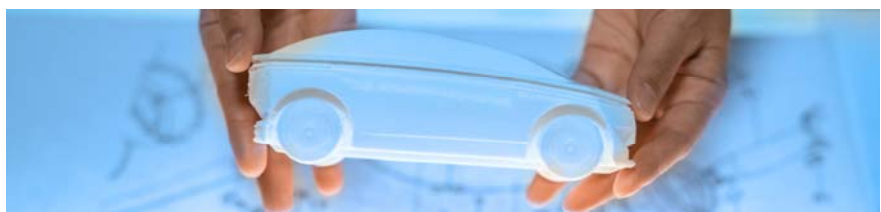
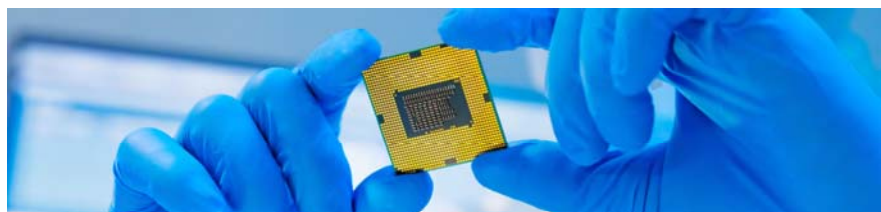


IPR-intensive industries and economic performance in the European Union

Industry-level analysis report, fourth edition
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A joint project of the European Patent Office and the European Union Intellectual Property Office

Executive summary



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Executive summary

α. Main findings¹

- There are now 357 IPR-intensive industries in the EU economy, compared with the 353 identified in the previous (2019) study. Of these industries, 229 (64%) are intensive in respect of more than one IPR.
- IPR-intensive industries generated 29.7% of all jobs in the EU during the 2017–2019 period, up from 28.9% in 2014–2016 (adjusting for small differences in methodology between the studies). On average over this period, they employed more than 61 million people in the EU and generated another 20 million jobs in industries that supply goods and services to IPR-intensive industries. Taking indirect jobs into account, the total number of IPR-related jobs rises to 82 million (39.4%).
- Over the same period, IPR-intensive industries generated more than 47% of total economic activity (GDP) in the EU, worth €6.4 trillion. They also accounted for most of the EU's trade with the rest of the world and generated a trade surplus of €224 billion, thus helping to keep the EU's external trade broadly balanced.
- IPR-intensive industries make an important contribution to the functioning of the EU's internal market. They account for more than 75% of intra-EU trade. While countries such as Germany, France, Italy and the Netherlands are leading in the creation of new IPRs, other countries including Hungary, Poland and Estonia also strongly benefit from the division of labour within IPR-intensive industries. In total, almost 7 million IPR-related jobs in the EU Member States are created by companies from other Member States, with the share of such jobs in IPR-intensive industries exceeding 30% in some countries.
- IPR-intensive industries pay significantly higher wages than other industries, with a wage premium of 41% over other industries. This is consistent with the fact that the value added per worker is higher in IPR-intensive industries than elsewhere in the economy.
- A comparison of the results of this study with those of the 2019 edition reveals that the relative contribution of IPR-intensive industries to the EU economy has increased between 2014–2016 (2019 study) and 2017–2019 (the present study), taking into account the change in the list of IPR-intensive industries.
- Among IPR-intensive industries, the economic weight of industries engaged in the development of CCMTs and those related to green TMs has increased in recent years. Sectors

¹ Because of the exit of the UK from the European Union in 2020, the figures in this report are for the EU27 and are not directly comparable, therefore, with those in the earlier published studies, which refer to the EU28.

intensive in CCMT patents or green TMs accounted for 9.3% of employment and 14.0% of GDP in the EU in 2017–2019 and for a significant part of the EU's external trade activity.

- Comparable results on the contribution of IPR-intensive industries to GDP and employment are shown for Iceland, Norway, Switzerland and the UK. The contribution of IPR-intensive industries to employment was below the EU average in Norway, Switzerland and the UK, and at the same level as the EU average in Iceland. The contribution to GDP was above the EU average in Norway but below it in the other three countries.

b. IPR-intensive industries in the EU economy

IPR-intensive industries are defined² as those having an above-average ownership³ of IPRs per employee, as compared with other IPR-using industries. In principle, this means that an industry is identified as IPR intensive in the EU if for at least one of the IPR under consideration, the number of those IPRs per employee exceeds the average of all EU industries that use that same IPR. As shown in chapters 3 and 4, these industries are concentrated in the manufacturing, technology and business services sectors.

It should be emphasised, however, that most industries often use IPRs in combination, to some extent. By focusing exclusively on IPR-intensive industries, this study covers that part of the European economy in which IPRs are most prominent.⁴

The contribution of IPR-intensive industries to the two principal economic indicators – employment and output – is summarised in Tables 1 and 2.^{5,6}

IPR-intensive industries generated 29.7% of all jobs in the EU during the 2017–2019 period, with 21% in trade mark-intensive industries, 13% in design-intensive industries, 11% in patent-intensive industries, 6% in copyright-intensive industries and smaller proportions in GI-intensive and PVR-intensive industries.⁷ On average over this period, IPR-intensive industries employed more than 61 million Europeans, out of a total employment figure of approximately 207 million. In addition to their direct employment contribution, IPR-intensive industries also generate employment in other, non-IPR-intensive industries which supply them with goods and services as inputs for their production processes. Using the EU input-output tables⁸ published by Eurostat, it is possible to calculate this indirect effect on employment in non-IPR-intensive industries. Taking this indirect effect into account, the total number of IPR-related jobs amounts to more than 81 million (39.4%).

² See chapter 2 on methodology. Due to the particular nature of copyright, GIs and PVRs, they required different approaches.

³ In this report, the expressions "use of IPRs" and "ownership of IPRs" are used interchangeably and should be understood to refer to ownership of IPRs in all cases.

⁴ The industries identified as TM-intensive in this report accounted for 73% of the EUTMs, the design-intensive industries for 78% of the RCDs, the patent-intensive industries for 84% of European patents and the PVR-intensive industries for 91% of the Community plant variety rights registered during the period covered.

⁵ In order to minimise the impact of data gaps in the economic statistics and avoid attaching undue importance to a particular year, the economic indicators were calculated as an average for the years 2017–2019, with the exception of the UK, for which data was only available for 2017–2018.

⁶ It should be noted that the shares in GDP and employment shown do not necessarily reflect the degree to which a country is innovative, but rather the importance of these industries in its economy.

⁷ The total contribution of IPR-intensive industries is less than the sum of the individual contributions of TM-intensive, patent-intensive, design-intensive, copyright-intensive, PVR-intensive and GI-intensive industries because many industries are intensive in respect of more than one IPR. However, the study methodology ensures that there is no double counting of industry contributions.

⁸ Input-output tables show the flow of goods and services between all industries in the economy.

These results are summarised in Table 1, which shows a breakdown by direct and indirect employment.

Table 1:

Direct and indirect contribution of IPR-intensive industries to employment, 2017–2019 average, EU27

IPR-intensive industries	Employment (direct)	Share in employment (direct)	Employment (direct and indirect)	Share in total employment (direct and indirect)
TM-intensive	43 606 597	21.1%	59 705 627	28.9%
Design-intensive	26 768 543	12.9%	40 142 839	19.4%
Patent-intensive	22 824 753	11.0%	36 076 680	17.4%
Copyright-intensive	12 924 552	6.2%	16 917 340	8.2%
GI-intensive*	n/a	n/a	n/a	n/a
PVR-intensive	1 933 519	0.9%	2 541 175	1.2%
All IPR-intensive	61 499 614	29.7%	81 592 215	39.4%
Total EU employment			206 899 343	

* Not calculated due to gaps in employment statistics for agriculture (farm structure statistics).

Note: Due to overlapping use of IPRs, the sum of the figures for the individual IPRs exceeds the total figure for IPR-intensive industries.

Besides employment, IPR-intensive industries contribute to economic output, as measured by gross domestic product (GDP). Table 2 shows that, overall, more than 47% of EU GDP is generated in IPR-intensive industries, with TM-intensive industries accounting for 39%, design-intensive industries for 16%, patent-intensive industries for 17%, copyright-intensive industries for 7%, and GI-intensive and PVR-intensive industries for smaller percentages. Chapter 4 provides a more detailed breakdown of these industries' contributions to the national economies of the EU Member States as well as the four non-EU Member States included in this study.

Table 2:

Contribution of IPR-intensive industries to GDP, 2017–2019 average

IPR-intensive industries	Value added/GDP (€ million)	Share in total EU GDP
TM-intensive	5 217 903	38.5%
Design-intensive	2 101 305	15.5%
Patent-intensive	2 361 457	17.4%
Copyright-intensive	934 176	6.9%
GI-intensive	15 011	0.1%
PVR-intensive	187 774	1.4%
All IPR-intensive	6 375 796	47.1%
Total EU GDP	13 541 581	

Note: Due to overlapping use of IPRs, the sum of the figures for the individual IPRs exceeds the total figure for IPR-intensive industries.

A comparison of the results of this study with those of the 2019 edition reveals that the contribution of IPR-intensive industries to the EU economy was higher in the 2017–2019 period than in 2014–2016. However, the comparison is complicated by the fact that in order to ensure that this study reflects the current structure of the EU economy, the matching exercise used to identify IPR-intensive industries was updated, resulting in an increase in the number of these industries from 353 in the 2019 study to 357 in the present one.⁹ Furthermore, the present study is based on data for the EU27 while the earlier studies were based on the EU28. In Table 3, the figures from the earlier studies have been re-calculated using the new definitions so as to illustrate the true change in the contribution of IPR-intensive industries.

Table 3:
Comparison of the main results: 2013, 2016, 2019 and 2022 studies

Contribution of IPR-intensive industries (EU27)	2013 study (2008–2010)	2016 study (2011–2013)	2019 study (2014–2016)	2022 study (2017–2019)
Employment (direct)	28.6%	28.5%	28.9%	29.7%
GDP	46.2%	46.1%	46.2%	47.1%
Exports of goods and services	76.7%	78.4%	79.1%	80.1%

The first column contains the results reported in the 2013 study for the 2008–2010 period. The second column shows the results from the 2016 study (2011–2013). The third column shows the results of the 2019 study (2014–2016) and the last column shows the results for the present study (2017–2019). All the results from the earlier studies have been recalculated for the EU27¹⁰ using the current definition of IPR-intensive industries. This means that the results are comparable across the four columns.

Thus, the contribution of IPR-intensive industries increased throughout the period from 2011 to 2019, whether measured by GDP, employment or external trade. In particular, the contribution of those industries to employment increased by 1.1 percentage points during that period, while the contribution to GDP rose by 0.9 percentage points.

Given that 47.1% of GDP (value added) in the economy and 29.7% of employment is generated by IPR-intensive industries, the value added *per employee* is higher in IPR-intensive industries than in the rest of the economy. Economic theory suggests that, *ceteris paribus*, industries in which the average worker produces more value added can be expected to pay their workers higher wages than other industries. It is interesting to examine, therefore, whether this higher value added is reflected in wages in IPR-intensive industries.

As shown in Table 4, wages in IPR-intensive industries are indeed higher than in non-IPR-intensive industries. The average weekly wage in IPR-intensive industries is €840, compared with €597 in non-IPR-intensive industries – a difference of almost 41%. This “wage premium” is 34% in design-

⁹ While the net change in the number of IPR-intensive sectors is small, behind it there are more substantial gross changes, as explained in chapter 2, footnote 37.

¹⁰ EU27 refers to the current Member States of the EU. This definition was used to re-calculate all of the earlier results, including those of the 2013 study.

intensive industries, 40% in TM-intensive industries, 49% in copyright-intensive industries and 65% in patent-intensive industries.

Table 4:
Personnel costs in IPR-intensive industries, 2017–2019 average

IPR-intensive industries	Average personnel costs (€ per week)	Premium (compared with non-IPR-intensive industries)
TM-intensive	838	40.4%
Design-intensive	802	34.4%
Patent-intensive	985	65.0%
Copyright-intensive	891	49.3%
GI-intensive*	n/a	n/a
PVR-intensive*	n/a	n/a
All IPR-intensive industries	840	40.7%
Non-IPR-intensive industries	597	

* Not calculated due to lack of remuneration statistics for agriculture.

Compared with the situation in the 2019 study, the wage premium has declined slightly. This reflects stronger growth in wages in non-IPR-intensive industries between 2014–2016 and 2017–2019, combined with the impact of Brexit (in the UK, the average salary in non IPR-intensive industries, measured in EUR, declined over the same period, so moving from EU28 to EU27 decreases the wage premium associated with IPR-intensive industries, *ceteris paribus*). Nonetheless, the pattern seen in the earlier studies continues to hold, with patent-intensive and copyright-intensive industries generating the highest wage premiums.

The role played by IPR-intensive industries in the EU's external trade was also examined. The bulk of EU trade is in IPR-intensive industries – which, at first glance, may be somewhat surprising. It is explained by the fact that even some industries producing commodities such as energy are IPR intensive,¹¹ while many non-IPR-intensive activities are also non-tradable.¹² For that reason, 93% of EU goods imports consist of products of IPR-intensive industries, and these industries account for an even higher share of EU goods exports, 95.3%. In the case of trade in services, the share of IPR-intensive industries is lower, with imports and exports of IPR-intensive services accounting for 48% and 41% of total services imports and exports, respectively. Taking both goods and services trade into account, in 2017–2019, 80.5% of EU imports and 80.1% of EU exports were generated by IPR-intensive industries.

In 2017–2019, the EU as a whole had an average overall trade surplus of approximately €294 billion, or 2.2% of GDP. The trade surplus in IPR-intensive industries was €224 billion, thus contributing more than three quarters of the total EU trade surplus. This surplus is principally generated by the patent-intensive and design-intensive industries, offsetting small deficits in the TM-intensive, copyright-intensive and PVR-intensive industries.

¹¹ NACE class 06.10 (*Extraction of crude petroleum*) is patent and TM intensive.

¹² For example, service industries such as those included in NACE divisions 86 (*Human health activities*) and 96 (*Other personal service activities*). Such services are generally consumed at the point of production.

Table 5 summarises trade volumes in IPR-intensive industries based on data from 2017-2019.¹³

Table 5:
EU external trade in IPR-intensive industries, 2017–2019 average

IPR-intensive industries	Exports (€ million)	Imports (€ million)	Net exports (€ million)
TM-intensive	1 547 270	1 551 618	-4 348
Design-intensive	1 232 068	1 014 158	217 910
Patent-intensive	1 559 811	1 341 864	217 947
Copyright-intensive	229 082	249 340	-20 258
GI-intensive*	13 126	1 769	11 357
PVR-intensive	43 248	50 743	-7 495
Total IPR-intensive	2 163 517	1 939 655	223 862
Total EU trade	2 701 959	2 408 212	293 747

*Goods only.

Note: Due to overlapping use of IPRs, the sum of the figures for the individual IPRs exceeds the total figure for IPR-intensive industries.

In addition to accounting for a large share of the EU's trade with the rest of the world, IPR-intensive industries also account for a high and growing share of trade among the EU Member States. During the decade between 2008–10 and 2017–19, internal trade within the EU grew by 38%, while intra- EU trade of IPR-intensive industries increased by 46%. Thus, IPR-intensive industries are an important element in the functioning of the EU single market.

As major drivers of trade between EU Member States, IPR-intensive industries generate a total of intra-EU trade that exceeds the total of their extra-EU exports. Taking both goods and services trade into account, in 2017–2019, 75.9% of intra-EU trade was generated by IPR-intensive industries. This impact is chiefly driven by cross-border trade in goods, 85% of which is generated by IPR-intensive industries. The impact of these industries on intra-EU trade in services is smaller but still significant, accounting for 36% of total intra-EU exports of services, generated mainly by TM-intensive industries (32%).

Table 6:
Intra-EU trade in IPR-intensive industries, 2017–2019 average

IPR-intensive industries	Intra-EU trade	Share in total intra-EU trade
TM-intensive	1 942 032	53.0%
Design-intensive	1 802 177	49.2%
Patent-intensive	2 044 794	55.8%
All IPR-intensive	2 781 639	75.9%

A closer look at the activity of IPR-intensive industries within the EU single market reveals a division of labour between EU Member States. Countries including Austria, Denmark, Germany, Italy,

¹³ As with the employment and GDP calculations, the figures for the individual IPRs do not add up to the overall figure for IPR-intensive industries due to the fact that many industries are intensive in more than one IPR. However, the study methodology ensures that there is no double counting of industry contributions.

Luxembourg, Malta and Sweden are above the EU average in terms of IPR creation per employee. But the companies in those countries that create the IP, taking advantage of the possibilities offered by the single market, often locate their production facilities in other Member States, based on cost, marketing and other business considerations.

Thus, IPR-intensive industries in Romania, Estonia, the Czech Republic, Hungary, Poland, Slovakia and Luxembourg have the highest proportion of jobs that are attributed to companies based in other EU Member States. As shown in Table 7, overall, 21.6% of jobs in the EU in IPR-intensive industries are generated in subsidiaries of foreign companies, a majority of which are based in another EU Member State. Among the EU Member States, only in Cyprus, Ireland and the Netherlands do non-EU companies create more jobs than companies from other EU Member States. Overall, companies based in any one of the 27 EU Member States created approximately 6.8 million jobs in IPR-intensive industries in other Member States.

Table 7:
Share of employment in IPR-intensive industries attributed to foreign companies 2017–2019, EU average*

IPR-intensive industries	EU share	Non-EU share	Total non-domestic share
TM-intensive	11.2%	9.2%	20.4%
Design-intensive	14.4%	10.2%	24.6%
Patent-intensive	15.9%	12.5%	28.4%
All IPR-intensive	12.3%	9.3%	21.6%

* Due to data limitations, it was not possible to disentangle job creation in the UK by companies based in the EU and jobs in EU Member States created by UK-based companies. Therefore, in contrast to the rest of this report, the percentages in this table refer to the EU28 as it existed prior to Brexit.

Note: “Foreign” companies are companies whose head offices or controlling units are located in another country.

Finally, patent data and TM data are used to identify IPR-intensive industries that are active in sustainable innovation. Overall, around one in ten European patent applications from EU applicants in 2019 was related to CCMTs aimed at reducing or preventing the emission of greenhouse gases.¹⁴ Green TMs¹⁵ filed by EU-based companies account for a similar share of all EUTM applications in 2021. CCMTs and green products will play an important role in achieving the goal set out in the European Green Deal – a climate-neutral Europe – and European companies are among the world leaders in these technologies and products.

In total, 110 NACE classes were identified that are either CCMT patent-intensive or green TM-intensive, many of which are related to the energy and transport sectors. These two sectors account for 9.3% of employment and 14.0% of economic output in the EU, and have seen their contributions increase in the past decade. Employees in these sectors also earn much higher wages than those in other industries. At 60.7% compared with non-IPR-intensive industries, the “wage premium” in in-

¹⁴ The CCMT identification is based on the EPO’s Y02/Y04S tagging scheme, which is part of the Co-operative Patent Classification (CPC). It covers selected technologies which control, reduce or prevent anthropogenic emissions of GHGs within the framework of the Kyoto Protocol and the Paris Agreement. For example, it includes technologies that help reduce GHG emissions related to energy generation, transmission or distribution and technologies that allow the capture, storage, sequestration or disposal of GHGs, as well as information and communication technologies aimed at reducing their own energy use.

¹⁵ See footnote 6.

dustries that contribute to sustainable innovation is half as high again as that of IPR-intensive industries in general (40.7%). Exports of goods and services produced by these industries have also risen strongly from €714 billion in 2008–2010 to €1 078 billion, or 39.9% of all EU exports, in 2017–2019. Related imports have also risen, but more slowly, from €782 billion in 2008–2010 to €1 042 billion, or 43.3% of all EU imports, in 2017–2019, turning a trade deficit into a surplus for the EU in the most recent period. This indicates that these industries are a particular strength of the EU economy.

Since these figures are a subset of the patent and TM-intensive industries, they are already included in the overall figures in Tables 1-5.

Table 8:

Contribution of CCMT patent-intensive and green TM-intensive industries to EU employment, GDP and trade, 2017–2019

Share in EU employment (direct)	Share in EU GDP	Share in EU exports	Share in EU imports	EU trade balance (€ million)
9.3%	14.0%	39.9%	43.3%	36 539

c. IPR-intensive industries in the economies of Iceland, Norway, Switzerland and the UK

In addition to the 27 EU Member States, the study also includes basic results for the EFTA countries Iceland, Norway and Switzerland, and for the UK.¹⁶ The contributions to employment and GDP of IPR-intensive industries in those countries are shown in Table 9. The EU average is included for reference purposes.

¹⁶ In calculating the contributions of IPR-intensive industries in Iceland, Norway, Switzerland and the UK, it was assumed that industries that are IPR intensive in the EU are also IPR intensive in these countries. In addition, due to lack of data coverage, it was not possible to calculate the contributions of GI-intensive industries for these countries.

Table 9:
Contributions of IPR-intensive industries to employment and
GDP in EFTA countries and the UK, 2017–2019 average¹⁷

IPR-intensive industries	Employment (direct)	Share in total employment (direct)	GDP (€ million)	Share in GDP
TM-intensive				
IS	46 654	23.3%	7 266	32.9%
NO	533 340	19.1%	158 684	43.9%
CH	1 053 631	20.8%	214 259	33.8%
UK	7 012 803	21.6%	1 008 365	41.4%
Design-intensive				
IS	16 989	8.5%	1 733	7.8%
NO	216 148	7.7%	24 067	6.7%
CH	577 542	11.4%	118 995	18.8%
UK	2 967 795	9.2%	246 036	10.1%
Patent-intensive				
IS	12 698	6.3%	1 967	8.9%
NO	263 756	9.4%	91 836	25.4%
CH	594 315	11.7%	140 398	22.2%
UK	2 623 181	8.1%	300 064	12.3%
Copyright-intensive				
IS	17 438	8.7%	1 395	6.3%
NO	182 693	6.5%	19 858	5.5%
CH	312 236	6.2%	39 129	6.2%
UK	2 449 623	7.6%	215 395	8.8%
PVR-intensive				
IS	959	0.5%	192	0.9%
NO	15 463	0.6%	2 395	0.7%
CH	44 178	0.9%	8 780	1.4%
UK	188 373	0.6%	22 513	0.9%
All IPR-intensive				
IS	59 641	29.7%	8 244	37.2%
NO	731 005	26.2%	176 447	48.8%
CH	1 425 471	28.2%	253 744	40.1%
UK	9 218 008	28.4%	1 140 505	46.8%
All IPR-intensive (EU)		29.7%		47.1%

Note: Due to overlapping use of IPRs, the sum of the figures for the individual IPRs exceeds the total figure for IPR-intensive industries.

The contribution of IPR-intensive industries to GDP is above the EU average in Norway, and below the EU average in the other three countries. The contribution to employment in those industries is equal to the EU average in Iceland and below the EU average in Norway, Switzerland and the UK.

¹⁷ Data for the UK refers to 2017–2018.

d. Methodology and data

The basic methodology of this study is the same as that used in the previous studies. Nevertheless, to make this report self-contained, a large part of it, specifically chapter 2 and Appendix 8, is devoted to documenting this methodology.

Using data from the EUIPO and EPO registers, combined with economic data from other sources, the numbers of TMs, designs, patents and PVRs per employee were calculated for each industry. The industries which were above average according to this measure were considered to be IPR-intensive. This calculation was performed at EU level, no account being taken of national filings by the companies in the database. This approach, made necessary in part by data limitations, is nevertheless justified by the assumption that an industry which is defined as IPR-intensive based on its registration of EU-level IPRs would also be deemed IPR-intensive if national IPRs per employee were included as well. Due to the special nature of copyright and GIs, different methods were used to identify the sectors using those IPRs intensively, as explained in chapter 2.

A fundamental assumption behind the methodology is that the degree to which an industry is IPR-intensive is an intrinsic characteristic of that industry, regardless of where it is located.¹⁸ In assessing the contribution of each industry to the economy, what is being measured are the jobs and GDP generated by that industry in each Member State and in the EU, rather than the origin of the underlying IPRs.

For example, if a car company based in country A builds an assembly plant in country B, then the jobs and value added created as a result accrue to the economy of country B. Therefore, no conclusions as to how innovative a particular country is can be drawn on the basis of the country-level contributions of IPR-intensive industries alone. In this example, the higher contribution of patent-intensive industries in country B is the result of decisions on where to site the production of vehicles, but the underlying R&D could have been performed in country A or indeed any other country.

To shed some light on this issue, chapter 5 shows in which countries the patents, TMs, designs and PVRs in the database used for this study originate, and presents statistics on the proportion of jobs in IPR-intensive industries in each Member State that are created in companies based in other Member States or outside the EU. The ability to innovate in one Member State while producing the resulting goods in another is yet another indication of the importance of IPRs to the functioning of EU's internal market.

¹⁸ The exception is GI, which is analysed on a country-by-country basis.

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