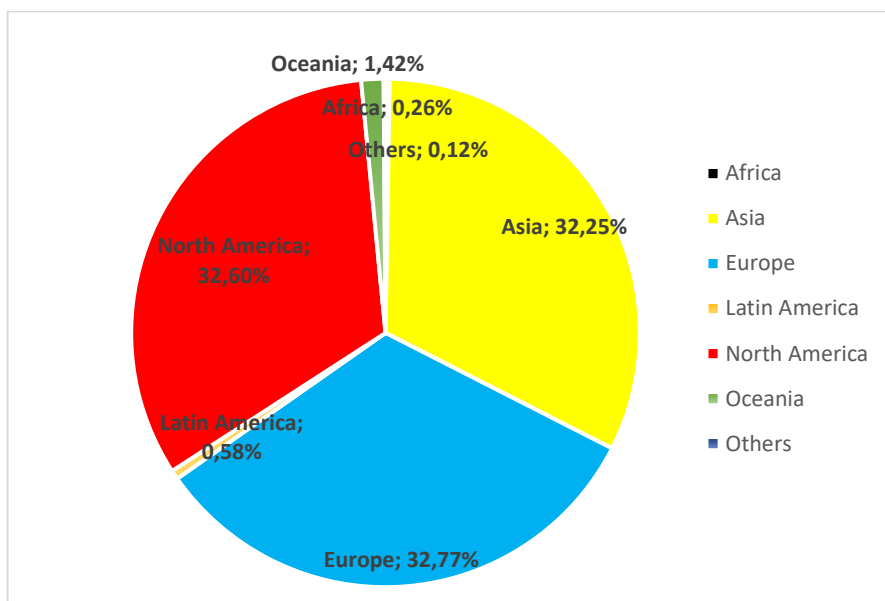


Fig. 1. Region share patent applications for 1978 - 2018

Source: processed according to [20]

In the last 40 years, Europe, North America and Asia have applied for patents at about the same volume - Europe (1,219,399) North America (1,213,077) and Asia (1,200,024). These three regions constitute 97.6% of the total administered in the period 1978-2018. Oceania (52,718), Latin America and the Caribbean (LAC) (21,620) and Africa (9,596) recorded in the same period a much lower volumes. The view of individual countries is also interesting. Applicants for patent applications from the United States of America (USA) have filed 31.1% of the total number of applications in the last 4 decades. The second largest number of applications was recorded in Japan (17.3%). If we add the applicants from Germany (10.4%), China (8.1%) and the Republic of Korea (4.6%), the total sum of the top five countries together accounted for 71.4% of the total number of patent applications during this period.

In 2018, the list of the most successful countries did not change, but their share increased to 77.5%. The largest increase in the proportion of experienced China, which grew from the cumulative 8.1% over the last 40 years to 21.1% in 2018. This is especially remarkable given the fact that between 1978 and 1993 filed by Chinese applicants only five patent applications.

The majority of applications submitted in Africa between 1978 and 2018 came from South Africa (76.6%), in Asia by Japan (53.3%), in North America and Oceania by the USA (95.3%) and Australia (86,1%). Less than half share in the continent achieved the most successful countries in Europe and LAC, where Germany and Brazil represents 31.8% and 41.6% of the total. In terms of the nominal number of patent applications for 40 years dominated by the USA (1,156,062), Japan (641,903), Germany (387,338) and China (303,103). [20,21,22]

The view of the Top 30 patent applicants in the world is also interesting:

Applicant	Country of Origin	Patent applications		Ranking in time			
		1978-2018	1978-2018	1990	2000	2010	2018
PANASONIC IP MANAGEMENT	Japan	34 081	1	23	6	1	12
HUAWEI TECHNOLOGIES	China	33 899	2		6 896	4	1
KONINKLIJKE PHILIPS ELECTRONICS	Netherland	32 783	3		2	5	18
ROBERT BOSCH CORPORATION	Germany	27 654	4	2	5	6	10
SIEMENS AKTIENGESELLSCHAFT	Germany	27 403	5	5	1	12	14
ZTE CORPORATION	China	25 746	6			2	5
QUALCOMM INCORPORATED	U.S.	24 858	7	1 510	16	3	4
TELEFONAKTIEBOLAGET LM ERICSSON	Sweden	22 429	8	98	3	9	9
MITSUBISHI ELECTRIC CORPORATION	Japan	19 342	9	72	19	14	2
INTEL CORPORATION	U.S.	17 963	10		22	62	3
LG ELECTRONICS INC.	Korea	17 349	11		378	7	8
SHARP KABUSHIKI KAISHA	Japan	16 593	12	833	261	8	16
SAMSUNG ELECTRONICS	Korea	15 680	13	1 510	37	17	6
3M INNOVATIVE PROPERTIES COMPANY	U.S.	14 746	14	195	13	16	30
BASF	Germany	14 654	15	22	7	13	34
SONY CORPORATION	Japan	14 563	16	127	17	28	13
TOYOTA JIDOSHA KABUSHIKI KAISHA	Japan	14 201	17	1 510	223	11	236
PROCTER & GAMBLE COMPANY	U.S.	13 603	18		4	27	36
NEC CORPORATION	Japan	13 282	19		122	10	22
MICROSOFT TECHNOLOGY LICENSING	U.S.	12 870	20		30	20	11
HEWLETT-PACKARD DEVELOPMENT	U.S.	12 095	21	1 510	160	18	15
NOKIA TECHNOLOGIES	Finland	11 749	22		61	15	35
FUJITSU	Japan	10 049	23	34	27	19	43
HITACHI	Japan	9 854	24	84	18	26	27
MOTOROLA	U.S.	9 666	25	6	12	116	329
E I DU PONT DE NEMOURS	U.S.	9 352	26	8	11	21	460
FUJIFILM	Japan	8 736	27			48	21
UNIVERSITY OF CALIFORNIA	U.S.	8 096	28	21	23	38	38
INTERNATIONAL BUSINESS MACHINES	U.S.	7 706	29	195	62	22	100
BOE TECHNOLOGY GROUP	China	7 443	30				7

Table 2. TOP 30 patent applicants 1978–2018

Source: processed according to [20]

Top 30 patent applicants come from eight countries. On top of the list are the USA with 10 applicants, followed by Japan (9), Germany (3) China (3) South Korea (2), Finland (1), Netherlands (1) Sweden (1). Seven of the 10 best candidates in the last 40 years appeared among the 10 best candidates in 2018. The exception was Panasonic (12th place in 2018), Philips Electronics (18) and Siemens (14). Each active since 1978 10 best candidates in the electronics industry. [20,21,22]

List of 30 best covers only businesses, the best university is the University of California (8096) to 38th place.

Ranking	University	Origin	Published PCT 2018	Ranking All Applicants
1	UNIVERSITY OF CALIFORNIA	U.S.	501	38
2	MASSACHUSETTS INSTITUTE OF TECHNOLOGY	U.S.	216	108
3	SHENZHEN UNIVERSITY	China	201	119
4	SOUTH CHINA UNIVERSITY OF TECHNOLOGY	China	170	145
5	HARVARD UNIVERSITY	U.S.	169	147
6	UNIVERSITY OF TEXAS SYSTEM	U.S.	158	158
7	SEOUL NATIONAL UNIVERSITY	Korea	137	181
8	TSINGHUA UNIVERSITY	China	137	181
9	LELAND STANFORD JUNIOR UNIVERSITY	U.S.	121	211
10	CHINA UNIVERSITY OF MINING AND TECHNOLOGY	China	114	219
11	OSAKA UNIVERSITY	Japan	105	242
12	JOHNS HOPKINS UNIVERSITY	U.S.	99	259
13	KOREA ADVANCED INSTITUTE OF SCIENCE	Korea	94	273
14	UNIVERSITY OF TOKYO	Japan	92	280
15	HANYANG UNIVERSITY	Korea	89	294
16	TOHOKU UNIVERSITY	Japan	87	300
17	KYOTO UNIVERSITY	Japan	86	304
18	UNIVERSITY OF MICHIGAN	U.S.	81	324
19	OXFORD UNIVERSITY INNOVATION LIMITED	U.K.	79	332
20	UNIVERSITY OF FLORIDA	U.S.	79	332

Table 3. TOP 20 patent applicants by universities in 2018

Source: processed according to [20]

3.2 Patent examination and approval

The average time duration of the process from application to approval patent in each patent offices varies.

In 2018 the largest national and multinational patent offices needed for the approval process following time period:

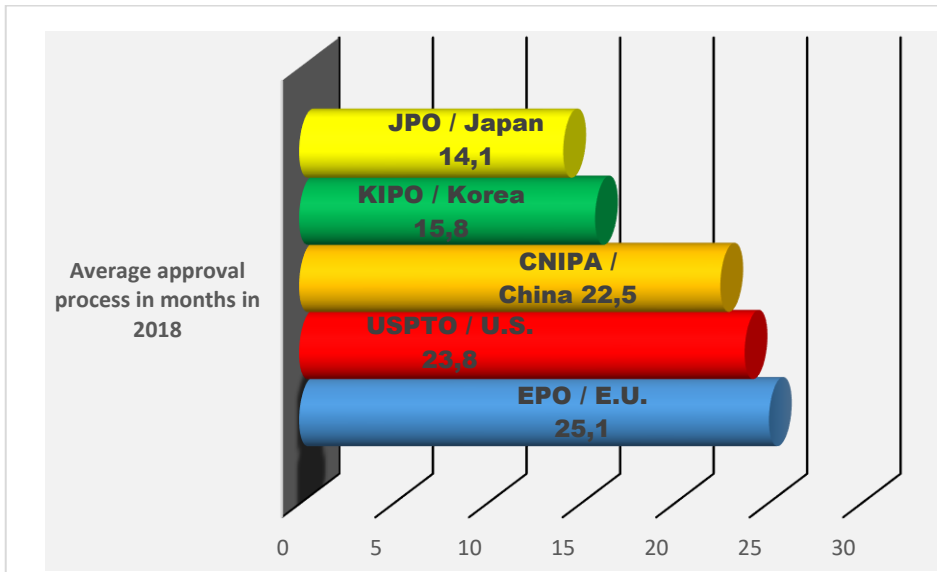


Fig. 2. Average approval process for patents in 2018

Source: processed according to [23]

The time required for the entire patent assessment process is the shortest at the Japan Patent Office (JPO) - 14.1 months. Almost twice as long this process takes at the European Patent Office (25.1 months). All TOP 3 leaders come from Asia.

JPO focuses mainly on accelerating internal processes within its organization. It employs more than 1,400 specialists / examiners who assessed the various patent applications, work closely and actively search for information on patents that are already established in international patent organizations. Speed process, however, must comply with established quality criteria of the organization. [23]

4 Conclusion

In the long run, it is clear that innovation efforts are shifting more to Asia. On the contrary, Europe has recently been losing innovation potential, which is very dangerous for its future economic development. The electronic sector is a key accelerator of innovation, which is developing rapidly year by year.

An important factor is also the support of innovation / patents in terms of legislative and approval processes in individual countries. It is certainly motivating for many applicants the shortest possible response to the submitted patent from the patent office. Innovative support from academic institutions is the basis not only for the emergence of new innovative solutions, but also the basis for the education of new innovators. Mentioned attributes should be the minimum for the European Union a major challenge to ensure its future.

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