Global Intellectual Property Applications and Active IP Rights (2015-2020) – Result of IP Education

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Abstract. The purpose of this paper is to compare data, covering four types of industrial property – patents, utility models, trademarks, and industrial designs in the period 2015-2020, based on the World Intellectual Property Organization (WIPO) Indicators. In the category patents and utility models are compared percentage shares of total patent applications by the top five offices; patent applications for the top 10 offices; top 10 Patent Cooperation Treaty (PCT) applicants; utility model applications for the top 10 offices. In the category trademark are compared percentage shares of total trademark filing activity by the top five offices; application class counts for the top 10 offices; Madrid international applications for the top 10 origins. In the category industrial design are compared percentage shares of total design filing activity by the top five offices; application design counts for the top 10 offices; designs in Hague international applications for the top 10 origins. The analysis shows the development in all areas of intellectual property (IP), which is directly related to raising awareness of IP issues in university environment.

Keywords: Intellectual Property, Patent, Utility Model, Trademark, Industrial Design, WIPO.

1 Introduction

The competitiveness of a knowledge-based economy increasingly depends on the availability of qualified, enterprising, and well-informed professionals who are formed in modern universities. To the current two classic functions of universities – education of highly qualified specialists and dissemination of knowledge among the general public, is added a third new function, namely raising awareness of the intellectual property (IP) issues of future professionals. Universities are becoming one of the most powerful generators of IP, and hence of innovation. All this determines the relevance of this study, which is determined by the desire to raise awareness on all issues related to IP. Awareness of the importance and understanding of IP is essential for today's students, who are the future information specialists, engineers, researchers, lawyers, politicians, and

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managers of tomorrow. In the university information environment students have to master the important IP related matter and its application in their upcoming career development. Students and universities have to know how to utilize and benefit from the unparalleled richness of the technical and commercial information, found in IP-related documentation. It is necessary for universities to make efforts to raise awareness of IP issues in the academic community, to research IP right, by engaging in a transfer of technology to industrial partners to create value and benefit for society. Last but not least, students and universities have to be aware with the consequences of the lack of knowledge and the inability to protect their intangible assets under the form of IP, including from risks such as misuse of foreign intangible assets, industrial espionage, etc. (Peteva, Denchev, & Trenchev, 2019) (Trencheva, Stoianoff, Denchev, & Zdravkova, 2020).

2 Methodology

The Intellectual Property (IP) Facts and Figures report published by the World Intellectual Property Organization (WIPO) provides an overview of IP activity using the latest available year of complete statistics. The figures presented in the reports are based on a selection of those reported in WIPO's more comprehensive World Intellectual Property Indicators for the previous year, hence WIPO IP Facts and Figures 2016 refers to activity in 2015, WIPO IP Facts and Figures 2017 refers to activity in 2016, WIPO IP Facts and Figures 2018 refers to activity in 2017, etc. IP Facts and Figures covers four types of industrial property: patents, utility models, trademarks, and industrial designs. The goal of this paper is to compare the data in certain categories in the period 2015-2020, based on the reports of WIPO IP Facts and Figures, published in the period 2016-2021. The research methodology is based on the following general scientific methods: analysis and synthesis, observation, graphical representation, and tabular presentation of processed and summarized information.

3 Results

3.1 Patents and Utility Models

The top five offices together accounted for 82,4% of the 2,9 million patent applications in 2015, 84% of the 3,1 million patent applications filed worldwide in 2016, 85% of the 3,17 million patent applications filed worldwide in 2017, 85,3% of the 3,3 million patent applications filed worldwide in 2018, 84,7% of the 3,2 million patent applications filed worldwide in 2019 and 85,1% of 3,2 million patent applications in 2020. The result in 2020 is 7,7% points higher than the combined share for the top five in 2010. In the period under review, there is no change in the top five offices, they retain their positions, and there is growth every year. China remains in first place, whose share of the world's total has more than doubled from 19.6% in 2010 to 45.7% in 2020 (Fig. 1) (WIPO, IP Facts and Figures 2016 , 2016) (WIPO, IP Facts and Figures 2017, 2017)

(WIPO, IP Facts and Figures 2018, 2018) (WIPO, IP Facts and Figures 2019, 2019) (WIPO, IP Facts and Figures 2020 , 2020) (WIPO, IP Facts and Figures 2021, 2021).

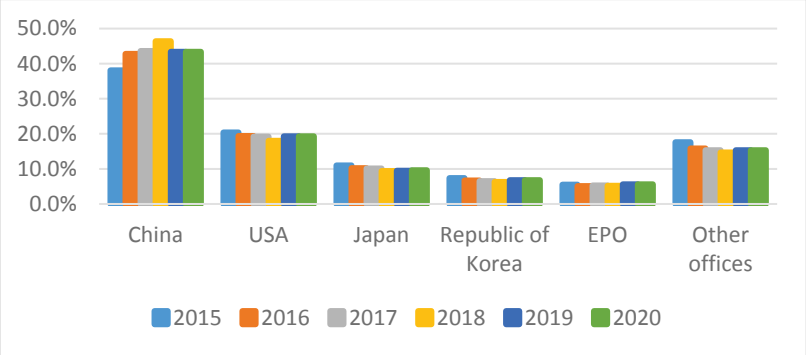

Fig. 1. Percentage shares of total patent applications by the top five offices.

In 2015, China became the first office to receive over a million patent applications in a single year and received almost as many applications as Japan, the Republic of Korea and the U.S. combined and to this day this result remains unsurpassed. In 2018, China's IP office received 1.54 million patent applications, which is 46.4% of the global total and similar in magnitude to the combined total of the next 10 top-ranked offices added together. In 2019, China's IP office received 1,4 million patent applications, which is a slight decrease compared to 2018 when there are 1,54 patent applications. In 2020, China's IP office returned to growth, with around 1.5 million patent applications filed for the year. Among the top 10 offices, only three – China (+6.9%), India (+5.9%) and the Republic of Korea (+3.6%) – recorded an increase in patent applications in 2020. (Table 1) (WIPO, IP Facts and Figures 2016 , 2016) (WIPO, IP Facts and Figures 2017, 2017) (WIPO, IP Facts and Figures 2018, 2018) (WIPO, IP Facts and Figures 2019, 2019) (WIPO, IP Facts and Figures 2020 , 2020) (WIPO, IP Facts and Figures 2021, 2021).

Table 1. Patent applications for the top 10 offices

	2015	**2016**	**2017**	**2018**	**2019**	**2020**
China	1,1 mil	1,3 mil.	1,38 mil.	1,5 mil.	1,4 mil.	1,49 mil.
USA	589,410	605,571	606,956	597,141	621,453	597,172
Japan	318,721	318,381	318,479	313,567	307,969	288,472
Rep. of Korea	213,694	208,830	204,775	209,992	218,975	226,759
EPO	160,028	159,358	166,585	174,397	181,479	180,346
Germany	66,893	67,899	67,712	67,898	67,434	62,105
India	45,658	45,057	46,582	50,055	53,627	56,771
Russia	45,517	41,587	36,883	37,957	35,511	34,984
Canada	36,964	34,745	35,022	36,161	36,488	34,565
Australia	30,219	28,394	28,906	29,957	29,758	29,294

The Patent Cooperation Treaty (PCT), an international treaty administered by WIPO, facilitates the acquisition of patent rights in a large number of jurisdictions. The Top 10 PCT applicants are:

- 2015 – Huawei Technologies (3,898), ZTE (2,155) – *China*; Qualcomm (2,442), HP (1,310) – USA; Samsung (1,683), LG Electronics (1,457) – *Republic of Korea*; Mitsubishi Electric (1,593), Sony (1,381) – *Japan*; Ericsson (1,481) – *Sweden*; Philips (1,378) – *Netherlands*.
- 2016 – ZTE (4,123), Huawei Technologies (3,692), BOE Technology (1,673) – China; Qualcomm (2, 466), Hewlett-Packard (1,742), Intel (1,692) – USA; Mitsubishi Electric (2,053), Sony (1,665) – Japan; LG electronics (1,888), Samsung Electronics (1,672) – Republic of Korea.
- 2017 – Huawei Technologies (4,024), ZTE (2,965), BOE Technology (1,818) – China; Intel (2,637), Qualcomm (2,163) – USA; Mitsubishi Electric (2,521), Sony (1,735) – Japan; LG Electronics (1,945), Samsung Electronics (1,757) – Republic of Korea; Ericsson (1,564) – Sweden.
- 2018 – Huawei Technologies (5,405), ZTE (2,080), BOE Technology (1,813) – China; Intel (2,499), Qualcomm (2,404) – USA; Samsung Electronics (1,997), LG Electronics (1,697) – Republic of Korea; Mitsubishi Electric (2,812) – Japan; Ericsson (1,645) – Sweden; Robert Bosch (1,524) – Germany.
- 2019 – Huawei Technologies (4,411), OPPO Mobile Telecommunications (1,927), BOE Technology (1,864), Ping An Technology (1,691) – China; Samsung Electronics (2,334), LG Electronics (1,646) – Republic of Korea; Mitsubishi Electric (2,661) – Japan; Qualcomm (2,127) – USA; Ericsson (1,698) – Sweden; Robert Bosch (1,687) – Germany.
- 2020 – Huawei Technologies (5,464), BOE Technology (1,892), OPPO Mobile Telecommunications (1,801) – China; Mitsubishi Electric (2,810), Sony (1,793), Panasonic (1,611) – Japan; Samsung Electronics (3,093), LG Electronics (2,759) – Republic of Korea; Qualcomm (2,173) – USA; Ericsson (1,989) – Sweden.

For the fourth consecutive year, China-based telecoms giant Huawei Technologies, with 5,464 published Patent Cooperation Treaty (PCT) applications, was the top filer in 2020 and was also leading in 2015, but only in 2014 ZTE was ahead of them. In 2015 telecom firms lead international patent filings. ZTE Corp., which was the top applicant in 2016, saw a 29.8% drop in published PCT filings in 2018, a second straight year of decline. Only companies from China, Japan, USA, and Republic of Korea are always present among the top 10 PCT applicants, and in 2016 are the only countries in the top 10. Among the top 10 filers, LG Electronics recorded the fastest growth (+67.6%) in published applications in 2020 and moved up from 10th position in 2019 to rank 4th in 2020. The list of top 10 PCT applicants includes companies operating in digital communication, telecommunications, and electronics, among other fields of technology (WIPO, IP Facts and Figures 2016 , 2016) (WIPO, IP Facts and Figures 2017, 2017) (WIPO, IP Facts and Figures 2018, 2018) (WIPO, IP Facts and Figures 2019, 2019) (WIPO, IP Facts and Figures 2020 , 2020) (WIPO, IP Facts and Figures 2021, 2021).

A utility model is a special form of patent right and they are not available in all jurisdictions. China dominates filing activity for utility models in the period, passing

over 2 million applications in 2018 and is expected to surpass 3 million in the next year. In 2015 the intellectual property (IP) office of China received over 90% of the world total utility model applications, 95% in 2016, 95.8% in 2017, 96.6% in 2018, 96.9% in 2019 and over 97% in 2020. Applications at the offices of Germany, Japan and the Republic of Korea declined substantially between 2009 and 2019.

Table 2. Utility model applications for the top 10 offices

	2015	**2016**	**2017**	**2018**	**2019**	**2020**
China	1,1 mil.	1,5 mil.	1,69 mil.	2,1 mil.	2,3 mil.	2,9 mil.
Germany	14,274	14,030	13,301	12,307	11,668	12,318
Russia	11,906	11,112	10,643	9,747	10,136	9,195
Japan	6,860	6,480	6,105	5,388	5,241	6,018
Ukraine	8,616	9,584	9,108	9,120	8,458	5,281
Rep. of Korea	8,711	7,767	6,811	6,232	5,447	4,981
Australia	--------	-------	--------	--------	--------	4,412
Turkey	3,583	3,534	3,320	2,770	2,971	3,627
Thailand	--------	2,571	2,517	2,969	3,310	3,455
Spain	2,354	2,439	2,465	2,731	2,757	3,448
Brazil	2,718	2,936	2,918	2,587	2,824	--------
Italy	2,915	--------	---------	---------	--------	--------

Australia enters the top 10 in 2020, replacing Brazil, and in 2016, Thailand replaces Italy, and since then Italy has not entered the top 10. Among the top 10 offices, the IP office of Australia received 137,3% more applications in 2020 compared to a year earlier (Table 2) (WIPO, IP Facts and Figures 2016 , 2016) (WIPO, IP Facts and Figures 2017, 2017) (WIPO, IP Facts and Figures 2018, 2018) (WIPO, IP Facts and Figures 2019, 2019) (WIPO, IP Facts and Figures 2020 , 2020) (WIPO, IP Facts and Figures 2021, 2021).

3.2 Trademarks

The global trademark is measured by class counts. The number of classes specified in a trademark application or registration. In the international trademark system and at certain national and regional offices, an applicant can file a trademark application that specifies one or more of the 45 goods and services classes of the Nice Classification. Offices use a single- or multi-class filing system.

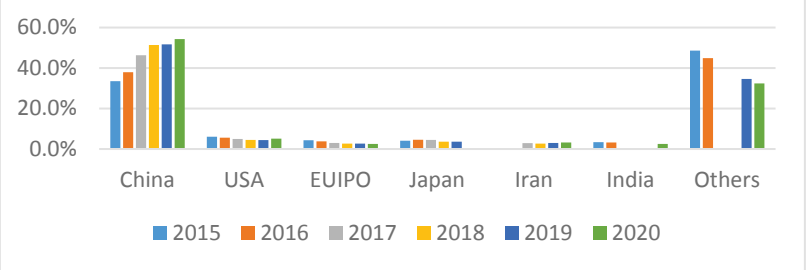

Fig. 2. Percentage shares of total trademark filing activity by the top five offices

When differences in filing systems across national and regional offices are harmonized using the application class count, trademark filing activity grew by 13,7% in 2015. In 2016, 55% of all trademarks filing activity – measured in class counts – occurred at the top five offices, 62% in 2017, 65% in 2018 and 2019 and around 68 in 2020. In 2020 the office of China (54,3%) was responsible for more than half of all the world's trademark filing activity, the majority of which originated from Chinese residents. The four other offices among the top five each accounted for 5% or less of the total (Fig. 2) (WIPO, IP Facts and Figures 2016 , 2016) (WIPO, IP Facts and Figures 2017, 2017) (WIPO, IP Facts and Figures 2018, 2018) (WIPO, IP Facts and Figures 2019, 2019) (WIPO, IP Facts and Figures 2020 , 2020) (WIPO, IP Facts and Figures 2021, 2021).

Table 3. Application class counts for the top 10 offices

	2015	**2016**	**2017**	**2018**	**2019**	**2020**
China	2,8 mil.	3,7 mil.	5,74 mil.	7,4 mil.	7,8 mil.	9,34 mil.
USA	517,297	545,587	613,921	640,181	672,681	870,306
Iran	---------	--------	358,353	384,338	454,925	541,750
EUIPO	366,383	369,970	371,508	512,156	407,712	438,511
India	289,843	313,623	283,575	342,698	367,764	424,583
Japan	345,070	451,320	560,269	512,156	546,244	421,166
Russia	219,158	251,549	291,732	263,976	306,976	398,240
Turkey	227,273	227,159	247,474	244,525	282,448	363,708
Rep.of Korea	236,168	231,978	230,466	263,976	284,072	319,945
Brazil	---------	--------	---------	---------	---------	297,933
France	282,993	274,201	270,412	298,895	311,634	---------
Germany	210,176	209,983	---------	---------	---------	---------

In 2015, 65% of all trademarks filing activity worldwide occurred at the top 10 intellectual property (IP) offices combined. The IP office of China accounted for a third of all trademarks filing activity worldwide. In 2016, trademark filing activity in China – measured in class counts – was between 7 and 10 times that in the next highest ranked offices of the U.S., Japan, and the European Union Intellectual Property Office

(EUIPO). In 2018 China's office continues to record the highest trademark filing activity. In 2019 trademark filing activity in China is more than double that of the next nine largest offices combined. Eight of the top 10 offices recorded double-digit growth in trademark filing activity in 2020. China's class count has grown from about twice that of the U.S. in 2006 to almost 11 times as much in 2020. In 2017, Germany was replaced by Iran, and in 2020 France dropped out of the top 10 and was replaced by Brazil (Table 3) (WIPO, IP Facts and Figures 2016 , 2016) (WIPO, IP Facts and Figures 2017, 2017) (WIPO, IP Facts and Figures 2018, 2018) (WIPO, IP Facts and Figures 2019, 2019) (WIPO, IP Facts and Figures 2020 , 2020) (WIPO, IP Facts and Figures 2021, 2021). The Madrid System makes it possible for a trademark holder to apply for trademark registration in multiple countries by filing a single international application via a national or regional intellectual property (IP) office.

Table 4. Madrid international applications for the top 10 origins

	2015	2016	2017	2018	2019	2020
USA	7,361	7,730	7,889	8,825	10,087	10,014
Germany	6,759	7,544	7,319	7,495	7,700	7,326
China	1,830	3,820	6,066	6,900	6,339	6,696
France	4,134	4,124	4,260	4,490	4,437	3,716
UK	2,704	3,012	3,297	3,347	3,460	3,693
Switzerland	3,146	3,068	3,269	3,364	3,729	3,504
Japan	2,197	2,412	2,542	3,124	3,160	3,063
Italy	2,628	3,079	2,877	3,140	2,649	2,765
Australia	1,951	2,060	2,122	2,074	2,094	2,216
Turkey	---------	--------	---------	---------	1,980	1,871
Russia	---------	--------	1,460	1,502	---------	---------
Netherlands	1,278	1,492	---------	---------	---------	---------

2015 marked the sixth consecutive year of growth and the highest number of international applications was filed by applicants domiciled in the U.S. (7,361). 2016 also marked the seventh consecutive year of growth, but the highest numbers of international applications were filed by applicants domiciled in the U.S. (7,730), but also Germany (7,544). The eighth consecutive year of growth was marked in 2017 and this 7.2% increase was driven by strong growth in applications from China (+57,8%), the Russian Federation (+23,9) and the United Kingdom (+9,5%). In 2018 there was 6,4% increase, which represents a ninth year of uninterrupted expansion. In 2019 there was an increase of almost 3,500 on the previous year, resulting in an annual growth rate of 5,7% and marking a 10th year of uninterrupted expansion. International trademark applications filed via the WIPO-administered Madrid System for the International Registration of Marks decreased by 0,5% to 63,837 in 2020, representing the first decline in over a decade. In 2017 the Netherlands was replaced by Russia, but in 2019 Russia was overtaken by Turkey (Table 4) (WIPO, IP Facts and Figures 2016 , 2016) (WIPO, IP Facts and Figures 2017, 2017) (WIPO, IP Facts and Figures 2018, 2018) (WIPO, IP Facts

and Figures 2019, 2019) (WIPO, IP Facts and Figures 2020 , 2020) (WIPO, IP Facts and Figures 2021, 2021).

3.3 Industrial Designs

As stated in the report: "World Intellectual Property Organization (WIPO) uses the application design count to measure filing activity for industrial designs; in other words, we do not just count the number of applications, we count the number of designs in applications. Design count is a better way of comparing filing activity across intellectual property (IP) offices, because at some offices users can register multiple designs through a single application (WIPO, IP Facts and Figures 2018, 2018).

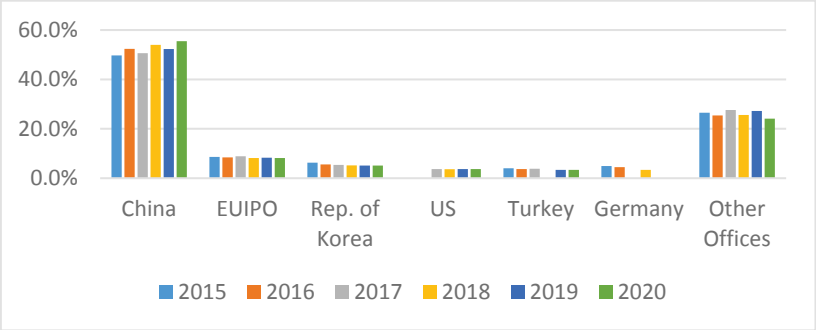

Fig. 3. Percentage shares of total design filing activity by the top five offices

The number of designs contained in all applications filed around the world was around 1,1 million in 2015. In 2016 about 1,240,600 industrial designs applications were filed. In 2017, about 945,100 industrial design applications were filed worldwide, as these applications contained a total of 1,24 million designs. In 2018, about 1,02 million industrial design applications were filed worldwide and they contained a total of 1,3 million designs. In 2019, just over one million industrial design applications were filed worldwide, containing a total of 1,4 million designs. In 2020, about 1,1 million industrial design applications were filed worldwide. The number of designs contained in applications increased by 2% to 1,4 million designs (Fig. 3) (WIPO, IP Facts and Figures 2016 , 2016) (WIPO, IP Facts and Figures 2017, 2017) (WIPO, IP Facts and Figures 2018, 2018) (WIPO, IP Facts and Figures 2019, 2019) (WIPO, IP Facts and Figures 2020 , 2020) (WIPO, IP Facts and Figures 2021, 2021).

In 2015, about 84% of all industrial design filing activity worldwide occurred among the top 10 offices. China leads on application design count, in fact China's intellectual property (IP) office received 650,344 designs in applications filed in 2016, hence, it got more designs in applications filed than the next nine top offices added together.

Table 5. Application design counts for the top 10 offices

	2015	2016	2017	2018	2019	2020
China	569,059	650,344	628,658	708,799	711,617	770,362

EUIPO	98,162	104,522	111,021	108,174	113,319	113,196
Rep. of Korea	72,458	69,120	67,357	68,054	69,360	70,821
USA	40,128	44,967	45,881	47,137	49,848	50,743
Turkey	45,852	46,305	46,875	42,320	46,202	47,653
Germany	56,499	56,188	45,803	44,460	44,097	40,638
UK	---------	---------	19,269	27,442	29,896	32,731
Japan	30,351	31,013	32,457	31,468	32,176	31,650
France	13,997	---------	----------	---------	37,404	31,196
Italy	---------	27,088	30,925	36,024	31,111	25,364
Spain	17,855	18,315	22,628	18,853	---------	----------
Iran	---------	15,979	----------	---------	---------	----------
Switzerland	12,242	---------	----------	---------	---------	----------

Italy (+14.2%), Spain (+23.5%) and the U.K. (+92.1%) all recorded strong annual growth in the number of designs in applications received in 2017. Top 10 offices the U.K. (+9,5%) and China (+8,3%) recorded a strong annual growth in the number of designs in applications received in 2020, whereas Italy (–18,5%) and France (–16,6%) saw a sharp on-year decline. Switzerland was among the top 10 offices only in 2015 and in 2016 was replaced by Italy and Iran, which was only in the top 10 in this year.

Table 6. Designs in Hague international applications for the top 10 origins

	2015	**2016**	**2017**	**2018**	**2019**	**2020**
Germany	3,453	3,917	4,261	3,942	4,509	3,666
USA	1,039	1,410	1,661	1,359	1,354	2,217
Switzerland	3,316	2,555	2,935	2,441	2,180	1,948
Rep. of Korea	1,282	1,882	1,742	1,535	2,735	1,669
Italy	1,186	1,125	1,065	1,261	1,995	1,231
Netherlands	765	1,317	807	1,352	1,391	999
Japan	411	860	831	1,257	1,151	942
France	1,317	1,212	1,396	1,436	1,296	935
China	-------	------	--------	-------	673	826
Turkey	-------	577	421	477	-------	530
UK	391	------	--------	------	550	----------
Greece	-------	------	-------	410	-------	----------
Belgium	-------	------	457	-------	-------	----------
Sweden	-------	492	--------	-------	-------	----------
Austria	497	------	--------	-------	-------	----------

France dropped out of the top 10 in 2016, 2017 and 2018. (Table 5) (WIPO, IP Facts and Figures 2016 , 2016) (WIPO, IP Facts and Figures 2017, 2017) (WIPO, IP Facts and Figures 2018, 2018) (WIPO, IP Facts and Figures 2019, 2019) (WIPO, IP Facts and Figures 2020 , 2020) (WIPO, IP Facts and Figures 2021, 2021).

The Hague System makes it possible for an applicant to obtain protection for industrial designs in multiple jurisdictions by filing a single application with the International Bureau of the World Intellectual Property Organization (WIPO). It simplifies the process of multinational registration by eliminating the need to file a separate application in each jurisdiction in which protection is sought. Hague applicants can protect up to 100 industrial designs for products belonging to one and the same class through a single application (WIPO, IP Facts and Figures 2016 , 2016).

In 2015 Germany and Switzerland are the biggest users of the Hague System. Around 18,700 designs in Hague applications were filed in 2016, up 13,9% in 2015 and marking a decade of continuous year-on-year growth and the Republic of Korea joined Germany and Switzerland in the top users of the system. In 2017, the Hague System received 5,213 international applications, down 6,3% in 2016. In 2018, the Hague System received 5,443 international applications, up 3.6% on 2017. However, these applications contained 19,387 designs, representing a drop of 1.8% and ending 11 years of uninterrupted growth. In 2019, the Hague System received 5,894 international applications, up 8.1% on 2018 and 2019 is also the year, which The Republic of Korea has become the second biggest user of the Hague System. These applications contained 21,857 designs, representing an increase of 10.6% on the previous year and a 13th year of uninterrupted growth. Hague international applications dropped by 1.6% in 2020, down to 5,799 applications. Moreover, the number of designs contained in applications fell by 14.7%, down to 18,636 designs – a first fall since 2006. With 703 international applications filed containing 3,666 designs, Germany remained the biggest user of the Hague System in 2020. The U.S. (2,217) moved up from 6th to 2nd position, while Switzerland (1,948) remained in 3rd place (Table 6) (WIPO, IP Facts and Figures 2016 , 2016) (WIPO, IP Facts and Figures 2017, 2017) (WIPO, IP Facts and Figures 2018, 2018) (WIPO, IP Facts and Figures 2019, 2019) (WIPO, IP Facts and Figures 2020 , 2020) (WIPO, IP Facts and Figures 2021, 2021).

4 Conclusions

There is a direct connection between business and education – business relies on the educational sector, in this case of university education, to teach students with up-to-date knowledge, skills and competences to meet market needs. One of the reasons for the growth in registering patents, utility models, trademarks, and industrial designs in the period under review is precisely the increase in awareness of intellectual property (IP), with the role played by universities that introduce disciplines on the basics of intellectual property in most of the specialties they offer, and bachelor's and master's programs are becoming more common, which fully train specialists in IP issues. IP teachers consider the development in economic, social, and cultural aspects and therefore constantly update the content of training courses to meet the new needs of society. Depending on the nature of the specialties, profiled curricula are prepared, in which specific knowledge for the specific studied specialty is offered. Teachers are often members of IP-related organizations, attend scientific forums and exchange experiences with colleagues and professionals (Trencheva, Stoianoff, Denchev, & Zdravkova, 2020).

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