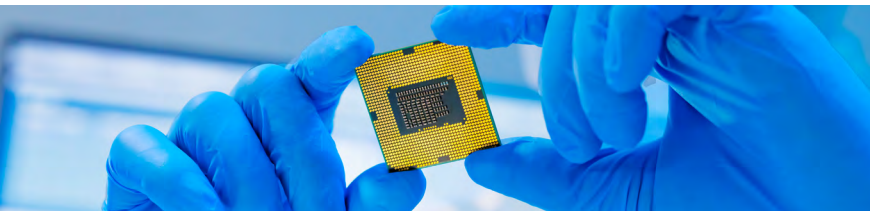


IPR-intensive industries and economic performance in the European Union

Industry-level analysis report, fourth edition
October 2022

A joint project of the European Patent Office and the European Union Intellectual Property Office



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Foreword

Innovation is a key component of the growth strategy adopted by the European Union (EU) and its Member States, as well as by many other countries. The aim is to create a more competitive economy with higher employment. The achievement of this goal depends on several factors, but an efficient system of intellectual property rights (IPRs) undoubtedly ranks among the most important, given IP's capacity to encourage creativity and innovation throughout the economy.

In response to the need to provide policymakers and the public with accurate information, the European Union Intellectual Property Office (EUIPO) and the European Patent Office (EPO) joined forces in 2013 to carry out a study that quantified the economic contribution of IPR-intensive industries to the EU economy.

Following previous editions published in 2016 and 2019, this study has now been updated for the third time, demonstrating that in the intervening period IPR-intensive industries have become even more integral to GDP, employment and trade in Europe. Other studies published jointly by our two offices have also shown the importance of IPRs in promoting growth and employment at company level, especially among small and medium-sized enterprises.

Europe has a long tradition of encouraging creativity and innovation. The Member States of the EU and the European Patent Organisation member states have played a major role in shaping a modern and balanced IPR system which not only guarantees innovators their due reward but also stimulates a competitive market. In today's world of globalised markets and the knowledge economy, it is vital to ensure that this system remains effective for implementing new innovation policies. It is essential that the debate on IP's role in supporting innovation and creativity be based on sound evidence.

To safeguard the enduring value of the study, this fourth edition includes new elements which provide an improved overview of the situation of IPR industries in Europe. Firstly, the database matching used to identify IPR-intensive industries has been refreshed, resulting in an updated list of the sectors concerned. Secondly, the report matches the contemporary focus of policymakers in Europe and beyond with a specific chapter on the economic importance of climate change mitigation technologies (CCMTs) and trade marks (TMs) that contain terms related to the environment and sustainability in their goods and services specifications. In addition to providing data about the EU, this report also includes information about Iceland, Norway, Switzerland and the UK.

This new report shows that the shares of IPR-intensive industries in EU employment and GDP are even higher than in the 2019 study, and confirms the increasing centrality of intellectual assets in modern economies.

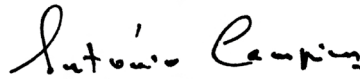
For the first time, the report not only examines the EU's external trade but also analyses trade among EU Member States in IPR-intensive goods and services. IPR-intensive industries are the backbone of the EU single market: they generate three quarters of intra-EU trade and are a major

driver of cross-border job creation. This highlights the importance of EU-wide IPRs in supporting successful economic integration. After the creation of the EU Trade Mark (EUTM) in 1994 and the Registered Community Design (RCD) in 2003, the introduction of the European patent with unitary effect will mark another major step forward to that end.

The study makes no policy recommendations, as this is not within its scope. Instead, it is designed to provide evidence that can be used by policymakers in their work, and to serve as a basis for raising IP awareness throughout Europe. It is our hope that readers can draw upon this information to ensure the continuing strength not just of our IP system, but of the European economy in which it has been found to play such a vital part.



Christian Archambeau
Executive Director, EUIPO



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President, EPO

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List of abbreviations

BvD	Bureau van Dijk
CCMTs	Climate change mitigation technologies
CPA	Classification of products by activity
CPC	Co-operative Patent Classification
CPVO	Community Plant Variety Office
CPVR	Community plant variety right
COMEXT	Eurostat reference database for external trade
CR	Copyright
DES	Design rights
DG AGRI	Directorate-General for Agriculture and Rural Development
DG GROW	Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs
DUO	Domestic ultimate owner
EAA	Economic accounts for agriculture
EC	European Commission
EFTA	European Free Trade Association
EPC	European Patent Convention
EPO	European Patent Office
EU	European Union
EUIPO	European Union Intellectual Property Office
EUTM	European Union Trade Mark
FATS	Foreign affiliates statistics
GDP	Gross domestic product
GHG	Greenhouse gases
GI	Geographical indication
GVA	Gross value added
IP	Intellectual property
IPR	Intellectual property right
LFS	Labour Force Survey (Eurostat)
NACE	Nomenclature générale des activités économiques dans les Communautés Européennes (Statistical classification of economic activities in the European Community)
NAICS	North American Industry Classification System
OECD	Organisation for Economic Cooperation and Development
OHIM	Office for Harmonization in the Internal Market (from 23 March 2016: EUIPO)
PAT	Patents
PATSTAT	Worldwide Patent Statistical Database (EPO)

PDO	Protected designation of origin
PGI	Protected geographical indication
PVR	Plant variety right
R&D	Research and development
RCD	Registered Community design
SBS	Structural business statistics
SME	Small and medium-sized enterprise
TM	Trade mark
TRIPS	Agreement on Trade-Related Aspects of Intellectual Property Rights
TSGs	Traditional specialities guaranteed
UK IPO	United Kingdom Intellectual Property Office
UPOV	International Union for the Protection of New Varieties of Plants
USPTO	United States Patent and Trademark Office
VA	Value added
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

List of countries

AT	Austria
BE	Belgium
BG	Bulgaria
CH	Switzerland
CY	Cyprus
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
ES	Spain
FI	Finland
FR	France
GR	Greece
HR	Croatia
HU	Hungary
IE	Ireland
IT	Italy
IS	Iceland
LT	Lithuania
LU	Luxembourg
LV	Latvia
MT	Malta
NL	Netherlands
NO	Norway
PL	Poland
PT	Portugal
RO	Romania
SE	Sweden
SI	Slovenia
SK	Slovakia
UK	United Kingdom
EU28	28 Member States of the European Union (pre-Brexit)
EU27	27 Member States of the European Union (without the UK)

About this study

One of the mandates of the EUIPO through its European Observatory on Infringements of Intellectual Property Rights (“the Observatory”)¹ is to provide evidence-based data on the impact, role and public perception of intellectual property in the economy of the European Union. In order to meet that objective, the Observatory is conducting a programme of socio-economic studies. This study was included in the 2022 Work Programme of the Observatory. The Terms of Reference were discussed in the meeting of the Economics & Statistics Working Group, held in Alicante in March 2022.

Similarly, the Strategic Plan 2023 of the EPO prioritises the conduct of economic studies to meet the increasing demand among stakeholders for greater awareness of the impact of the European patent system and its development.

The present report, drawn up as a joint EUIPO-EPO project, is the fourth industry-level IP contribution study resulting from this collaboration, following a first study published by the two offices in 2013² and updates released in 2016³ and 2019⁴. It aims to provide an updated assessment of the combined contribution of industries that make intensive use of the various types of IPRs to the economy of the EU as a whole and of individual European countries. Although this report quantifies the collective contribution of IPR-intensive industries, it does not claim to show causal relationships between IPRs and economic variables.

The study covers a broad range of IPRs⁵ — trade marks, patents, designs, copyright, geographical indications (GIs) and plant variety rights (PVRs) — and considers a variety of economic indicators, in particular GDP, employment, external trade and wages.

The 2013 study covered the 2008–2010 period, the 2016 update the 2011–2013 period, and the 2019 update was based on the years 2014–2016. The present study looks at the 2017–2019 period and uses a methodology similar to that of the previous studies. However, a number of improvements have been made as regards the underlying data and the methodology. In particular, the matching exercise used to identify IPR-intensive industries has been updated to ensure that the selection

1 The Observatory was transferred to the Office for Harmonization in the Internal Market (OHIM) under Regulation (EU) No 386/2012 of the European Parliament and of the Council of 19 April 2012, which entered into force on 5 June 2012. OHIM was renamed the European Union Intellectual Property Office (EUIPO) following the entry into force of Regulation (EU) 2015/2424 on 23 March 2016. Except in bibliographical references, its new name is used throughout this report.

2 OHIM/EPO: “Intellectual property rights intensive industries: contribution to economic performance and employment in the European Union”, September 2013.

3 EPO/EUIPO: “Intellectual property rights intensive industries and economic performance in the European Union”, October 2016.

4 EPO/EUIPO: “IPR-intensive industries and economic performance in the European Union”, September 2019. It should be noted that in addition to the industry-level studies, the EUIPO and EPO have also published studies examining the contribution of IPRs to the performance of individual companies, most recently in 2021.

5 “IP” is usually, but not always, a result of innovation. However, it is a broader term than “IPR”, as it includes other types of knowledge, such as trade secrets and business methods. In this study, “IPR” is used to refer to the six rights included in the analysis: patents, TMs, registered designs, copyright, GIs and PVRs.

reflects recent developments. In order to ensure comparability among the four studies, the earlier results have been recalculated using the new selection of IPR-intensive industries.

In addition, to complement the data for the EU Member States, Iceland, Norway, Switzerland and the UK have been included in this study.

Given the increasing focus of policymakers and business leaders in Europe and beyond on developing technologies to deal with climate change, a chapter on the economic importance of CCMTs was added in the 2016 and 2019 studies and has been updated for the present edition. In that chapter, the economic weight of industries engaged in the development of those technologies is analysed in greater detail, based on data on patent filings at the EPO. In addition, a new section on the contribution of a subset of EUTMs, namely those related to the environment and climate change, has been included, building on a study of “green EUTMs” published by the EUIPO in 2021.⁶

⁶ EUIPO, “Green EU trade marks: Analysis of goods and services specifications, 1996–2020”, September 2021.

Executive summary

α. Main findings⁷

- 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

⁷ 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 defined⁸ as those having an above-average ownership⁹ 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.¹⁰

The contribution of IPR-intensive industries to the two principal economic indicators – employment and output – is summarised in Tables 1 and 2.^{11, 12}

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.¹³ 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 tables¹⁴ 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%).

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

9 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.

10 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.

11 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.

12 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.

13 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.

14 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.¹⁵ 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 EU27¹⁶ 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-

¹⁵ 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.

¹⁶ 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,¹⁷ while many non-IPR-intensive activities are also non-tradable.¹⁸ 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.

¹⁷ NACE class 06.10 (*Extraction of crude petroleum*) is patent and TM intensive.

¹⁸ 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 2017-2019.¹⁹

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,

¹⁹ 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.²⁰ Green TMs²¹ 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-

20 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.

21 See footnote 6.

industries 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.²² 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.

²² 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 average²³

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.

²³ 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.²⁴ 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.

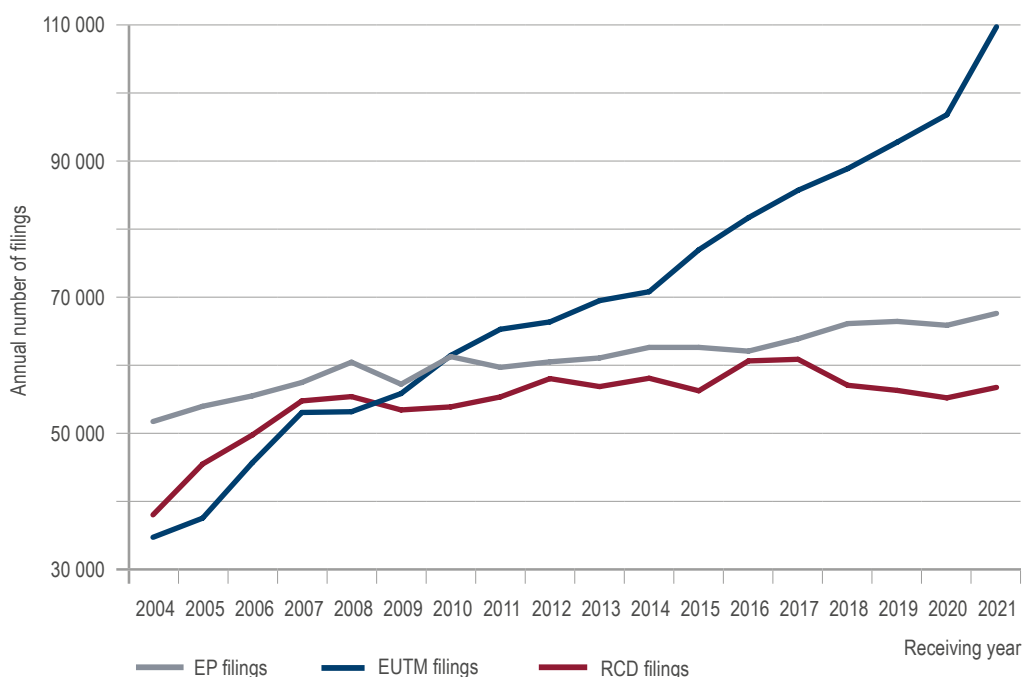
²⁴ The exception is GI, which is analysed on a country-by-country basis.

1. Introduction

Intellectual property (IP) is widely recognised as a key driver in modern economies. The emergence of the knowledge economy, globalised markets and the growing complexity of products and services have all served to increase the importance of IPRs. For many companies in advanced economies, their intangible assets are far more valuable than their physical assets. Empirical evidence suggests that, in their attempt to extract additional value from their innovations, companies consider alternative, often complementary means of IP protection. Looking to the future, most policymakers firmly believe that knowledge-intensive industries will drive growth and prosperity not only in Europe but across the globe.

As shown in Figure 1,²⁵ filings of European patents, TMs and designs by European applicants have grown significantly since 2004. Overall, filings of EUTMs and European patents have seen growth over the entire period, with faster growth in the case of TMs. Growth in EU design filings was faster than growth in TM filings during the first few years following the introduction of the RCD in 2003, but has been considerably slower since then. Overall, the resilience of IPR filing activity is yet another indication of the growing importance of IPRs.

Figure 1:
Numbers of EP, EUTM and RCD applications filed by
EU applicants between 2004 and 2021



²⁵ In Figure 1, EP = European patent, EUTM = European Union Trade Mark and RCD = Registered Community Design.

Quantifying IPRs and their economic contribution is difficult, as the data tends to be fragmented and disaggregated and focuses on individual rights and/or specific industries. In the past, research on the economic impact of IP concentrated on patents. In recent years, however, several studies have also assessed the impact of TMs on innovation, growth, employment and wages, but mostly at a national level.

As was the case with the 2019 report, this study offers a comprehensive assessment of how IPR-intensive industries contribute to the European economy, with a focus on GDP, employment and external trade.²⁶ Of course, IP also affects the economy in other ways that are not quantified in our study, including, for example, technology transfer, long-run effects on innovation and growth, and externalities related to the creation and use of IP that are not monetised through market transactions.²⁷

This study looks at TMs, patents, designs, copyright, geographical indications (GIs) and plant variety rights (PVRs). It identifies those EU industries with above-average use of those rights in relation to the size of their workforce. It quantifies the weight of those industries in the economy of the EU as a whole and that of each Member State. It also includes information for Iceland, Norway, Switzerland and the UK.

While this report quantifies the collective contribution of IPRs to the economy, its results do not reveal causal relationships between IP and economic variables. The report does not feature any comparative analysis of the effects of different types of IP protection either. The various IPRs serve different purposes, are used in different sectors of the economy and are also different in terms of scope. Nor does the study analyse the value of IPRs for individual companies; it is concerned, rather, with their contribution at the level of industries and Member States. Within any industry, some companies use IPRs more intensively than others. Such variations are not captured in this report. Similarly, companies have adopted different IP protection strategies. For example, some prefer to keep trade secrets rather than file for patents, or work with unregistered rather than registered designs. In other words, a number of key forms of IP are not included in this study.

This report defines IPR intensity as the number of IPRs divided by the number of employees in an industry. This means that industries with a relatively small number of valuable IPRs but a large number of employees would not be identified as IPR-intensive according to this methodology.

A company-level analysis published by the EPO and EUIPO in 2021 compares individual IPR-intensive companies with non-IPR-intensive companies in the same industries to assess whether the IPR-intensive companies perform better on indicators such as employment or wages.²⁸ Another study, published by the EUIPO and EPO in 2019, focuses on the growth performance of European SMEs that use registered IPRs.²⁹ Both of these company-level studies indicate a positive relationship between a company's IPR activity and its financial performance and growth potential.

This report offers a brief overview of the IPRs covered and their economic functions. It features a chapter on the methodology of the study, explaining how data was compiled and its analytical

26 The 2019 study is available at epo.org/service-support/publications.html?pubid=201#tab3. Similar studies on the US economy were published by the USPTO in 2012, 2016 and 2022. See uspto.gov/sites/default/files/documents/uspto-ip-us-economy-third-edition.pdf.

27 Copyright/cultural industries can also affect the economy through the mechanisms of exceptions and limitations. However, these types of contribution are not included in this study.

28 "Intellectual property rights and firm performance in Europe: an economic analysis". Available at euipo.europa.eu/ohimportal/en/web/observatory/ip-contribution#ip-contribution_feb-2021.

29 "High-growth firms and intellectual property rights: the IPR profile of high-potential SMEs in Europe". Available at epo.org/high-growth.

treatment. There are chapters on the results of the industry-level analyses for each of the six IPRs covered, at both EU and individual country level. The most IPR-intensive industries are also discussed in greater detail. The closing chapters of the study look at the origins of the IPRs covered, and present an additional analysis of industries patenting inventions in climate change mitigation technologies and registering EUTMs whose goods and services specifications are related to the environment, sustainability and climate change mitigation.

1.1 IPRs and their function in the economy

The growing importance of intellectual assets in today's competitive markets has led to the publication, in recent years, of a wealth of economic and management literature dealing with IPRs. The rising number of scientific publications (and the parallel increase in IPR coverage by management press and newspapers) reflects the steep increase in the number of patents, TMs and registered designs worldwide over the past two decades and their usage as output indicators for observing economic phenomena.

Legal protection of intellectual property encourages individuals and organisations to be creative and innovative by granting them exclusive legal rights to the fruits of their work. This section briefly introduces the six forms of IPRs studied in this report: patents, TMs, registered designs, copyright, GIs and PVRs. It specifies relevant subject-matter, the criteria that need to be met to gain protection and the principal rights conferred. It also provides a brief outline of the economic rationale behind each IPR.

1.1.1 What is patent protection?

Patent protection is available for inventions that aim to offer new solutions to technical problems. To be patentable, inventions must be new, non-obvious (i.e. include an "inventive step") and industrially applicable. The novelty requirement means that, at the filing date, the invention must not be known to the public anywhere. To satisfy the inventive step requirement, the invention must not be obvious to a person who is skilled in the field concerned. Finally, the invention must be susceptible of industrial application. Only patents granted by a patent authority are fully valid and enforceable. Patent authorities examine patent applications and ensure that the invention satisfies all legal requirements for patenting. Once granted, the patent confers on its owner the right to prevent any other entity from commercially exploiting the invention. This exclusive right is only granted for a limited time period. Typically, patent protection lasts 20 years from the date of the application, subject to the payment of renewal fees. It is also limited in space, as the exclusionary power of patents can only be enforced within the jurisdiction of the granting state.

In Europe, inventors can apply for patent protection in individual European states via the national patent systems and/or seek regional protection through a centralised procedure at the European Patent Office (EPO). A European patent granted by the EPO offers patent protection in up to 44 countries. Following the ratification of the Agreement on the Unified Patent Court by the Member States, applicants will be able to apply for a "Unitary Patent" covering most of the territory of the European Union, when the Unitary Patent system becomes operational in early 2023.³⁰

³⁰ See single-market-economy.ec.europa.eu/industry/strategy/intellectual-property/patent-protection-eu/unitary-patent-system_en for more details on the implementation of the Unitary Patent.

There are two main ways in which patent rights promote the progress of technology, innovation and social welfare: they create incentives to innovate and they promote the dissemination and valorisation of new knowledge.³¹

Patents drive innovation by creating a private reward for innovation in the form of the applicant's exclusive right to use or sell the patented invention ("reward function"). Why is there any need to introduce such an incentive mechanism? Innovation ultimately generates new knowledge. If this knowledge is not protected, rival firms could potentially exploit it, at little or no cost, reducing inventors' rewards to such an extent that it would no longer be worthwhile for them to innovate. Exclusive legal rights to inventions in the form of patents help to limit this risk by providing adequate incentives to engage in innovative activity.

The "contract function" describes the second main way in which patents can promote innovation: they grant inventors exclusive rights to a given invention in exchange for the disclosure of information on the underlying technical solution. The public availability of patent documents in national and international patent offices facilitates the dissemination of technical information, which can then be used by others to develop other novel solutions, creating additional gains for society. The combination of disclosure and legal exclusivity also enables contractual arrangements (such as licences or R&D co-operation agreements) for the exploitation of patented inventions.

1.1.2 What is trade mark protection?

A trade mark (TM) is a distinctive sign that identifies certain goods or services as those provided by a specific person or organisation and distinguishes them from those of other organisations. TMs are intended to reduce information and transaction costs in the marketplace by allowing customers to identify the nature and quality of goods and services before purchase. Among the most common signs eligible for TM protection are words, pictures, stylised words, logos, a colour or colour combination, a shape, a sound or some combination of those signs. Generally, a sign must fulfil the requirements of distinctiveness to serve as a TM. Distinctiveness means that consumers can recognise the sign as a TM and distinguish it from other TMs in the same field. If a TM is likely to deceive the public as to the nature, quality or any other characteristics of the goods and services to which it refers, it does not qualify for registration. TMs can be protected on the basis of either registration through a trade mark office (i.e. registered TMs) or, in some countries, through their actual use in the marketplace (i.e. unregistered TMs). Registering TMs is not compulsory in all countries, but it makes it easier to enforce associated legal rights.³² A registered TM owner has the exclusive right to use that TM on the goods and services in the product classes for which it has been registered and to prevent others from exploiting, in the same fields, any sign that is identical or similar to it. The term of protection of a registered TM is typically ten years, but it can be renewed indefinitely for successive periods (typically, ten years each), subject to payment of fees.

³¹ There is a rich body of economic literature dedicated to patents (see e.g. Hall and Harhoff, 2012 for a complete overview). This literature discusses the economic functions performed by patents and aims to assess their actual impact on the economy. It also explores the various ways in which patents are used across sectors and countries, and the economic impact of the legal design of patent systems.

³² To enforce the rights associated with an unregistered TM, proprietors must normally produce factual evidence to prove that they have an established TM that has acquired a reputation in the mind of the public.

The economic rationale underlying the protection of TMs has its roots in economic theories of information and reputation.

Competing products available in the market may differ from one another in terms of several characteristics and attributes. This difference is not a problem per se if consumers can obtain, at no cost, all the relevant information about these products and evaluate them appropriately to guide their purchase decisions. However, that is typically not the case. A product's characteristics are often difficult or impossible for consumers to observe until they have actually purchased the product. In this context, a brand, protected by a TM, acts as signal that a given product is of the consistent quality that the consumer associates with that brand.

The legal protection of TMs provides an incentive to develop and maintain distinguishing product features and create information about them for the benefit of market transparency. Creating this information and building up the reputation that the TM conveys is likely to require significant investments in product quality, service and advertising. In the absence of legal protection, and given the limited costs of imitating a competitor's TM, there would be insufficient incentive to incur such quality investments.

1.1.3 What is design protection?

Design protection³³ covers the visual appearance of a product, part of a product and/or its ornamentation. A product can be any industrial or handicraft item, including packaging, graphic symbols and typefaces. In other words, a design covers the appearance of a product, but cannot protect its functions, which fall under the regime of patent protection. The requirements that must be satisfied to register a design include that it must be new and have an individual character. It is new if no identical design has been made available to the public by the filing date. It has an individual character if the overall impression it produces on an informed user signifies that it differs from any previous designs. Industrial design protection is usually granted pursuant to a procedure for its registration (registered design). Under certain laws, however, design rights may also be automatically acquired by disclosing the design in a document or product (unregistered design). Like TMs, registered designs provide more comprehensive cover than their unregistered counterparts. Registered design owners have exclusive rights to use the design and can prevent any third parties from using it. In the EU, the rights conferred by registered designs can apply for a maximum of 25 years. Registered Community Designs (RCDs) have an initial life of 5 years from the date of filing and can be renewed for successive 5-year periods, up to a maximum of 25 years.

The economic case for design registration builds primarily on the idea of promoting innovation. The production of new designs is a creative activity, requiring significant investments of time, skills and labour. If no exclusive rights were available, any party could replicate a creative design and use it to directly compete with the original creator. Providing a legal mechanism to protect new designs should ultimately enhance investments in design production and creative work.

33 In this report, the term "design" is to be understood to mean "registered design".

1.1.4 What is copyright protection?

Copyright gives right-holders exclusive rights to authorise or prohibit the use (e.g. reproduction, distribution, adaptation, translation) of their content (e.g. films, programmes, etc.). It is important to note that copyright is applicable only to the expression of ideas, not to the ideas themselves. No copyright registration is required at EU level;³⁴ protection is granted automatically from the moment a work is created. In this respect, copyright differs significantly from the other IPRs considered in this report.

Thirteen directives and two regulations have been adopted to harmonise substantive copyright law provisions in the EU Member States. Despite this considerable harmonisation, there are still some national differences in copyright protection in areas not harmonised at EU level. In addition, there are slight differences between copyright regimes as implemented in the EU and three EFTA countries (Iceland, Norway and Switzerland). Following Brexit, changes in UK copyright law are under consideration, and over time UK law may also begin to diverge from current EU law due to developing case law. However, certain standards of copyright and related rights protection apply in all these countries under international legislation, such as the Berne Convention for the Protection of Literary and Artistic Works.

The most important economic rights granted to EU creators, performers, producers and broadcasters include:

- right of **reproduction** for authors, performers, producers of phonograms and films and broadcasting organisations
- right of **communication** to the public for authors, performers, producers of phonograms and films and broadcasting organisations
- right of **distribution** for authors and for performers, producers of phonograms and films and broadcasting organisations
- right of **fixation** for performers and broadcasting organisations
- right of **rental** and/or lending for authors, performers and producers of phonograms and films, with an associated right of **equitable remuneration** for lending and/or rental for authors and performers
- right of **resale** (droit de suite) for artists who work in visual art forms like sculpture, painting or photography
- right of **broadcasting** for performers, producers of phonograms and broadcasting organisations
- right of **computer program reproduction, distribution and rental** for authors

It should be noted, however, that some rights are not applicable to all right-holders or may only be applicable if certain conditions are met.

³⁴ Voluntary registration is, however, possible in many Member States.

The types of works that are protected under all national copyright laws include the following:

- literary works (including novels, short stories, poems, dramatic works and any other writings, irrespective of their content, both fiction and non-fiction)
- musical works
- artistic works (whether two-dimensional such as drawings, paintings, etc. or three-dimensional such as sculptures or architectural works)
- maps and technical drawings (including cartographic works, plans, blueprints, diagrams, etc.)
- photographic works
- cinematographic works
- computer programs and databases

The list is not exhaustive, as some copyright laws may protect other types of works as well.

Independently of the economic rights, authors are granted moral rights (the right of authorship, the right of integrity of work and the right of divulgation), but not through EU legislation. Moral rights can be asserted by the author even if the copyright has been transferred to a third party.

Related rights provide economic protection for performers, producers of phonograms and broadcasting organisations. In the EU, film producers and press publishers are also protected by related rights.

In the EU, copyright protection is currently valid for the author's lifetime and 70 years after their death. The protection conferred by related rights lasts for 50 years after the performance, film or transmission of a broadcast was published or communicated to the public. In 2011, the related rights term for performers and phonogram producers in the EU was extended from 50 to 70 years under certain conditions.

The economic aspects of copyright are complicated, reflecting various trade-offs between the interests of creators, distributors, performers and consumers, and between short-term versus long-term effects. The general objective of the system is to ensure appropriate remuneration for creators and other right-holders (so that a socially optimal level of creative activity is guaranteed), while at the same time providing broad public access to creative works and making it possible for other creators to build upon prior works.

1.1.5 What is geographical indication protection?

A geographical indication (GI) is a name which identifies a product to link it to a specific geographical location or origin (e.g. place, region or country). The use of a GI may act as certification that a product has certain qualities, is made according to traditional methods or enjoys a certain reputation due to its geographical origin.

Their connection with the "territory" and the strict product manufacturing controls in place often lead to vertical integration in the different sectors involved in producing GI goods, starting with farmers and continuing to manufacturers and even wholesalers and retailers.

GIs are mainly used in the agriculture, food and beverage sectors, and primarily in Europe. This study considers agricultural, food and beverage GIs only.

The EU also recognises GIs of non-EU countries.

The two main types of GI for agricultural products and foodstuffs are summarised below.



Protected designation of origin (PDO): a name which identifies a product that is **produced, processed and prepared** in a defined geographical area using recognised know-how. Products owe their characteristics exclusively or essentially to their place of production and the skills of local producers.



Protected geographical indication (PGI): a name which identifies a product whose reputation or characteristics are attributable to its geographical origin. For PGI agricultural products and foodstuffs, at least one of the stages of production, processing or preparation takes place in the geographical area concerned. For PGI wines, at least 85% of the grapes come from the area.

Another difference between GIs and other IPRs is that while TMs, designs, patents, PVRs and copyright are usually applied for and owned by private entities (mostly individual companies), GIs are typically applied for and managed by producer associations in the relevant geographical area. The GI can then be used by all individual producers located in that area and complying with a product specification, including defined production methods.

In terms of their economic function, GIs and TMs both have the basic function of addressing information asymmetries between sellers and buyers and helping consumers to lower their search costs by certifying a product's origin and the manufacturing methods used to make it. This is reflected in the fact that consumers are often prepared to pay a price premium for GI products.³⁵

1.1.6 What is plant variety right protection?

Plant variety rights or plant breeder's rights (PVRs) are an independent *sui generis* form of intellectual property right, tailored to protect new plant varieties (Article 27(3)(b) TRIPS).

A plant variety is a plant grouping within a single botanical taxon of the lowest known rank, which can be defined by the expression of the characteristics resulting from a given genotype or combination of genotypes, distinguished from any other plant grouping by the expression of at least one of the said characteristics and considered to be a unit with regard to its suitability for being propagated unchanged.

The international legal framework for the protection of PVRs is provided by the International Convention for the Protection of New Varieties of Plants (the UPOV Convention).

³⁵ See EUIPO: "Infringement of protected geographical indications for wine, spirits, agricultural products and foodstuffs in the European Union", 2016. Available at euiipo.europa.eu/tunnel-web/secure/webdav/guest/document_library/observatory/documents/Geographical_indications_report/geographical_indications_report_en.pdf.

As far as the European Union is concerned, the Community Plant Variety Rights (CPVRs) system represents the sole and exclusive form of intellectual property right for plant varieties at the EU level. The CPVR system is managed by the Community Plant Variety Office (CPVO), which is responsible for granting CPVR titles. Titles can be obtained by means of a single procedure and have unitary effects throughout the whole territory of the European Union. The CPVR coexists with the Member States' respective own national PVR systems. However, if an EU PVR has been granted, a national right for the same variety cannot be enforced.

For a PVR to be granted, it is necessary to first file an application for examination before a national or regional designated authority. The candidate variety must then fulfil the technical criteria of distinctness, uniformity and stability (known as the "DUS" criteria). It must also be new and bear a suitable denomination. These criteria are tested by the CPVO following a formal, substantive and technical examination, the latter in co-operation with national authorities (entrusted examination offices).

A PVR certificate of protection will be granted for a fixed period if all due requirements are fulfilled. The UPOV 1991 Convention provides protection for a minimum of 20 years. In the EU protection is granted for 25 years for most species and 30 years for vines, trees and potato species.

Right-holders can bring civil proceedings against any person infringing a CPVR.

The economic rationale for PVRs is similar to that for patents: to incentivise innovation while at the same time promoting the diffusion of knowledge across the economy. In 2022, the EUIPO and CPVO published a joint study on the contribution of the CPVR system to the economy and the environment in the EU.³⁶

³⁶ Available at euiipo.europa.eu/ohimportal/en/web/observatory/ip-contribution#study_04-2022.

1.2 Summary of the six IPRs

The main characteristics of patents, TMs, registered designs, copyright, GIs and PVRs are summarised in the table below.

Main characteristics of the different types of IPRs

IPR	Patents	Designs	Trade marks	Copyright	Geographical indications	Plant variety rights
Subject-matter	Inventions (solutions to technical problems)	Appearance of an article or product or parts of it and/or its ornamentation	Distinctive signs that identify certain goods or services and distinguish them from those of other businesses	Artistic, literary, dramatic, musical, photographic and cinematographic works; maps and technical drawings; computer programs and databases	Product originating in a particular geographical area whose quality or reputation is linked to its geographical environment or origin	Plant varieties
Requirements for protection	Novelty; inventive step (non-obviousness); industrial applicability	Novelty; individual character	Distinctiveness	Originality of the work, irrespective of its literary or artistic merit	Technical specifications justifying the special characteristics of the product and their link to the geographical area	Distinctness, uniformity, stability and novelty
Acquisition of right	Examination by the patent office, followed by grant and validation	For registered designs, examination by the IP office. For unregistered designs, automatically acquired by the act of disclosure	For registered TMs, examination by the IP office. For unregistered TMs, use in commerce	Automatic upon creation	Examination by the national authority (depending on the country), then by the European Commission	Examination by examination authority chosen by the CPVO, followed by grant
Conferred rights	Exclusive right to make, use and sell the patented invention	Exclusive right to use the design and to prevent any third party from using it without the right-holder's consent	Exclusive right to use the TM in trade	Reproduction, communication to the public, including making the work available to the public, distribution, rental, resale, translation, adaptation, public performance	Collective right. Exclusive rights to commercialise comparable products and prevent imitation, misuse or evocation	Exclusive right to commercialise the protected plant variety
Duration	Typically 20 years from filing, subject to payment of annual renewal fees	For registered designs, the maximum term is 25 years. In the case of RCDs, up to 25 years (in successive 5-year terms)	For registered TMs, commonly 10 years from filing, but can be renewed indefinitely, on payment of fees, for successive periods	For authors, lifetime plus 70 years. For performers, generally 70 years from the date of first public performance, fixation, publication or transmission. For producers of phonograms, 70 years after the fixation is made, the phonogram is published or communicated to the public. For film producers, 70 years after the fixation is made, the film is published or communicated to the public. For broadcasters, 50 years after first transmission	Indefinite; no need for renewal	For most plant varieties, 25 years; 30 years for vines, trees and potatoes, subject to payment of annual fees

2. Methodology of the study

The purpose of the present study is to examine the economic characteristics of IPR-intensive industries. The methodology used for this study follows that applied in the 2019, 2016 and 2013 studies as closely as possible, in order to achieve maximum comparability. Thus, the principles behind the methodologies of the studies are the same: first, determine which industries use IPRs more than others; second, use industry-level economic statistics to determine employment and value added (GDP), trade and wages generated in those industries; third, compare the industry-level economic aggregates to those for the overall economy in order to determine the economic weight of IPR-intensive industries.

As was the case in the 2019 study, a new matching exercise has been carried out to ensure that the classification of industries as IPR-intensive or non-IPR-intensive reflects today's economy as closely as possible. As explained in section 2.2 and in chapter 8, the data matching methodology was also improved, requiring fewer manual checks than the previous method. In all, the new methodology resulted in 357 industries being identified as IPR-intensive, 4 more than in the 2019 study.³⁷ In order to analyse trends, the data for previous periods has been re-calculated using the new set of IPR-intensive industries and excluding the UK, to ensure that the figures are comparable.

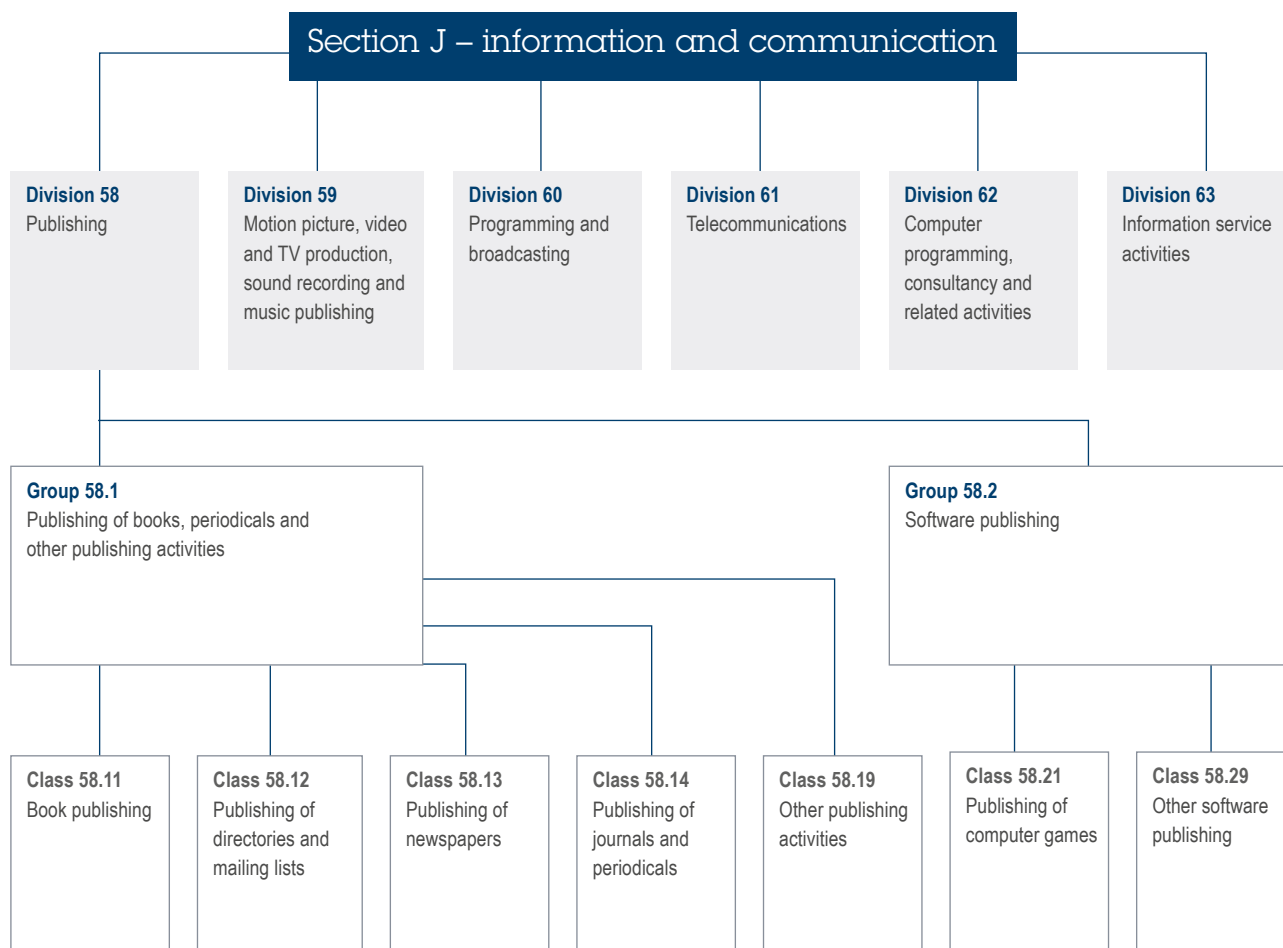
Four countries that are not members of the EU – Iceland, Norway, Switzerland and the UK – are included in the study this time. The calculation of the contribution of IPR-intensive industries in those four countries was based on the assumption that industries that are IPR-intensive in the EU are also IPR-intensive in those countries.³⁸ In other words, no separate matching exercise was carried out for them. This was done mainly to ensure that their results could be compared with those of the EU. In addition, given that all four countries are European economies whose level of economic development is similar to that of many EU Member States, it is reasonable to assume that their economic structure does not differ from that of comparable EU Member States.

The basic unit of analysis in this study is the industry as defined in the NACE classification used by Eurostat. In this classification, overall economic activity is divided into 22 sections, which are further subdivided into 88 divisions (often referred to as the two-digit level), 272 groups (three-digit level) and 615 classes (four-digit level). An example of the hierarchical NACE structure is shown in Figure 2.

³⁷ While the net change in the number of IPR-intensive sectors is small, behind it there are more substantial gross changes. Thus, 17 industries that were patent intensive in the previous matching are no longer considered patent intensive; on the other hand, 19 industries that were not previously classified as patent intensive are now classified as such. In the case of TM-intensive industries, 22 industries were eliminated, while 17 were added. For design-intensive industries, the outflow was 35 industries, while 28 new industries were added.

³⁸ Strictly speaking, the matching exercise to determine which industries are IPR-intensive did include TM, design and patent filings from the UK, but all other calculations were performed on EU27 data.

Figure 2:
NACE structure, SECTION J – Information and communication



The list of industries that are intensive in their use of copyright and GIs is pre-determined, as explained in sections 2.6 and 2.7. For patents, TMs, designs and PVRs, IPR intensity is determined by examining the volume of IPRs obtained by all industries at the EUIPO, EPO and CPVO in relation to the level of employment in those industries. This was the most labour-intensive part of the study and is explained in section 2.2. How the data was used is explained in more depth in sections 2.3 for patents, 2.4 for TMs and 2.5 for designs. Section 2.8 explains the methodology used for PVRs.

When calculating the IPR intensity of industries, IPRs were associated as far as possible with industries on the four-digit level. However, Eurostat employment data is not available on a sufficient level for all industries. For some industries, the most granular employment data available is by NACE division (two-digit) level. The source of the employment data for those industries is the Labour Force Survey (LFS).³⁹ The IPR intensity of those industries can only be calculated at NACE division level. Including those industries in the calculation of overall employment-weighted average IPR intensity would lower the average, so that a higher number of industries would be classified as IPR intensive.

³⁹ For more information on the LFS, see ec.europa.eu/eurostat/web/microdata/labour-force-survey.

Therefore, the calculation of the weighted average of IPR applications per 1 000 is based solely on industries for which Structural Business Statistics (SBS) employment data is available (on the NACE class, or four-digit level). On the other hand, once the average value had been calculated, for the purpose of selecting the group of IPR-intensive industries all NACE codes were considered, including those for which only LFS employment data was available.

2.1 Data sources and selection criteria

One of the distinguishing features of this study is the variety of databases and other data sources used to determine which industries are IPR intensive and to assess the contribution of these industries to employment, GDP and other economic indicators. These databases and sources include:

- the EUIPO's register of EU Trade Marks and Registered Community Designs
- the EPO's PATSTAT database, containing information on patent applications that have been published and/or granted by the EPO
- the CPVO's Register of Community Plant Variety Rights
- ORBIS, a commercial database containing industry classification and other information for more than 100 million European companies.⁴⁰ Together with the EUIPO, EPO and CPVO databases, this was the basic database of registered intellectual property rights (patents, designs, TMs and PVRs) used for the analysis. ORBIS is provided by a Brussels-based company, Bureau van Dijk, which compiles data based on filings made by companies in trade registers and similar government records in their respective countries
- COMEXT, Eurostat's reference database for the EU's external trade and intra-EU trade of goods. This data was used to quantify the contribution of IPR-intensive industries to external trade and intra-EU trade
- Eurostat's Balance of Payment (BoP), which was used to estimate the international trade in services among EU Member States (intra-EU transactions) and with non-EU countries (extra-EU transactions)
- Eurostat's structural business statistics (SBS) data, showing employment, labour costs and value added for each industry at EU and Member State level, as well as in the four non-EU countries included in this study, using the NACE classification of economic activity. This data was the main source for the contribution of IPR-intensive industries to employment and GDP (except for GIs)
- Eurostat's Labour Force Survey (LFS), which was used to estimate employment in certain industries not reported in the SBS
- Eurostat's national accounts statistics, the main source of official data on total GDP, employment and compensation of employees at EU level, for individual Member States and for non-EU countries that are members of the European Statistical System
- Eurostat's input-output tables (IOT), showing flows of products and services between the different industries. This data was mainly used to quantify the indirect employment contribution of IPR-intensive industries at EU level
- economic accounts for agriculture (EAA), Eurostat's main data source for statistics on the

⁴⁰ bdinfo.com/en-gb/our-products/data/international/orbis?gclid=Cj0KCQjwrs2XBhDjARIsAHVymmTfOCRrrr_EcGZXtjJzkovmF4oRyG-8FrY9dBM4tq7X5vvy11ypl5saAsmKEALw_wcB, consulted on 11 August 2022.

agricultural sector. This database was used in the analysis of PVR- and GI-intensive industries for the EU, EU Member States and non-EU countries

- economic data from national statistics offices in several EU Member States and the UK. This data was used to supplement the Eurostat data, particularly for some of the copyright-intensive sectors
- Eurostat's foreign affiliates statistics (FATS), which were used to calculate the number of jobs in IPR-intensive industries created by companies based outside each Member State
- E-ambrosia of the European Commission's DG AGRI, showing all GIs registered in the EU
- data on sales of GI products sourced from a recent study commissioned by DG AGRI, which was used to quantify the contribution of GI-intensive industries to GDP⁴¹

The IPRs chosen for the analysis were patents, TMs, designs and PVRs applied for at the EPO, EUIPO and CPVO during the 2013–2017 period and granted.⁴² Using a five-year period rather than a single year has the advantage of avoiding bias resulting from factors that might have affected the economy in any particular year.

When selecting the sample of IPRs for the analysis, a time lag of three to four years was applied, as an innovation is expected to yield economic benefits only after a certain amount of time has elapsed. Accessing complementary assets such as marketing channels, cost-effective manufacturing and after-sales support takes time and is a prerequisite for successful commercialisation in a dynamic environment. Moreover, in the case of new products and services, negotiating licence agreements and attracting financing can be a lengthy process. This may explain the time lag suggested by empirical research between successful patent applications and subsequent changes in company performance.⁴³ A similar case can be made for TMs and designs, since a newly registered TM or design may not confer the same benefits as one that has been in the market for several years, giving consumers time to gain confidence in that particular company or product.

The economic contribution by the IPR-intensive industries identified according to the methodology described in this chapter was analysed using economic data for the 2017–2019 period,⁴⁴ thus updating the earlier study, which used economic data for 2014–2016.

The IPRs used were those registered at EU level, irrespective of any 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 were included as well.

The EUIPO, EPO and CPVO data had to be matched to ORBIS. Only patents, TMs, designs and PVRs with at least one EU-based owner were included in this exercise, because the version of the ORBIS database used for this study contains data on EU-based companies, including affiliates of

41 Study on economic value of EU quality schemes, geographical indications (GIs) and traditional specialties guaranteed (TSGs). October 2019, AND-International and European Commission.

42 In other words, the application was filed during the 2013–2017 period, but the corresponding IPR could have been granted at any time up to the first half of 2022 (when the data used for the matching exercise was extracted from the underlying databases).

43 Holger Ernst (2001) examined the relationship between patent applications and subsequent changes in corporate performance for 50 German machine tool manufacturers between 1984 and 1992 and found that the time lag effect can be up to three years after priority in the case of European patents.

44 The only exception is the contribution of IPR-intensive industries in the UK, which refers to the 2017–2018 period, due to data limitations.

non-EU companies. However, the exclusion of non-EU IPR owners does not affect the ultimate goal of the data matching exercise, namely the selection of IPR-intensive industries. It is a fundamental assumption of this study that whether or not an industry is IPR intensive is an inherent characteristic of that industry, irrespective of its geographical location. In the subsequent economic analysis of the employment and GDP contribution of IPR-intensive industries to the EU economy, all relevant industries are included, regardless of the ultimate ownership of the companies within each industry. For example, jobs at a Korean-owned car factory located in an EU Member State are included in Eurostat's statistics and in the quantification in chapter 4.

2.1.1 Economic data

The primary source of employment and value added data is Eurostat's Structural Business Statistics (SBS) data series, which shows employment in each four-digit NACE sector for the EU and for each Member State, as well as for the four non-EU countries included in this study (Iceland, Norway, Switzerland and the UK). In practice, there are data gaps in the Eurostat statistics for some years, owing to one or more of the following factors:

- **quality of data:** In some cases, Eurostat and/or the relevant national statistical office may decide that the data for a particular industry is of questionable quality. In those cases, Eurostat does not publish the data. However, it is important to note that even then, the data is included in Eurostat's aggregate estimate at EU27 level.
- **confidentiality:** It may be that only one company operates in a particular industry in a Member State (this is especially true for the smaller Member States). In such cases, in order to maintain confidentiality, Eurostat does not report the data at Member State level. However, the data is included in aggregate EU-level estimates, and for higher-level (two-digit) NACE industries.
- **exclusion of certain industries:** For 16 IPR-intensive industries, no data at all is reported in SBS.⁴⁵

In the case of the remaining 14 IPR-intensive industries for which Eurostat does not collect data, the employment data was obtained from the national statistics offices of the Czech Republic, Denmark, France, Italy, Spain and Sweden. The ratio of employment and GVA in each of the industries to total employment and GVA in the corresponding divisions (85 and 90 to 94) was calculated for these six countries, and these ratios were then applied to the other EU Member States in order to obtain the missing employment numbers. In effect, this procedure assumes that the share of the 14 industries in total employment and GVA of those six divisions in the EU is the same as that of the six Member States together.

All in all, for the EU as a whole, SBS data was available for 343 of the 357 IPR-intensive industries, while data for the remaining 14 industries was completed by imputation based on Member State data, as described above.⁴⁶

⁴⁵ These industries are all classes included in divisions 01 *Crop and animal production, hunting and related service activities*; 66 *Activities auxiliary to financial services and insurance activities*; 85 *Education*; 90 *Creative, arts and entertainment activities*; 91 *Libraries, archives, museums and other cultural activities*; 92 *Gambling and betting activities*; 93 *Sports activities and amusement and recreation activities*; and 94 *Activities of membership organisations*.

⁴⁶ In theory, 19 000 data points (employment and value added for 357 industries for 27 Member States) were needed at Member State level. However, less than one tenth of the total data needed at country level was missing from the published Eurostat statistics at four-digit level and was estimated based on two-digit or three-digit data in SBS. The imputed data is only significant in the case of Malta.

The basic source of data on the EU's external and intra-EU trade of goods is Eurostat's COMEXT database. One difficulty with trade data is that it is organised on the basis of products rather than industries or economic activities. COMEXT, however, provides a "translation" through its Classification of Products by Activities (CPA 2008) nomenclature, which is consistent with the NACE classification used throughout this report.

The source of data for the external and intra-EU trade in services is Eurostat's balance of payment compiled on the basis of the extended balance of payment services classification (EBOPS 2010). The correspondence table between EBOPS 2010 and CPA 2008 is used for the calculation of exports and imports from IPR-intensive industries. When IPR-intensive and non-IPR-intensive industries are included in the same EBOPS item, the share of the former is estimated based on value added from SBS.

2.2 Data matching for patents, TMs and designs

In order to determine which industries are IPR intensive, the EUIPO and CPVO registers and the PATSTAT database were matched with the commercial database ORBIS, which contains industry classification and other information for more than 100 million European companies.⁴⁷ The first step in the data preparation process (name harmonisation) was carried out using an algorithm developed at KU Leuven (KUL) and further refined by the project team.⁴⁸ The second step, the actual matching of databases, was based on an original methodology developed by the project team. The companies in all databases were matched using name, legal form, postcode and other criteria, in order to overcome the inherent difficulties resulting from inconsistencies in spelling, abbreviations, etc. between the different databases.

The end result of this was a matched database containing data for more than 500 000 companies (ORBIS ids) with the number of EUTMs, RCDs, patents and CPVRs applied for by each company.

Following the matching, the data was filtered to include only those applications filed during the 2013–2017 period and registered/granted. Depending on the type of IPR, between 76% and 93% of IPRs were matched with the data on their owners.⁴⁹ There are various reasons why not all patent, EUTM, RCD or CPVR owners can be found:

- ORBIS does not contain data on private individuals (who may be owners of IPRs).
- Changes of name of applicants may not have been communicated to IP offices.
- There may be errors or gaps in the ORBIS data.
- There may be spelling differences that are not captured by the matching algorithms.

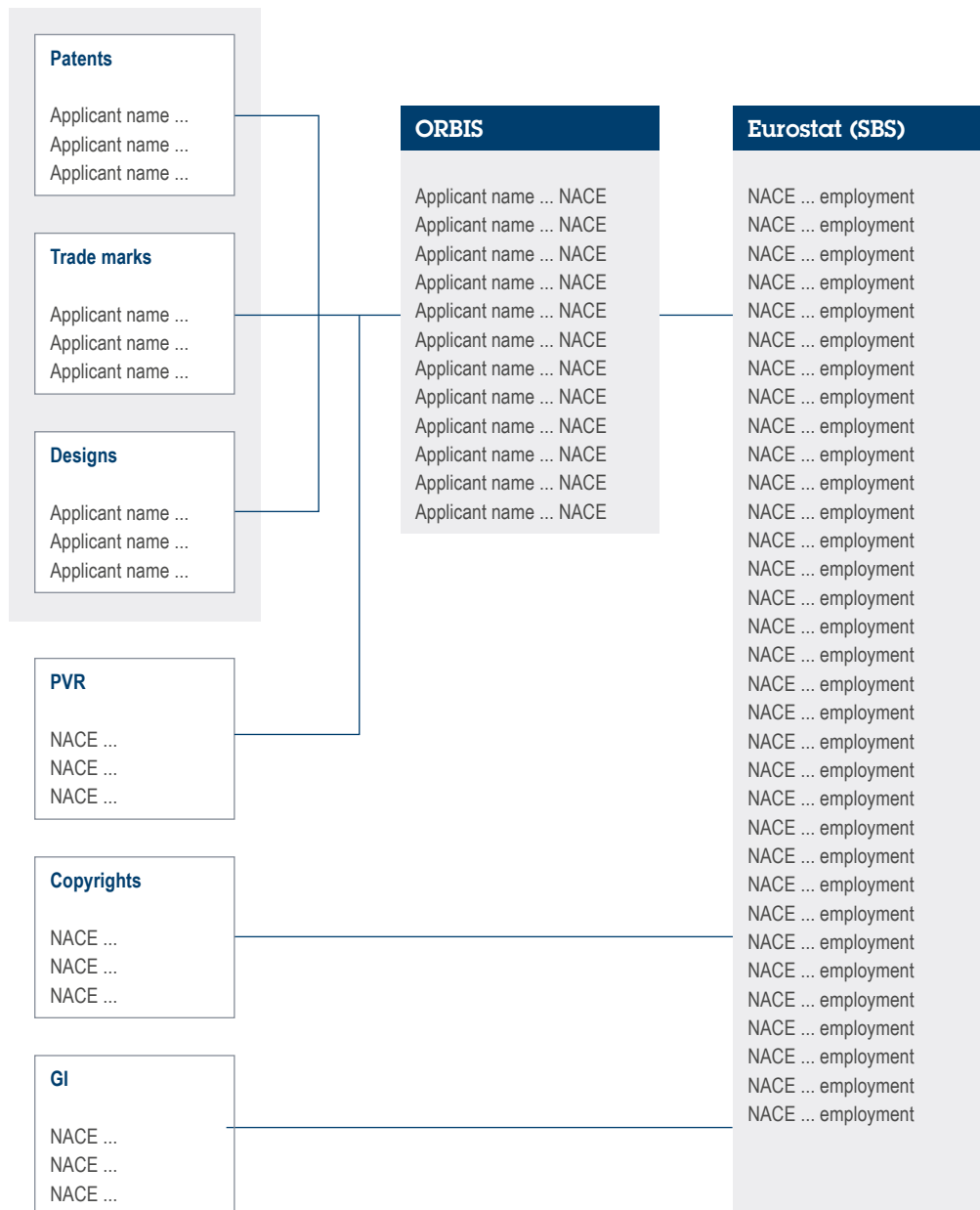
⁴⁷ bvdinfo.com/en-gb/our-products/data/international/orbis?qclid=Cj0KCQjwrs2XBhDjARIsAHVymTfOCRrrr_EcGZXtjJzkovmF4oRyG-8FrY9dBM4tq7X5vvy11ypl5saAsmKEALw_wcB consulted on 11/08/2022.

⁴⁸ For a detailed description of this step, see Appendix 8.

⁴⁹ The last known owner of the registered IPR was used for the matching. For example, for patents, the applicant mentioned on the publication of the grant was used. No subsequent transfers of rights were taken into account due to data availability. However, it can be assumed that most right transfers take place between entities active in the same industry and will therefore not have any major impact on the results of this study.

When combined with the industry classification (NACE) used by Eurostat, the data could be aggregated to show industries linked with those IPRs. This step is crucial in determining which industries are intensive in their use of TMs, designs, patents and PVRs.⁵⁰

Figure 3:
Simplified illustration of the data matching process



⁵⁰ Although ORBIS is the best available data source for extracting information on companies' industrial activity, IP management practices and the nature of a company's business activity can sometimes distort information on the industrial application of IPRs. That will be the case, for example, if a company operates in multiple industries and protects the IPRs relevant to each of those industries. In ORBIS, each company/branch can be associated with one principal industry only, so all its IPRs will be linked with the NACE code for that principal industry. Similarly, if a company operates in both manufacturing and wholesale trade but wholesale trade is indicated as its principal industry in ORBIS, its IPRs will count as related to wholesale trade although they may in fact relate to manufacturing only.

2.3 Identification of patent-intensive industries

This section explains how the patent-intensive industries were identified. Intensity was determined at EU level in two steps. First, the total number of patents protected under the EPC for each industry was calculated. This is known as **absolute patent intensity**. Second, for each industry, the total number of patents was divided by the number of persons employed in that industry at EU level, as reported by Eurostat in its SBS series. The result is the **relative patent intensity** of that industry. Finally, the overall employment-weighted average of relative patent intensities was calculated for all the industries that have patents. Those industries whose relative patent intensities were above this average value were considered to be patent intensive.

When calculating the absolute intensity for patents, TMs, designs and PVRs, two important issues had to be dealt with. The first was the head offices, i.e. the presence of general, non-specific industry codes in the ORBIS data: 64.20 *Activities of holding companies*, 70.10 *Activities of head offices* and 82.99 *Other business support services*. This phenomenon reflects the common business practice among large companies of concentrating IP portfolios at their head offices. In order to avoid distorting the absolute intensity calculations, a procedure was developed and applied in order to allocate those IPRs to *bona fide* industry codes. This procedure is described in Appendix 8.

Another data limitation also common to patents, TMs, designs and PVRs is the assignment in ORBIS of NACE codes at a higher level of aggregation than the four-digit level used in the analysis. As in the case with the head office issue, this problem was solved by re-allocating the IPRs within the division (two-digit level) or group (three-digit level).

2.3.1 Absolute patent intensity

- The starting point for the calculation of absolute patent intensities was the PATSTAT database (2021 autumn edition). The dataset was limited to published applications filed at the EPO between 1 January 2013 and 31 December 2017 by at least one applicant having its domicile in an EU Member State, yielding a total of 297 839 patent applications.
- The dataset was then filtered to include only applications that were ultimately successful, leaving only the applications granted between 2013 and 2021. That reduced the number of applications in the dataset to 166 358.
- Next, patent applications were merged with concordance tables linking patent applicants' data to company information in ORBIS. A match was found for 142 727 unique patent applications, i.e. 86% of all relevant applications.
- Where a patent had multiple owners of which one or more had their seat outside of the EU, the fraction of patents associated with third-country owners was discounted. The total sum of the patent fractions corresponding to the subset of patents matched with ORBIS data amounted to 139 644.
- For some companies, ORBIS provides no information on the NACE industry of their activity. In such cases, this information was inferred based on the concordance table between NACE and IPC classes built upon the matched dataset. Patent applicants were assigned a NACE class with the highest probability, given a particular IPC class composition within the company's patent portfolio.

2.3.2 Relative patent intensity

To calculate relative patent intensity, Eurostat employment data was matched with the data on absolute intensities. Relative patent intensity is defined as the total number of granted patents assigned to an industry divided by the total employment figure for that industry (in thousands), leading to an indicator of patent numbers per 1 000 employees. Patent-intensive industries are defined as those industries where the value of this indicator is higher than the employment-weighted mean of patents per 1 000 employees, which amounts to 0.951 patents per 1 000 employees. Although divisions for which only LFS employment data was available were not taken into consideration when calculating the weighted average, those industries were compared with the cut-off point to determine whether they met the definition of patent intensity. None of those industries proved to be patent intensive.

2.4 Identification of trade mark-intensive industries

2.4.1 Absolute TM intensity

- The starting point for the calculation of absolute TM intensities was the EUIPO TM register. The EUIPO dataset was limited to EUIPO TM applications filed between 1 January 2013 and 31 December 2017 with at least one applicant having its domicile in an EU Member State, yielding a total of 444 571 TM applications (1 300 355 NICE classes).
- The dataset was then filtered to include only applications that were ultimately successful, leaving only the applications that were granted between 2013 and 2022. That reduced the number of applications in the dataset to 387 917 (1 146 224 classes).
- Next, TM applications were merged with concordance tables linking TM applicants' data to company information in ORBIS. A match was found for 295 363 unique TM applications (872 674 classes), i.e. 76.14% of all relevant applications.
- Where a TM had multiple owners of which one or more had their seat outside of the EU, the fraction of the TM associated with third-country owners was discounted. The total sum of TM fractions corresponding to the subset of TMs matched with ORBIS data amounted to 294 269 (864 982 classes).
- For the subset of TM owners that were matched with ORBIS data but for which a NACE code was not available in ORBIS, the relevant information was inferred from patent data in cases where they had also filed for patent protection. In total, NACE codes were unavailable for 10 194 TM applications for which a match with ORBIS was found. For 783 applications, NACE could be inferred on the basis of patent applications associated with their owners. The other applications for which a NACE code was unavailable in ORBIS were discarded from further analysis. A total of 285 952 TM applications were considered for the analysis (836 338 classes assigned to fractions corresponding to EU owners).
- In order to assign proper industry codes to companies linked in ORBIS with head office status, NACE industry codes of companies linked with head offices within the same economic groups were used. For a given head office, the NACE codes were assigned proportionally to the number of companies representing various NACE industries within the head office economic group.
- For companies associated with head office codes for which ORBIS provided no information on group structure, if they filed for a patent, the NACE code was inferred from patent data based on the IPC classes structure in their patent portfolios.

- The remaining TMs associated initially with head offices' NACE codes were redistributed to other NACE codes in proportion to the distribution of valid NACE codes associated with head offices in the subset of data for which the assignment was possible, based on the two steps described above.
- Finally, for some companies, ORBIS assigns NACE codes at a higher level of aggregation than the four-digit level used in the analysis. This problem was solved by reallocating TMs linked with those companies to the lower level of NACE based on the distribution of TMs within the division or group resulting from the calculation performed on the subset of companies correctly associated with the lowest NACE industry level.

2.4.2 Relative TM intensity

To calculate relative TM intensity, Eurostat employment data was matched with the data on absolute intensities. Relative TM intensity is defined as the total number of granted TMs assigned to an industry, divided by the total employment figure for that industry (in thousands). TM-intensive industries are defined as those industries where the value of this indicator is higher than the employment-weighted mean of TMs per 1 000 employees, which amounts to 5.13 TMs per 1 000 employees.

Although divisions for which only LFS employment data was available were not taken into consideration while calculating the weighted average, those industries were compared with the cut-off point to determine whether they met the definition of TM intensity. The following industries, defined at division level and with employment data available only from LFS, turned out to be TM intensive: 66 *Activities auxiliary to financial services and insurance activities*, 92 *Gambling and betting activities* and 93 *Sports activities and amusement and recreation activities*.

2.5 Identification of design-intensive industries

The methodology for identifying design-intensive industries was very similar to that used for TMs described in section 2.4.

2.5.1 Absolute design intensity

- The starting point for the calculation of absolute design intensities was the EUIPO design register. The dataset was limited to RCD applications filed between 1 January 2013 and 31 December 2017 with at least one applicant having its domicile in an EU Member State, yielding a total of 326 450 design applications.
- The dataset was subsequently filtered to include only applications that were ultimately successful, leaving only the applications granted between 2013 and 2022. That reduced the number of applications in the dataset to 313 867.
- Next, design applications were merged with concordance tables linking design applicants' data to company information in ORBIS. A match was found for 255 611 unique design applications, i.e. 81.44% of the initial dataset.
- Where a design had multiple owners of which one or more have their seat outside of the EU, the fraction of designs associated with third-country owners was discounted. The total number of design fractions corresponding to the subset of designs matched with ORBIS data amounted to 249 731.

- For the subset of design owners that were matched with ORBIS data but for which no NACE code was available in ORBIS, the relevant information was inferred from patent data in cases where patent protection had also been applied for. In total, NACE codes were unavailable for 4 602 applications for which a match with ORBIS was found. For 988 RCD applications, NACE was inferred on the basis of patent data associated with their owners. The remaining 3 614 applications for which a NACE code was unavailable in ORBIS were discarded from further analysis, leaving a final sample of 251 997 design applications (246 179 design fractions corresponding to EU owners).
- In order to assign proper industry codes to companies linked in ORBIS with head office status, ORBIS information on the structure of an economic group of companies associated with head offices was used. For a given head office, NACE codes were assigned in proportion to the number of companies representing various NACE industries within the head office economic group. For those companies associated with head office codes for which ORBIS provided no information on group structure, if they had filed for patent protection, the NACE code was inferred from patent data based on the IPC classes structure within their patent portfolios. The remainder of the designs associated initially with head office NACE codes were redistributed to other NACE codes in proportion to the distribution of valid NACE codes associated with head offices in the subset of data for which the assignment was possible, based on the two steps described above.
- Finally, for some companies, ORBIS assigns NACE codes at a higher level of aggregation than the four-digit level used in the analysis. This problem was solved by reallocating design applications linked with those companies to the lower level of NACE based on the distribution of designs within the division or group resulting from the calculation performed on the subset of companies correctly associated with the lowest NACE industry level.

2.5.2 Relative design intensity

The methodology used to calculate relative intensity was the same as for patents and TMs.

To calculate relative design intensity, Eurostat employment data was matched with the data on absolute intensities. Relative design intensity is defined as a number of granted design rights assigned to an industry divided by the total employment figure for that industry (in thousands). Design-intensive industries are defined as those for which the value of this indicator exceeds the employment-weighted mean of design per 1 000 employees, which amounts to 1 655. Although divisions for which only LFS employment data was available were not taken into consideration when calculating the weighted average, those industries were compared with the cut-off point to determine whether they met the definition of design intensity. None of those industries proved to be design intensive.

2.6 Identification of copyright-intensive industries

IPR intensity (number of rights per 1 000 employees) cannot be calculated for copyright in the same way as for TMs, patents, design rights and PVRs, because copyright is not registered. Copyright registries do exist in some EU Member States, but their use is not mandatory and there is no EU-level registry. The approach taken to overcome this difficulty was to adapt a methodology developed

by WIPO and documented in its “*Guide on Surveying the Economic Contribution of the Copyright-based Industries*”, published in 2015.⁵¹

The WIPO guidelines group industries into four categories according to the degree to which their activity depends on copyright. These four categories are: core copyright industries, inter-dependent industries, partial copyright industries and non-dedicated support industries.

Core copyright industries, as defined by WIPO, include:

- press and literature
- music, theatrical productions, operas
- motion picture and video
- radio and television
- photography
- software and databases
- visual and graphic arts
- advertising services
- copyright collecting societies

Examples of inter-dependent industries include the manufacture, wholesale and retail of TV sets or musical instruments. Partial copyright industries include furniture, toys and games and museums, while non-dedicated support industries include, for example, general wholesale and transportation.

WIPO defines **core copyright industries** as “wholly engaged in creation, production and manufacturing, performance, broadcast, communication and exhibition, or distribution and sales of works and other protected subject-matter”. The underlying idea is that core copyright industries as a category would not exist or would be significantly different without copyright in works.

Inter-dependent copyright industries are industries that are engaged in the production, manufacture and sale of equipment whose function is wholly or primarily to facilitate the creation, production or use of works and other protected subject-matter.

Partial copyright industries are industries in which some activities are related to works and other protected subject-matter and may involve creation, production and manufacturing, performance, broadcasting, communication and exhibition or distribution and sales.

Non-dedicated support industries are those in which some activities are related to facilitating the broadcasting, communication, distribution or sales of works and other protected subject-matter, but whose activities have not been included in the core copyright industries.

To industries in these three groups, WIPO assigns factors that represent the proportion of the activity of each industry that can be attributed to copyright-intensive activities.

⁵¹ See wipo.int/publications/en/details.jsp?id=259. This methodology is referred to in the following as the “WIPO methodology”.

Non-dedicated support industries have been excluded from this study, as they all have a factor of 6%. Appendix 9 shows the complete list of copyright-intensive industries and the associated factors.

Therefore, the following industries identified by WIPO are included in this study:

- core copyright industries
- inter-dependent copyright industries
- partial copyright industries with factors above 20%

EU-level employment and GVA data for copyright-intensive industries was obtained from Eurostat's SBS dataset. However, for 12 industries SBS provides no data on either employment or value added. These industries include 85.52 *Cultural education*, 90.01 *Performing arts*, 90.02 *Support activities to performing arts*, 90.03 *Artistic creation*, 90.04 *Operation of arts facilities*, 91.01 *Library and recreation activities*, 91.02 *Museums activities*, 91.03 *Operation of historical sites and buildings and similar visitors attractions*, 93.21 *Activities of amusement parks and theme parks*, 93.29 *Other amusement and recreation activities*, 94.12 *Activities of professional membership organisations* and 94.99 *Activities of other membership organisations n.e.c.*

In order to include these activities in the study, data for those sectors was obtained from the national statistics offices of the Czech Republic, Denmark, France, Italy, Spain and Sweden. By comparing the employment and value added for the sectors in question in those six countries with total employment and value added in the relevant divisions in the EU, ratios were obtained which can reasonably be assumed to be representative of the EU as a whole. Those ratios were then used to impute EU-level employment and GVA data for those industries.

2.7 Identification of GI-intensive industries

The methodology for the identification of GI-intensive industries is similar to that used in previous studies, but updated information has been used, for the year 2017, for the sale of GI products.⁵²

GIs (geographical indications) have two important characteristics which had to be considered when devising the methodology:

- GIs are not owned by private parties; they are usually applied for by regional producer associations. This means that there are no comparable databases that could be used for matching right-holder information with economic information. In this respect, there is a certain similarity between GIs and copyright, for which the approach likewise entails applying a pre-defined set of industries (defined by WIPO in the case of copyright). The set of industries to be considered in the context of GIs is determined by the relevant EU regulations and sources of information provided by the regulator, in this case the European Commission (DG AGRI).
- The proportion of a given NACE class corresponding to GIs varies significantly from one Member State to another.⁵³ This means that the same industry can be GI intensive in one

⁵² Study on economic value of EU quality schemes, geographical indications (GIs) and traditional specialties guaranteed (TSGs). October 2019, AND-International and European Commission. Available at data.europa.eu/doi/10.2762/396490.

⁵³ For example, about 47% of German beer sales are protected by GIs, while virtually no Belgian beer manufacturer uses this IPR.

Member State but not in another. This is in contrast to the other IPRs included in this study, for which the intensity in any given industry is a function of the inherent characteristics of that industry; it can therefore be safely assumed that if a particular industry is, say, patent intensive in one country, it will also be patent intensive in others. This assumption cannot, however, be made for GIs, and GI-related employment and value added must be quantified on a country-by-country basis.

Furthermore, GI industries are often vertically integrated. For example, GI wine designation (by far the most important GI sector) is based on the grapes grown and processed in a particular area. This means that input-output tables are unsuitable for calculating indirect employment generated by GI industries. In fact, due to gaps in the statistics on agricultural employment, the contribution of GI-intensive industries to employment could not be calculated.

There were 3 153 registered GIs in the EU in 2017:

- 50.0% related to wines⁵⁴
- 41.6% related to agricultural products and foodstuffs⁵⁵
- 8.2% related to spirits⁵⁶
- 0.2% related to aromatised wines⁵⁷

Nearly 90% of GI products are produced in five EU Member States: France, Germany, Italy, Portugal and Spain. GIs are mainly a European phenomenon, although their use in countries outside the EU is increasing.

The GI-intensive industries were identified, and their value added subsequently calculated, on the basis of the DG AGRI study referred to above,⁵⁸ coupled with data from Eurostat and other sources, as described below.

The DG AGRI study calculates the volume and sales of GI products by product and Member State. For the EU as a whole, GI products account for 7.1% of all food and drink sales, with significant variation among Member States, as shown in Table 10.

In order to estimate the value added attributable to GIs in each Member State, a factor for each industry and Member State was calculated, showing the percentage of industry sales accounted for by GIs. Since the DG AGRI study does not include data on total sales by industry, turnover data from Eurostat was used to calculate this sales ratio. In other words, the factor by country and product was computed by dividing the **sales of GIs** from the DG AGRI report by the **turnover for total product (GI+non-GI)** from Eurostat SBS. This ratio was then applied to value added data from SBS in order to calculate the value added generated by GIs.⁵⁹

⁵⁴ Reg. (EC) No 1308/2013.

⁵⁵ Reg. (EC) No 1151/2012.

⁵⁶ Reg. (EC) No 110/2008.

⁵⁷ Reg. (EC) No 251/2014.

⁵⁸ See footnote 52.

⁵⁹ The underlying assumption is that the value added ratios between GI and non-GI products are the same as the ratio between GI and non-GI in sales. This may not be accurate, given that GI products usually command a price premium over non-GI products. On the other hand, GI products may also cost more to produce, which would, at least partially, offset this error.

Table 10:
GI sales by Member State, 2017

Country	Production value 2017 (€ million)	% of value from agro-food products	% of value from wine	% of value from spirits	GI % of food and drinks sector	GI % of trade (intra- + extra-EU)
FR	26 819	15%	72%	13%	14.9%	43%
IT	15 758	44%	55%	1%	11.8%	47%
DE	8 672	61%	37%	2%	5.1%	13%
ES	6 166	26%	72%	2%	6.4%	32%
PT	1 847	9%	91%	0%	11.8%	41%
NL	1 577	99%	1%	0%	2.1%	48%
GR	1 195	77%	17%	5%	8.4%	42%
IE	991	1%	0%	99%	4.2%	96%
CZ	937	83%	17%	0%	7.1%	26%
AT	935	21%	71%	8%	4.1%	23%
PL	433	25%	0%	75%	0.8%	38%
HU	397	20%	76%	5%	3.4%	24%
SE	226	22%	0%	78%	1.2%	76%
SI	218	12%	88%	0%	10.4%	6%
RO	218	0%	99%	1%	1.8%	5%
DK	133	100%	0%	0%	0.5%	72%
HR	124	5%	86%	9%	2.3%	10%
SK	94	15%	85%	1%	2.2%	1%
BG	83	12%	80%	8%	1.5%	35%
BE	57	49%	10%	41%	0.1%	16%
LU	49	20%	80%	0%	6.4%	31%
FI	29	99%	0%	1%	0.3%	19%
CY	22	2%	79%	19%	1.5%	7%
LT	20	32%	0%	68%	0.5%	5%
MT	13	0%	100%	0%	n/a	0%
EE	s*	s	s	s	s	s
LV	s	s	s	s	s	s
EU	67 017	33%	59%	8%	7.1%	39%

* Not published for reasons of confidentiality.

Source: DG AGRI (2019)

The most important GI industry – wine – required special treatment, because Eurostat does not publish SBS statistics for primary sectors such as agriculture. Therefore, data for value added for NACE 01.21 (*Growing of grapes*) had to be obtained from other sources. Production data was taken from another Eurostat data series: economic accounts for agriculture (EAA). Subsequently, the value added/turnover ratio for NACE 11.02 (*Manufacture of wine*) from SBS was applied to the sum of 01.21 and 11.02 production to arrive at an estimate of value added related to wine production.⁶⁰

⁶⁰ Here again, it is assumed that the turnover/production ratio for the wine industry is the same in economic accounts for agriculture (EAA) as in SBS.

2.7.1 Contribution of GIs to external trade

Exports

The DG AGRI study referred to above contains data on exports by country and by GI industry in 2017, based on DG AGRI's own data and COMEXT, Eurostat's reference database on external trade. This data is used in the presentation of results in chapter 3.

Imports

While exports of GI products from the EU to non-EU countries are easy to define, deciding what constitutes a "GI import" is more difficult. This is because, strictly speaking, the EU only recognises a limited number of GIs from outside the EU, the most significant of which are Scotch whisky from the UK, Napa Valley wine from California, Vale dos Vinhedos wine from Brazil, Darjeeling tea from India and Café de Colombia. However, in addition to the third-country GIs protected through direct application, the EU has international agreements with a number of countries that provide protection essentially equivalent to GIs.

Hence, "GI imports" are defined as imports from third countries of any wine, spirits, aromatised wine, agricultural products and foodstuffs which are protected in the EU either through direct application of a GI or under bilateral or multilateral international agreements.

The COMEXT database provides information on wine imports by country of origin, distinguishing wines with PDO (protected designation of origin) or PGI (protected geographical indication). Imports of other products from relevant countries (e.g. Scotch whisky from the UK, Tequila from Mexico, Pisco from Peru and Chile and GI cheese from Switzerland, among others) were added to the result to arrive at an overall estimate of GI imports into the EU.

2.8 Identification of PVR-intensive industries

For the identification of PVR-intensive industries, this study relies on register data from the Community Plant Variety Office (CPVO). A total of 8 351 PVR applications filed between 1 January 2013 and 31 December 2017 with at least one applicant domiciled in a EU Member State are currently in "registered" status.

- Further, the CPVR applications dataset was matched with concordance tables linking CPVR applicant data with information available in ORBIS. A match was found for 7 730 applications, i.e. 92.6% of all relevant CPVR applications.
- In total, NACE codes were unavailable for 198 applications for which a match with ORBIS was found. For 2 applications, NACE could be inferred on the basis of patent applications associated with their owners; the remaining 196 applications were discarded from the subsequent analysis. Ultimately, data of 7 534 CPVR applications were used for the analysis of the distribution of CPVRs among industries.
- In order to assign a proper industry code to companies linked in ORBIS with head office status, NACE industry codes of companies linked with head offices within the same economic

groups were used. For a given head office, the NACE codes were assigned proportionally to the number of companies representing various NACE industries within the head office economic group. The remaining CPVRs associated initially with head offices' NACE codes were redistributed to other NACE codes proportionally to the distribution of valid NACE codes associated with head offices in the subset of data for which the assignment was possible based on the procedure described above.

- Finally, for some companies ORBIS assigns NACE codes at a higher level of aggregation than the four-digit level used in the analysis. This problem was solved by reallocating CPVR applications linked with those companies to the lower level of NACE based on the distribution of PVRs within the division or group resulting from the calculation performed on the subset of companies correctly associated with the lowest NACE industry level.

Table 11 shows the industries with the greatest number of filings during the 2013–2017 period, along with the number of countries from which the filings in each NACE code originated.

Table 11:
Top filing industries at the CPVO, 2013–2017

NACE code	NACE description	Filings	Countries
01.30	Plant propagation	923	10
01.19	Growing of other non-perennial crops	905	8
46.21	Wholesale of grain, unmanufactured tobacco, seeds and animal feeds	830	9
01.11	Growing of cereals (except rice), leguminous crops and oil seeds	788	10
72.19	Other research and experimental development on natural sciences and engineering	657	14
01.64	Seed processing for propagation	584	6
01.13	Growing of vegetables and melons, roots and tubers	554	10
46.22	Wholesale of flowers and plants	458	7
72.11	Research and experimental development on biotechnology	432	7
77.40	Leasing of intellectual property and similar products, except copyrighted works	291	5

As can be seen in Table 11, agricultural and horticultural sectors are the main users of the CPVO registration system. However, the employment data available for those sectors from Eurostat is not sufficiently detailed. It is available at division level (two-digit NACE) only and LFS is the source of employment data. In order to determine which sector of agriculture is the most PVR-intensive, data from the CPVO register was classified into groups of species corresponding to the Eurostat economic accounts for agriculture (EAA) statistics. EEA contains detailed data on the value of output measured in basic prices. Table 12 contains detailed information on the intensity of registration of CPVRs by crop types.

This analysis confirms that horticulture, comprising flowers and ornamental plants, vegetables and nurseries, is the main user of the CPVR system in the EU.

Table 12:
Intensity of CPVR applications by crop type

Eurostat output code	Species name	Number of registered applications	Share in total applications	Production value at basic price (€ million)	Applications per €10 million in production value
04220	Ornamental plants and flowers (including Christmas trees)	3 086	38.5%	8 523	3.62
04190	Other fresh vegetables	1 189	14.8%	24 459	0.49
01500	Grain maize	880	11.0%	10 600	0.83
01100	Wheat and spelt	436	5.4%	24 890	0.18
04120	Tomatoes	337	4.2%	6 770	0.50
02200	Protein crops (including seeds)	308	3.8%	1 279	2.41
05000	Potatoes (including seeds)	255	3.2%	11 524	0.22
02110	Rape and turnip rape seed	213	2.7%	7 738	0.28
06190	Other fresh fruit	198	2.5%	8 657	0.23
01300	Barley	170	2.1%	8 942	0.19
02120	Sunflower	155	1.9%	3 061	0.51
06130	Peaches	151	1.9%	1 575	0.96
01200	Rye and meslin	143	1.8%	1 044	1.37
01900	Other cereals	64	0.8%	1 978	0.32
06110	Dessert apples	61	0.8%	4 259	0.14
01600	Rice	53	0.7%	739	0.72
02900	Other industrial crops	51	0.6%	4 034	0.13
01400	Oats and summer cereal mixtures	49	0.6%	1 406	0.35
03000	Forage plants	41	0.5%	23 735	0.02
06400	Grapes	38	0.5%	2 958	0.13

For the remainder of the NACE industries for which information was available at class level (four digits), the standard procedure involving calculation of employment-weighted average of CPVRs per 1 000 employees was used to determine their CPVR intensity.

CPVR-intensive industries are defined as those having a CPVRs per 1 000 employees value higher than the employment-weighted mean of CPVRs per 1 000 employees, which amounts to 0.16 CPVRs per 1 000 employees.

2.9 Limitations of data and methodology

Due to the size of the dataset, data limitations and the scope of analysis, the method of selecting IPR-intensive industries was necessarily based on a number of simplifying assumptions.

IPR-intensive industries were identified at EU level. This method may conceal important heterogeneities between countries regarding innovation level, propensity to register IPRs at European level and national industry structures.

To qualify as IPR intensive, an industry has to intensively use at least one of the IPRs covered in the present study. However the protected subject-matter, legal strength and other aspects differ across different IPRs. Therefore, IPR intensity has a different meaning for different IPRs.

The method of determining the IPR intensity of industries does not take into account the fact that the distribution of the economic value of individual IPRs is highly skewed. All the IPRs applied for are simply aggregated by industry and their individual values are not evaluated. As a result, some industries with few IPRs, which may nevertheless be very valuable for the operation of those industries, may not be regarded as IPR intensive. In addition, due to the specificity of the protected subject-matter, some industries may prefer other forms of IP protection which are not included in the present study, such as trade secrets.

Future research, taking into account national IPRs, national patterns of IPR intensity of industries or other, richer datasets including non-registered IPRs, may lead to different conclusions as regards the set of IPR-intensive industries and their importance in the economies of the EU and the four non-EU countries included in this study.

Despite these caveats, this report offers a thorough and systematic analysis of the differences between industries making intensive use of IPRs and those in which IPRs play a less important role.

3. IPR-intensive industries at EU level

This chapter presents the main results of the analysis described in chapter 2: the identification of IPR-intensive industries at EU level, separately for each of the six IPRs considered in this study, and in terms of overall IPR intensity, i.e. taking the simultaneous use of more than one IPR into account.⁶¹

3.1 Patent-intensive industries

Out of 615 NACE classes, 477 industries in the matched database filed successful patent applications during the 2013–2017 period. Of those industries, 150 are patent-intensive.

Table 13 shows the 20 most patent-intensive industries. The full list of patent-intensive industries is shown in Appendix 8.2.

Table 13:
The 20 most patent-intensive industries*

NACE code	NACE description	Patents per 1 000 employees
77.40	Leasing of intellectual property and similar products, except copyrighted works	107.92
26.30	Manufacture of communication equipment	41.94
72.11	Research and experimental development on biotechnology	27.65
23.11	Manufacture of flat glass	20.61
28.91	Manufacture of machinery for metallurgy	18.55
28.11	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines	15.86
72.19	Other research and experimental development on natural sciences and engineering	15.54
26.11	Manufacture of electronic components	15.47
27.51	Manufacture of electric domestic appliances	15.37
20.11	Manufacture of industrial gases	14.60
28.23	Manufacture of office machinery and equipment (except computers and peripheral equipment)	14.36
30.99	Manufacture of other transport equipment n.e.c.	13.19

61 The industries identified as TM intensive in this report accounted for 73% of the European Union Trade Marks (EUTMs), the design-intensive industries for 78% of the Registered Community designs (RCDs), the patent-intensive industries for 84% of the European patents and the PVR-intensive industries for 91% of the Community Plant Variety Rights registered during the period covered.

NACE code	NACE description	Patents per 1 000 employees
22.11	Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber tyres	12.88
26.60	Manufacture of irradiation, electromedical and electrotherapeutic equipment	12.63
26.70	Manufacture of optical instruments and photographic equipment	12.10
23.43	Manufacture of ceramic insulators and insulating fittings	11.30
28.95	Manufacture of machinery for paper and paperboard production	11.29
28.30	Manufacture of agricultural and forestry machinery	11.01
24.34	Cold drawing of wire	10.81
28.94	Manufacture of machinery for textile, apparel and leather production	10.41

*Based on patent applications filed in 2013–2017 and granted.

The list of patent-intensive industries is dominated by manufacturing activities (often referred to as the secondary sector), accounting for 17 of the top 20 industries. There are three service industries (tertiary sector) on the list, including two research-related industries and industry 77.40,⁶² which covers activities such as licensing and managing IP portfolios.

3.2 TM-intensive industries

Companies representing 511 industries in the matched database filed successful TM applications during the 2013–2017 period. Of those industries, 275 are TM intensive.

Table 14 shows the 20 most TM-intensive industries. The full list of TM-intensive industries is shown in Appendix 8.3.

Table 14:
The 20 most TM-intensive industries*

NACE code	NACE description	TMs per 1 000 employees
77.40	Leasing of intellectual property and similar products, except copyrighted works	512.41
11.04	Manufacture of other non-distilled fermented beverages	90.10
58.21	Publishing of computer games	74.67
17.24	Manufacture of wallpaper	73.92
10.86	Manufacture of homogenised food preparations and dietetic food	65.33

62 Official Eurostat definition of class 77.40: This class includes the activities of allowing others to use intellectual property products and similar products for which a royalty payment or licensing fee is paid to the owner of the product (i.e. the asset holder). The leasing of these products can take various forms, such as permission for reproduction, use in subsequent processes or products, operating businesses under a franchise, etc. The current owners may or may not have created these products. This class includes:

- leasing of intellectual property products (except copyrighted works, such as books or software)
- receiving royalties or licensing fees for the use of: patented entities, trade marks or service marks, brand names, mineral exploration and evaluation, and franchise agreements.

Qualitative analysis of the companies associated with NACE industry 77.40 showed that this industry is very heterogenous. It comprises, *inter alia*, special entities within larger economic groups responsible for managing their IP portfolios, the technology transfer offices of educational institutions, facilitators of innovation development and commercialisation, small entities set up to commercialise one innovation or, to a lesser extent, independent companies active in the area of valuation and management of IP assets.

The group of companies associated with this class includes both stand-alone companies without any economic links to other companies and branches whose main activity consists of managing the IP portfolios of their parent companies.

NACE code	NACE description	TMs per 1 000 employees
72.11	Research and experimental development on biotechnology	51.36
26.80	Manufacture of magnetic and optical media	48.53
30.99	Manufacture of other transport equipment n.e.c.	46.02
11.01	Distilling, rectifying and blending of spirits	45.79
20.42	Manufacture of perfumes and toilet preparations	42.95
11.02	Manufacture of wine from grape	42.78
21.10	Manufacture of basic pharmaceutical products	42.53
32.40	Manufacture of games and toys	40.68
32.30	Manufacture of sports goods	39.84
26.52	Manufacture of watches and clocks	37.16
32.99	Other manufacturing n.e.c.	36.07
63.12	Web portals	36.00
59.20	Sound recording and music publishing activities	35.73
23.43	Manufacture of ceramic insulators and insulating fittings	34.71
10.89	Manufacture of other food products n.e.c.	33.16

*Based on trade mark applications filed in 2013–2017 and granted.

As is the case for patents, manufacturing (or secondary) industries are prominent in the top 20 list for TMs, occupying 15 of the 20 spots. The remaining 5 industries on the list belong to the service sector (tertiary industries).

3.3 Design-intensive industries

Companies representing 487 industries in the matched database filed successful design applications during the 2013–2017 period. Of those industries, 177 were found to be design intensive.

Table 15 shows the 20 most design-intensive industries. The full list of design-intensive industries is shown in Appendix 8.4.

Table 15:
The 20 most design-intensive industries*

NACE code	NACE description	Designs per 1 000 employees
77.40	Leasing of intellectual property and similar products, except copyrighted works	128.00
27.40	Manufacture of electric lighting equipment	47.21
25.71	Manufacture of cutlery	46.30
46.47	Wholesale of furniture, carpets and lighting equipment	39.81
14.39	Manufacture of other knitted and crocheted apparel	35.37
46.15	Agents involved in the sale of furniture, household goods, hardware and ironmongery	33.70
46.48	Wholesale of watches and jewellery	33.60
27.51	Manufacture of electric domestic appliances	27.80

NACE code	NACE description	Designs per 1 000 employees
30.99	Manufacture of other transport equipment n.e.c.	24.25
17.24	Manufacture of wallpaper	23.91
28.14	Manufacture of other taps and valves	21.71
32.99	Other manufacturing n.e.c.	21.20
32.40	Manufacture of games and toys	21.12
14.14	Manufacture of underwear	20.77
23.42	Manufacture of ceramic sanitary fixtures	20.28
15.20	Manufacture of footwear	19.70
32.30	Manufacture of sports goods	19.48
32.12	Manufacture of jewellery and related articles	19.23
32.91	Manufacture of brooms and brushes	18.13
26.52	Manufacture of watches and clocks	18.01

*Based on design registrations filed in 2013–2017 and granted.

Design-intensive industries, too, are mostly found in the manufacturing (secondary) sector of the economy, occupying 16 of the top 20 spots in that sector. The remaining four spots are taken up by service industries, including 3 wholesale/distribution industries. As is the case for patents and TMs, sector 77.40 is also one of the most design-intensive industries.

3.4 Copyright-intensive industries

Tables 16 and 17 list the copyright-intensive industries included in this study, identified as described in section 2.6 above. The “type” column indicates whether the industry is core, inter-dependent or partial copyright intensive according to the WIPO classification. For inter-dependent and partial copyright industries, the “factor” column shows the percentage of each sector’s activity considered to be related to copyright.

Table 16:
List of core copyright industries

NACE code	NACE description
18.11	Printing of newspapers
18.12	Other printing
18.13	Pre-press and pre-media services
18.14	Binding and related services
18.20	Reproduction of recorded media
47.61	Retail sale of books in specialised stores
47.62	Retail sale of newspapers and stationery in specialised stores
47.63	Retail sale of music and video recordings in specialised stores
58.11	Book publishing
58.13	Publishing of newspapers
58.14	Publishing of journals and periodicals
58.19	Other publishing activities

NACE code	NACE description
58.21	Publishing of computer games
58.29	Other software publishing
59.11	Motion picture, video and television programme production activities
59.12	Motion picture, video and television programme post-production activities
59.13	Motion picture, video and television programme distribution activities
59.14	Motion picture projection activities
59.20	Sound recording and music publishing activities
60.10	Radio broadcasting
60.20	Television programming and broadcasting activities
61.10	Wired telecommunications activities
61.20	Wireless telecommunications activities
61.30	Satellite telecommunications activities
61.90	Other telecommunications activities
62.01	Computer programming activities
62.02	Computer consultancy activities
62.03	Computer facilities management activities
62.09	Other information technology and computer service activities
63.11	Data processing, hosting and related activities
63.12	Web portals
63.91	News agency activities
63.99	Other information service activities n.e.c.
73.11	Advertising agencies
73.12	Media representation
74.10	Specialised design activities
74.20	Photographic activities
74.30	Translation and interpretation activities
79.90	Other reservation service and related activities
82.19	Photocopying, document preparation and other specialised office support activities
85.52	Cultural education
90.01	Performing arts
90.02	Support activities to performing arts
90.03	Artistic creation
90.04	Operation of arts facilities
91.01	Library and archives activities
93.21	Activities of amusement parks and theme parks
93.29	Other amusement and recreation activities
94.12	Activities of professional membership organisations

Table 17:
Inter-dependent and partial copyright industries

NACE code	NACE description	Type	Factor
17.11	Manufacture of pulp	Inter-dependent	25.0%
17.12	Manufacture of paper and paperboard	Inter-dependent	25.0%
20.59	Manufacture of other chemical products n.e.c.	Inter-dependent	25.0%
26.20	Manufacture of computers and peripheral equipment	Inter-dependent	30.0%
26.30	Manufacture of communication equipment	Inter-dependent	30.0%
26.40	Manufacture of consumer electronics	Inter-dependent	30.0%
26.70	Manufacture of optical instruments and photographic equipment	Inter-dependent	30.0%
27.31	Manufacture of fibre optic cables	Inter-dependent	30.0%
28.23	Manufacture of office machinery and equipment (except computers and peripheral equipment)	Inter-dependent	30.0%
32.20	Manufacture of musical instruments	Inter-dependent	35.0%
46.43	Wholesale of electrical household appliances	Inter-dependent	19.0%
46.51	Wholesale of computers, computer peripheral equipment and software	Inter-dependent	30.0%
46.52	Wholesale of electronic and telecommunications equipment and parts	Inter-dependent	25.0%
46.66	Wholesale of other office machinery and equipment	Inter-dependent	30.0%
46.76	Wholesale of other intermediate products	Inter-dependent	25.0%
47.41	Retail sale of computers, peripheral units and software in specialised stores	Inter-dependent	33.3%
47.43	Retail sale of audio and video equipment in specialised stores	Inter-dependent	33.3%
47.78	Other retail sale of new goods in specialised stores	Inter-dependent	33.3%
77.22	Renting of video tapes and disks	Inter-dependent	20.0%
77.29	Renting and leasing of other personal and household goods	Inter-dependent	20.0%
77.33	Renting and leasing of office machinery and equipment (including computers)	Inter-dependent	35.0%
77.39	Renting and leasing of other machinery, equipment and tangible goods n.e.c.	Inter-dependent	20.0%
32.11	Striking of coins	Partial	33.5%
32.12	Manufacture of jewellery and related articles	Partial	33.5%
32.40	Manufacture of games and toys	Partial	41.0%
91.02	Museums activities	Partial	46.0%
91.03	Operation of historical sites and buildings and similar visitor attractions	Partial	50.0%
94.99	Activities of other membership organisation n.e.c.	Partial	50.0%

3.5 GI-intensive industries

The methodology used to identify the GI-intensive industries was to some extent analogous to the WIPO methodology used to identify copyright-intensive sectors. The data from DG AGRI showed that the core GI-intensive industries are those set out in Table 18.

Table 18:
Core GI-intensive industries

NACE code	NACE description
10.51	Operation of dairies and cheese making
11.01	Distilling, rectifying and blending of spirits
11.02	Manufacture of wine from grape (including part of 01.21 <i>Growing of grapes</i>)
11.05	Manufacture of beer

Analogously to the industries considered copyright intensive, the above industries are responsible for the *production* of GI goods, but not for wholesale or retail distribution. All four GI-intensive industries belong to the manufacturing (secondary) sector. Part of the primary sector 01.21 is also included.

3.6 PVR-intensive industries

Companies representing 41 different industries filed successful CPVR applications between 2013 and 2017. Of those industries, 11 are CPVR intensive.

The final list of PVR-intensive industries identified as described in section 2.8 is shown in Table 19.

Table 19:
PVR-intensive industries*

NACE code	NACE description	PVRs per 1 000 employees
77.40	Leasing of intellectual property and similar products, except copyrighted works	10.76
46.22	Wholesale of flowers and plants	5.86
72.11	Research and experimental development on biotechnology	5.31
46.21	Wholesale of grain, unmanufactured tobacco, seeds and animal feeds	3.84
72.19	Other research and experimental development on natural sciences and engineering	1.27
46.11	Agents involved in the sale of agricultural raw materials, live animals, textile raw materials and semi-finished goods	1.16
01.00 (p)	Horticulture	0.53
77.31	Renting and leasing of agricultural machinery and equipment	0.41
10.61	Manufacture of grain mill products	0.24
20.53	Manufacture of essential oils	0.22
13.10	Preparation and spinning of textile fibres	0.17

* Based on CPVR registrations filed in 2013–2017 and granted.

3.7 All IPR-intensive industries

The results show that many industries are intensive in more than one of the IPRs analysed. For example, industry 23.43 *Manufacture of ceramic insulators and insulating fittings* is an intensive user of both TMs and patents. Some industries, for example 30.99 *Manufacture of other transport equipment n.e.c.*, intensively use TMs, designs and patents. Most of the copyright-intensive industries are also TM intensive, and all four GI-intensive industries are TM intensive as well. Appendix 7 summarises the preceding sections by listing all 357 IPR-intensive industries and, for each of them, specifying the IPRs used intensively. The overlaps are shown in Table 20.

Table 20:
Overlapping use of IPRs

IPR	Number of industries intensive in each IPR combination
TM	58
PAT	23
DES	16
CR	29
PVR	2
TM and PVR	3
TM, PAT and CR	2
TM and PAT	32
TM and GI	1
TM, PAT, DES and PVR	3
TM, PAT, DES and CR	9
TM, PAT and DES	69
TM, DES and PVR	3
TM, DES and GI	3
TM, DES and CR	9
TM and DES	53
TM and CR	30
PAT and DES	12

TMs are used intensively by most of the industries (275 out of 357). Patents tend to be used more intensively in the manufacturing sector. A total of 69 industries are intensive in patents, TMs and designs. Other significant overlaps are between TMs and designs (53 industries), TMs and patents (32 industries) and TMs and copyright (30 industries).

Conversely, some industries use only one of the analysed IPRs intensively. Thus, 58 industries are TM intensive only, 23 patent intensive only, 16 design intensive only and 29 copyright intensive only. Two industries are exclusively PVR intensive.

It is worthwhile examining more closely the industries that are intensive in just one of the IPRs considered, since such industries can be considered to reflect the contribution of that particular IPR as opposed to IPRs in general. The 58 industries that are exclusively TM intensive do not differ significantly from the larger group of 217 TM-intensive industries that also use another IPR intensively.

The 23 industries that are exclusively patent intensive are concentrated in manufacturing, energy and technical services. Examples of such industries include 24.52 *Casting of steel* and 71.12 *Engineering activities and related technical consultancy*. What these industries have in common is that many of them sell their products and services to other industries, not to end consumers. Branding and thus TMs seem to be less important in business-to-business than in business-to-consumer commerce.

The 16 exclusively design-intensive industries are concentrated in manufacturing, such as 31.02 *Manufacture of kitchen furniture*. There are also some trade sectors in this group, for example 47.59 *Retail sale of furniture*. As a group, these industries market their products and services to both businesses and consumers.

The 29 industries that are exclusively copyright intensive are in the service sector, with the exception of two manufacturing industries. Twenty-one of these industries are core copyright industries.

To prevent double counting, the fact that some IPR-intensive industries use multiple rights intensively was taken into account when quantifying their employment and value added contributions in chapter 4.

4. Contribution of IPR-intensive industries to the EU economy

4.1 Contribution to employment, GDP and trade at EU level

The preceding chapter explained how the industries that use IPRs intensively were identified. In order to calculate the contributions of those industries in terms of employment, GDP and external trade to the economy of the EU as a whole and the economies of the individual Member States, the list of IPR-intensive industries was combined with data from Eurostat and, where necessary, other EU or national sources.⁶³

4.1.1 Employment

In total, on average approximately 207 million people were employed within the EU27 during the 2017–2019 period.⁶⁴ A significant proportion of these jobs, almost 50 million, are in NACE divisions O–Q (public administration, defence, education, human health and social work activities), concerning services which are mostly provided in the public sector.⁶⁵

Table 21 shows the share of IPR-intensive industries in EU employment for each of the six IPRs.

⁶³ In particular, as discussed in sections 5.7 and 5.8, in the case of GIs, extensive use was made of information from agricultural statistics published by DG AGRI, and in the case of PVRs, data provided by the CPVO. In addition, in the case of copyright, Eurostat data was supplemented with data from several national statistical offices.

⁶⁴ The definition of “employment” used by Eurostat and other statistical agencies is as follows: Employed persons are persons aged 15 and over (with some country-specific exceptions) who, during the reference week, performed work, even for just one hour a week, for pay, profit or family gain, or who were not at work but had a job or business from which they were temporarily absent because of illness, holidays, industrial dispute or education and training.

⁶⁵ If such non-market-based activities were excluded from the calculation, the share in employment and GDP would be significantly higher than shown in this report. However, it was considered more appropriate to err on the side of caution and base the calculations on total employment and GDP.

Table 21:
Direct and indirect contribution of IPR-intensive industries to
employment, 2017–2019 average

IPR-intensive industries	Employment (direct)	Share in total 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 shares of the individual IPRs exceeds the total share of IPR-intensive industries.

Thus, **IPR-intensive industries account for more than 61 million jobs, or 29.7% of total employment, in the EU.** More than 21% of those jobs are in TM-intensive industries, 13% in design-intensive industries, 11% in patent-intensive industries and 6% in copyright-intensive industries, with lower percentages for PVR-intensive and GI-intensive industries.

As noted above, many industries are IPR intensive in respect of more than one IPR. To avoid double counting, therefore, total employment in all IPR-intensive industries is less than the sum of the individual employment figures for each IPR. In other words, for the purpose of calculating employment in all IPR-intensive industries, each industry was counted only once, even if it used more than one IPR intensively.

4.1.2 Indirect employment

Besides the direct employment shown above, IPR-intensive industries generate employment in non-IPR-intensive industries which supply them with goods and services as inputs. The EU-level input-output tables published by Eurostat were used to calculate this indirect effect on employment in non-IPR-intensive industries. These tables provide information on 65 industries at division level (NACE two-digit level).⁶⁶

In order to calculate indirect employment, the IPR-intensive industries were aggregated to the 65 divisions provided by the input-output framework. Some of these 65 divisions are completely intensive if all the four-digit level industries (classes) comprising the division are IPR intensive. For instance, all 16 classes included in the division *Basic pharmaceutical products and pharmaceutical preparations* are considered TM intensive and all six classes of the division *Rubber and plastic products* are patent intensive. However, other divisions are only partially IPR intensive because they contain both IPR-intensive and non-IPR-intensive industries. For such partially IPR-intensive divisions, informa-

⁶⁶ The information provided includes supply and use tables and symmetric input-output tables (domestic and total). In this context, "domestic" refers to intra-EU supply relationships.

tion was available on total employment in the division and the share of employment accounted for by the IPR-intensive industries within the division. Accordingly, an “intensity coefficient” was calculated for each division in the input-output tables, corresponding to the share of employment in the IPR-intensive industries within each division. These coefficients were then used to adjust the level of employment in the upstream industries in the input-output framework to ensure that indirect employment really corresponded to demand stemming from IPR-intensive industries. For example, if division A is 40% IPR intensive, then 40% of its purchases from division B are also considered to be IPR intensive, and therefore 40% of the portion of employment in division B which supports division B’s sales to division A is considered to be indirectly supported by IPR-intensive division A.

Employment data was obtained from the national accounts published by Eurostat.⁶⁷ For each IPR (except GI, for which employment figures could not be calculated), the indirect employment effect in non-IPR-intensive industries only was calculated in order to avoid double counting of employment in IPR-intensive industries.

The analysis shows that, in addition to the 61.5 million jobs in the IPR-intensive industries themselves, another 20 million jobs in the EU economy are generated in non-IPR-intensive industries that supply goods and services to them. If those additional jobs are taken into account, then 81.6 million jobs, or 39.4% of all jobs in the EU, are directly or indirectly associated with IPR-intensive industries.

4.1.3 GDP

Gross domestic product (GDP) is the total value of the goods and services produced in a given territory during a given time period. It is the most common measure of economic activity. GDP is calculated in the national accounts of a country (or the EU) by adding up the value added produced in each industry, including product-specific taxes and excluding product-specific subsidies. The value added equals the industry’s sales minus its purchases of goods and services from other industries. When these quantities are added up across the entire economy, the inter-industry purchases cancel each other out and what is left is the overall value added, or GDP, for the economy. Total average annual EU GDP was approximately €13.5 trillion in the 2017–2019 period.

The starting point for estimating the share of IPR-intensive industries in GDP was the value added figures for each industry at four-digit level in Eurostat’s SBS, on the one hand, and the overall GDP figure from the national accounts, on the other. However, before the sectoral figures could be compared with the overall economy-wide figure, they had to be adjusted in order to ensure that the numerators in the calculations of the weight of IPR-intensive industries in the economy were consistent with the denominator, i.e. overall GDP.

The industry-level value added in SBS is defined at factor cost, which excludes taxes linked to production. On the other hand, GDP is the sum of gross value added (GVA) at basic prices in all industries of the economy plus taxes less subsidies on production. The difference between factor cost and basic prices is that the latter (for each industry) include other taxes less subsidies on production.

⁶⁷ For the purposes of calculating the indirect employment requirements of IPR-intensive industries, the Leontief matrix was calculated on the basis of domestic symmetric input-output tables to ensure that only employment generated within the EU was included.

Therefore, in order to obtain a homogeneous ratio based on GDP, the figures from SBS had to be converted so as to be consistent with the GDP definition. Otherwise, the ratios of sectoral GDP to total GDP would be understated because the nominator and denominator would not be defined in the same way.

In order to achieve consistency, the SBS data was adjusted as follows. First, a factor was applied to the value added obtained from SBS for each IPR-intensive industry. This factor was calculated for each of the 65 industries (divisions) in national accounts as the ratio between value added at factor cost in SBS and GVA at basic prices in national accounts for each industry. All classes within each division were divided by the same factor.

Second, the ratio between GDP and GVA for the whole economy was applied to each adjusted value added figure from the first step.

The resulting adjusted industry-level value added figures are compatible with GDP. The contribution of IPR-intensive industries to the EU economy is shown in Table 22.⁶⁸ More than 47% of total economic output in the EU is generated in IPR-intensive industries. TM-intensive industries contribute 38.5% of GDP, while design-intensive and patent-intensive industries contribute 15.5% and 17.4% respectively, with smaller contributions from copyright-intensive (6.9%), PVR-intensive and GI-intensive industries. As for the employment calculation described in the preceding section, for the purpose of calculating the total contribution of IPR-intensive industries to GDP, each industry was counted only once, even if it used more than one IP right intensively.

Table 22:
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 of IPR-intensive industries.

It is notable that the share of IPR-intensive industries in GDP is significantly higher than in employment, most likely reflecting the higher value added associated with their output. This difference is particularly pronounced in the case of TM-intensive industries, which account for 21% of employment but 38.5% of GDP, but the pattern is similar for designs, patents, copyright and PVRs. As will be seen in section 4.1.5, it is also reflected in the wages paid to workers in IPR-intensive industries.

⁶⁸ As in the case of employment, the value added/GDP figures are averages for the period 2017–2019.

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.⁶⁹ In Table 23, 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 23:
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 second column contains the results reported in the 2013 study for the 2008–2010 period. The third column shows the results from the 2016 study, covering the 2011–2013 period. The fourth column shows the results of the 2019 study (covering 2014–2016) and the last column shows the results for the present study (2017–2019). All results from the earlier studies have been recalculated for the EU27 using the current definition of IPR-intensive industries, so the results are comparable across the four columns.

Thus, the contribution of IPR-intensive industries increased throughout the decade from 2008 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.

4.1.4 Trade

The third major economic variable to which IPR-intensive industries contribute is the EU's external trade. Indeed, the vast majority of both EU imports and exports are IPR intensive.

Table 24 summarises trade in IPR-intensive industries, based on data from 2017–2019. As in the case of the employment and GDP figures, the trade figures for the six IPRs add up to more than the overall figure for IPR-intensive industries because many industries are intensive in more than one IPR.

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

⁶⁹ While the net change in the number of IPR-intensive industries is small, behind it there are more substantial gross changes, as explained in chapter 2, footnote 38.

IPR intensive,⁷⁰ while many non-IPR-intensive activities are also non-tradable, for example services that are consumed when and where they are produced.⁷¹ For that reason, 93% of EU goods imports consist of products of IPR-intensive industries. 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.

Table 24:
EU external trade in IPR-intensive industries, 2017–2019

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
IPR-intensive share	80.1%	80.5%	

*Goods only

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

The EU as a whole had an overall annual trade surplus in 2017–2019 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.

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's single market.

IPR-intensive industries are a major driver of trade between EU Member States, generating a total of intra-EU trade that exceeds the total of their extra-EU exports. Taking both goods and services 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. In comparison, the impact of these industries on intra-EU trade in services is more limited

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

71 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.

but still significant, accounting for 36% of total intra-EU exports of services, generated mainly by TM-intensive industries (32%).

Table 25:
Intra-EU trade in IPR-intensive industries, 2017–2019 average

IPR-intensive industries	Intra-EU trade (€ million)	As a share of 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%

4.1.5 Wages

As noted above, 47% of GDP (value added) in the economy and 29.7% of employment is generated in IPR-intensive industries. This implies that value added *per employee* is higher in IPR-intensive industries than in the rest of the economy. It is relevant, therefore, to examine whether this higher value added is reflected in relative remuneration in the IPR-intensive industries.

Using SBS data from Eurostat, it is possible to calculate the average compensation paid by each industry to its workforce.⁷² In SBS, *personnel costs* are defined as the total remuneration, in cash or in kind, payable by an employer to an employee in return for work done by the latter during the reference period. Personnel costs are made up of wages, salaries and employers' social security contributions, both compulsory and voluntary. Average personnel costs (*or unit labour costs*) equal personnel costs divided by the number of employees (persons who are paid and have an employment contract). This is the definition of "wages" used in this report.

Data is available in SBS for most industries. However, for 15 industries, no personnel cost data was available at all.⁷³ Those industries were omitted from the analysis.

Remuneration in IPR-intensive industries is indeed higher than in non-IPR-intensive industries. The average weekly compensation in IPR-intensive industries is €840, compared with €597 in non-IPR-intensive industries: a difference of 40.7%. This "wage premium" is 40% in TM-intensive industries, 34% in design-intensive industries, 65% in patent-intensive industries and 49% in copyright-intensive industries.

⁷² Because SBS employment and compensation data is not available for the main public-sector industries, the analysis in this section is confined to the private sector.

⁷³ The industries for which no personnel cost data was available are: 01.00 (p) *Horticulture*, 79.11 *Travel agency activities*, 85.52 *Cultural education*, 90.01 *Performing arts*, 90.02 *Support activities to performing arts*, 90.03 *Artistic creation*, 90.04 *Operation of arts facilities*, 91.01 *Library and archives activities*, 91.02 *Museums activities*, 91.03 *Operation of historical sites and buildings and similar visitor attractions*, 92.00 *Gambling and betting activities*, 93.21 *Activities of amusement parks and theme parks*, 93.29 *Other amusement and recreation activities*, 94.12 *Activities of professional membership organisations*, and 94.99 *Activities of other membership organisations n.e.c.*

Table 26:
Average personnel costs in IPR-intensive industries, 2017–2019

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 because of lack of wage statistics for agriculture.

Compared with the situation in the 2019 study, the wage premium has declined (the overall wage premium for 2016 was 47%). 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.

4.2 The main IPR-intensive industries at EU level

So far, the analysis in this chapter has focused on the IPR-intensive industries aggregated by IPR or in total. In this section, the contributions to employment and GDP are broken down by industry. Table 27 shows the 20 IPR-intensive industries making the largest contributions to employment.

Table 27:
Top 20 IPR-intensive industries (employment, 2017–2019
average)

NACE code	NACE description	Type*	Employment	Intensive IPR
71.12	Engineering activities and related technical consultancy	SERV	1 890 489	PAT
94.12	Activities of professional membership organisations	SERV	1 838 871	CR
62.01	Computer programming activities	SERV	1 594 888	TM, CR
70.22	Business and other management consultancy activities	SERV	1 505 971	TM
93.00	Sports activities and amusement and recreation activities	SERV	1 351 118	TM
68.20	Renting and operating of own or leased real estate	SERV	1 322 944	TM

NACE code	NACE description	Type*	Employment	Intensive IPR
66.00	Activities auxiliary to financial services and insurance activities	SERV	1 297 020	TM
62.02	Computer consultancy activities	SERV	1 203 294	TM, CR
29.10	Manufacture of motor vehicles	MAN	1 120 228	DES, PAT
29.32	Manufacture of other parts and accessories for motor vehicles	MAN	1 036 106	DES, PAT
01.00 (p)	Horticulture	AGRI	929 969	PV
46.69	Wholesale of other machinery and equipment	SERV	777 034	TM, DES, PAT
73.11	Advertising agencies	SERV	754 872	TM, CR
46.73	Wholesale of wood, construction materials and sanitary equipment	SERV	743 263	TM, DES
47.59	Retail sale of furniture, lighting equipment and other household articles in specialised stores	SERV	715 424	DES
47.78	Other retail sale of new goods in specialised stores	SERV	663 564	TM, DES
31.09	Manufacture of other furniture	MAN	612 952	DES
46.46	Wholesale of pharmaceutical goods	SERV	602 374	TM, PAT
47.91	Retail sale via mail order houses or via Internet	SERV	567 878	TM, DES
21.20	Manufacture of pharmaceutical preparations	MAN	557 959	TM, PAT
TOP 20			21 086 215	

*AGRI = agriculture; MAN = manufacturing industry; SERV = service industry.

Employment in these 20 industries, at more than 21 million, accounts for 34.3% of total employment in the 357 IPR-intensive industries identified in this report. The list is dominated by patent-intensive and TM-intensive industries, but designs also play a major role: 10 of the top 20 industries are design intensive, and 2 of them are exclusively design intensive.

Table 28 shows the top 20 IPR-intensive industries, ranked according to their contributions to GDP.

Table 28:
Top 20 IPR-intensive industries (GDP, 2017–2019 average)

NACE code	NACE description	Type*	Value added (million €, adjusted to GDP)	Intensive IPR
68.20	Renting and operating of own or leased real estate	SERV	1 483 636	TM
29.10	Manufacture of motor vehicles	MAN	165 821	DES, PAT
70.22	Business and other management consultancy activities	SERV	138 198	TM
62.01	Computer programming activities	SERV	133 535	TM, CR
71.12	Engineering activities and related technical consultancy	SERV	126 736	PAT
62.02	Computer consultancy activities	SERV	122 707	TM, CR
35.11	Production of electricity	MAN	114 190	TM, PAT
21.20	Manufacture of pharmaceutical preparations	MAN	104 870	TM, PAT
72.19	Other research and experimental development on natural sciences and engineering	SERV	103 430	TM, PAT, DES, PVR

NACE code	NACE description	Type*	Value added (million €, adjusted to GDP)	Intensive IPR
66.00	Activities auxiliary to financial services and insurance activities	SERV	103 394	TM
41.10	Development of building projects	SERV	101 970	TM
61.10	Wired telecommunications activities	SERV	88 668	CR
46.46	Wholesale of pharmaceutical goods	SERV	83 874	TM, PAT
93.00	Sports activities and amusement and recreation activities	SERV	78 949	TM
29.32	Manufacture of other parts and accessories for motor vehicles	MAN	73 919	DES, PAT
46.69	Wholesale of other machinery and equipment	SERV	72 415	TM, DES, PAT
92.00	Gambling and betting activities	SERV	60 219	TM
68.10	Buying and selling of own real estate	SERV	50 392	TM, DES, PAT
61.20	Wireless telecommunications activities	SERV	48 943	TM, CR
20.14	Manufacture of other organic basic chemicals	MAN	47 862	PAT
TOP 20			3 303 727	

*MAN = manufacturing industry; SERV = service industry.

In total, these 20 industries account for 51.8% of the total GDP generated in the 357 IPR-intensive industries.⁷⁴ There is a great deal of overlap between the 2 top 20 lists, with 11 industries appearing on both lists. There are, however, some industries, for example 61.20 *Wireless telecommunications activities*, which generate high value added relative to employment and hence appear in the top 20 GDP list but not in the top 20 employment list, and others, for example 73.11 *Advertising agencies*, which do appear in the top 20 list for employment but not in that for GDP.

4.3 Analysis by Member State

This section presents the contribution of IPR-intensive industries to employment and GDP in each Member State. This part of the analysis was challenging because the availability of data at Member State level is more limited than at EU level. Consequently, more estimates and imputations were required, so that some of the results in this section may be less robust than those in sections 4.1 and 4.2. It is also important to reiterate that the IPR-intensive industries were identified at the level of the EU28, not at individual Member State level. As stated above, this study assumes that if an industry is IPR intensive in one Member State, it is also IPR intensive in all other Member States because IPR intensity is considered to be an intrinsic characteristic of an industry. The accuracy of the results presented in this section depends on the validity of this assumption.

The contribution of each industry to a Member State's economy is measured in terms of the jobs and

⁷⁴ This very high share is partly due to the fact that the top-ranked industry, NACE 68.20 *Renting and operating of own or leased real estate*, includes imputed rent on owner-occupied housing. This is in keeping with the national accounting standard applied by Eurostat and other statistical offices. It was decided to retain the imputed rent in order to ensure compatibility between the numerator and denominator in the calculation of GDP shares, since imputed rent is included in the overall GDP figure from national accounts.

GDP generated by that industry in that Member State. For example, if a car company from Member State A builds an assembly plant in Member State B, then the resulting jobs and value added accrue to the economy of Member State B. In other words, the measure of IPR intensity employed does not address the origin of the IPR being used, only its deployment. It cannot be concluded on the basis of this study, therefore, that if patent-intensive industries contribute more in terms of jobs and value added in country A than in country B, then country A is more innovative. The higher contribution made by patent-intensive industries to employment or GDP in country A could equally be the result of decisions on where to site production that were made in country C. The issue of the origin of IPRs and their relationship with economic prosperity is the subject of chapter 5 and is an area for potential further study.

In this study, data for the EFTA member countries Iceland, Norway and Switzerland is also included, as well as data for the UK.⁷⁵ The EU average is shown for reference and always refers to the EU27.

Because of data gaps, the employment contribution of GI-intensive industries by Member State is not calculated. However, since those industries are also intensive in other IPRs, this limitation does not affect the overall results on the contribution of IPR-intensive industries to employment.

4.3.1 Patent-intensive industries

Patent-intensive industries contribute 11% of employment and 17.4% of GDP in the EU. Above-average shares of employment are found in Austria, the Czech Republic, Germany, Hungary, Slovakia, Slovenia and Sweden. When measured by contribution to value added, patent-intensive industries have an above-average share in the Czech Republic, Denmark, Germany, Finland, Hungary, Ireland, Romania, Slovakia, Slovenia and Sweden. Of the largest EU economies, Germany has the highest shares for patent-intensive industries in employment and GDP, reflecting the high share of manufacturing industries (which predominate among the patent-intensive industries) in the German economy. The high shares of patent-intensive industries in employment and GDP in several of the Member States that joined the EU in 2004 and 2007 could also be related to the high share of manufacturing in their economies.

Among EFTA countries, Norway and Switzerland have higher GDP shares of patent-intensive industries than the EU average, and Switzerland is also above average in terms of employment shares of those industries. The shares of patent-intensive industries in employment and GDP in Iceland and the UK are below the EU average.

⁷⁵ Due to lack of data, it was not possible to calculate the contribution of GI-intensive industries for those countries.

Table 29:
GDP and employment shares of patent-intensive industries by
Member State, 2017–2019 average

Country	Share of GDP (%)	Share in employment (%)
AT	17.0%	11.8%
BE	15.5%	8.9%
BG	16.2%	9.4%
CY	6.1%	5.1%
CZ	25.6%	18.8%
DE	23.7%	15.4%
DK	19.9%	9.9%
EE	13.5%	9.1%
ES	11.5%	7.8%
FI	17.6%	10.3%
FR	13.8%	8.9%
GR	12.0%	5.9%
HR	11.6%	8.4%
HU	23.2%	13.1%
IE	20.3%	8.7%
IT	15.7%	10.0%
LT	12.0%	8.2%
LU	10.0%	6.5%
LV	9.7%	6.7%
MT	8.5%	6.5%
NL	14.7%	8.2%
PL	15.6%	9.9%
PT	15.0%	8.5%
RO	18.2%	8.7%
SE	17.7%	12.5%
SI	22.5%	15.0%
SK	19.4%	15.0%
EU27	17.4%	11.0%
CH	22.2%	11.7%
IS	8.9%	6.3%
NO	25.4%	9.4%
UK	12.3%	8.1%

4.3.2 TM-intensive industries

In the EU as a whole, TM-intensive industries contribute 21.1% of employment and 38.5% of GDP. The countries with above-average shares of employment in TM-intensive industries are Bulgaria, the Czech Republic, Denmark, Estonia, Germany, Hungary, Ireland, Latvia, Lithuania, Malta, Portugal, Slovakia, Slovenia and Sweden. In Bulgaria, the Czech Republic, Denmark, Finland, France, Hungary, Ireland, Italy, Malta, Romania, Slovakia and Slovenia the shares of GDP coming from TM-intensive industries are above average.

Table 30:
GDP and employment shares of TM-intensive industries by
Member State, 2017–2019 average

Country	Share of GDP (%)	Share in employment (%)
AT	36.2%	20.7%
BE	37.1%	20.5%
BG	47.3%	22.5%
CY	38.4%	19.4%
CZ	41.4%	24.8%
DE	36.2%	22.6%
DK	41.3%	22.0%
EE	32.6%	23.1%
ES	36.5%	19.6%
FI	41.3%	18.8%
FR	40.0%	18.1%
GR	38.5%	17.2%
HR	37.3%	20.7%
HU	41.0%	22.1%
IE	46.6%	23.5%
IT	45.2%	20.9%
LT	33.1%	23.5%
LU	37.8%	18.2%
LV	35.8%	22.6%
MT	40.0%	22.9%
NL	35.0%	21.0%
PL	33.8%	20.9%
PT	37.2%	22.1%
RO	41.7%	15.9%
SE	30.5%	21.5%
SI	39.5%	23.1%
SK	41.8%	25.5%
EU27	38.5%	21.1%
CH	33.8%	20.8%
IS	32.9%	23.3%
NO	43.9%	19.1%
UK	41.4%	21.6%

Among non-EU countries, Norway and the UK have a higher GDP share of TM-intensive industries than the EU average, while in terms of employment shares of those industries, Iceland and the UK are above the EU average.

4.3.3 Design-intensive industries

Design-intensive industries contribute 12.9% of employment and 15.5% of GDP in the EU. Bulgaria, the Czech Republic, Estonia, Germany, Hungary, Italy, Lithuania, Poland, Portugal, Slovakia and Slovenia all have design-intensive employment shares above the EU average. A broadly similar pattern holds for GDP.

Table 31:
GDP and employment shares of design-intensive industries by
Member State, 2017–2019 average

Country	Share of GDP (%)	Share in employment (%)
AT	15.3%	12.8%
BE	11.5%	10.0%
BG	15.9%	14.3%
CY	7.1%	8.2%
CZ	23.1%	20.9%
DE	20.1%	15.3%
DK	15.9%	11.8%
EE	15.2%	14.4%
ES	10.5%	9.7%
FI	14.4%	10.3%
FR	11.1%	8.9%
GR	10.4%	7.8%
HR	12.8%	12.6%
HU	20.6%	14.7%
IE	11.5%	9.9%
IT	17.3%	13.9%
LT	15.8%	15.1%
LU	11.5%	7.2%
LV	11.8%	11.3%
MT	10.1%	10.2%
NL	13.8%	9.6%
PL	17.6%	14.9%
PT	17.2%	15.4%
RO	19.0%	11.4%
SE	14.4%	12.4%
SI	20.1%	16.4%
SK	17.9%	18.4%
EU27	15.5%	12.9%
CH	18.8%	11.4%
IS	7.8%	8.5%
NO	6.7%	7.7%
UK	10.1%	9.2%

Among non-EU countries, Switzerland has a higher GDP share of design-intensive industries than the EU average, while the other three countries all lie below the average. In terms of employment shares of those industries, all four countries are below the EU average.

4.3.4 Copyright-intensive industries

Overall employment in copyright-intensive industries in the EU is 6.2% of total employment, and those industries contribute 6.9% of the EU's GDP.

Table 32:
GDP and employment shares of copyright-intensive industries
by Member State, 2014–2016 average

Country	Share of GDP (%)	Share in employment (%)
AT	5.9%	6.1%
BE	6.1%	5.9%
BG	8.9%	5.5%
CY	8.3%	5.9%
CZ	8.4%	5.9%
DE	6.7%	7.1%
DK	7.2%	7.7%
EE	8.2%	8.1%
ES	5.6%	6.1%
FI	8.1%	8.0%
FR	7.4%	6.6%
GR	4.6%	4.5%
HR	7.1%	5.8%
HU	7.1%	6.2%
IE	14.0%	8.0%
IT	5.5%	4.7%
LT	6.0%	6.6%
LU	6.8%	6.7%
LV	8.1%	8.0%
MT	15.7%	9.8%
NL	6.9%	6.8%
PL	6.3%	5.0%
PT	5.4%	5.1%
RO	8.1%	4.4%
SE	10.2%	8.4%
SI	6.4%	5.7%
SK	7.7%	6.1%
EU27	6.9%	6.2%
CH	6.2%	6.2%
IS	6.3%	8.7%
NO	5.5%	6.5%
UK	8.8%	7.6%

Countries with above-average employment in copyright-intensive industries are Denmark, Estonia, Finland, France, Germany, Ireland, Luxembourg, Latvia, Lithuania, Malta, the Netherlands and Sweden.

Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Hungary, Ireland, Latvia, Malta, Romania, Slovakia and Sweden all have above-average GDP shares attributable to copyright-intensive industries. All four non-EU countries are at or above the EU average when it comes to employment, but only the UK is above the EU average in terms of GDP contribution.

4.3.5 PVR-intensive industries

PVR-intensive industries in the EU contribute 0.9% of employment and 1.4% of GDP in the EU. Among the Member States, Austria, Croatia, the Netherlands, Portugal, Romania, Slovenia and Spain have a PVR-intensive industry with employment shares above the EU average.

Table 33:
GDP shares of PVR-intensive industries by Member State,
2017–2019 average

Country	Share of GDP (%)	Share in employment (%)
AT	0.9%	1.2%
BE	0.9%	0.7%
BG	1.3%	0.8%
CY	0.4%	0.4%
CZ	1.0%	0.7%
DE	1.3%	0.8%
DK	1.8%	0.8%
EE	1.5%	0.5%
ES	1.1%	1.2%
FI	1.0%	0.6%
FR	2.2%	0.7%
GR	0.7%	0.8%
HR	1.1%	1.2%
HU	2.0%	0.8%
IE	0.8%	0.7%
IT	1.5%	0.8%
LT	0.9%	0.7%
LU	1.9%	0.6%
LV	0.9%	0.4%
MT	0.8%	0.2%
NL	1.8%	2.6%
PL	0.9%	0.5%
PT	0.8%	2.3%
RO	1.0%	1.0%
SE	0.4%	0.6%
SI	1.4%	1.2%

Country	Share of GDP (%)	Share in employment (%)
SK	0.5%	0.3%
EU27	1.4%	0.9%
CH	1.4%	0.9%
IS	0.9%	0.5%
NO	0.7%	0.6%
UK	0.9%	0.6%

Member states with above-average GDP contributions from PVR-intensive industries are Denmark, Estonia, France, Hungary, Italy, Luxembourg and the Netherlands. Switzerland matches the EU average for both employment and GDP contribution, while the other three non-EU countries lie below it.

4.3.6 GI-intensive industries

Only the share of GI-intensive industries in GDP is calculated for the EU and the Member States due to limited data on employment in the wine industry. While the EU average for the share of GI-intensive industries in GDP is a modest 0.1%, these industries are heavily concentrated in particular regions of the Member States with relatively high contributions in Slovenia, France, Portugal and Greece and slightly above EU-average contributions in Italy, Romania and Spain.

Table 34:
GDP shares of GI-intensive industries by Member State, 2017–2019 average

Country	Share in GDP (%)
AT	0.1%
BE	0.0%
BG	0.0%
CY	0.0%
CZ	0.0%
DE	0.1%
DK	0.0%
EE	0.0%
ES	0.1%
FI	0.0%
FR	0.3%
GR	0.2%
HR	0.1%
HU	0.1%
IE	0.0%
IT	0.1%
LT	0.0%
LU	0.0%
LV	0.0%
MT	0.0%

Country	Share in GDP (%)
NL	0.0%
PL	0.0%
PT	0.3%
RO	0.1%
SE	0.0%
SI	0.4%
SK	0.0%
EU27	0.1%
CH	n/a
IS	n/a
NO	n/a
UK	0.1%

As noted above, the estimates of value added of GI-intensive industries were calculated using the shares of the relevant industries that produce the GI products in each Member State. This is in contrast to the estimates for the other IPRs, which are predicated on the assumption that IPR intensity is a fundamental characteristic of an industry, irrespective of its geographical location.

4.3.7 All IPR-intensive industries

If all six IPRs are combined and the overlaps eliminated, the overall contribution of IPR-intensive industries to the economies of the Member States is as shown in Table 35. At EU level, IPR-intensive industries contribute 29.7% of employment and 47.1% of GDP.

Table 35:
GDP and employment shares of all IPR-intensive industries by
Member State, 2017–2019 average

Country	Share in GDP (%)	Share in employment (%)
AT	44.2%	29.8%
BE	44.0%	26.9%
BG	53.7%	29.2%
CY	42.4%	25.2%
CZ	54.4%	36.6%
DE	48.2%	33.4%
DK	47.4%	29.3%
EE	41.3%	33.0%
ES	43.2%	27.5%
FI	48.9%	27.6%
FR	46.9%	25.7%
GR	43.2%	22.7%
HR	44.4%	29.1%
HU	51.5%	31.1%
IE	50.9%	29.3%
IT	52.3%	28.1%

Country	Share in GDP (%)	Share in employment (%)
LT	41.6%	32.5%
LU	44.4%	23.4%
LV	42.5%	30.1%
MT	49.3%	31.0%
NL	41.9%	28.7%
PL	42.5%	28.8%
PT	43.6%	31.0%
RO	53.3%	23.9%
SE	40.3%	31.6%
SI	50.2%	32.9%
SK	53.8%	36.0%
EU27	47.1%	29.7%
CH	40.1%	28.2%
IS	37.2%	29.7%
NO	48.8%	26.2%
UK	46.8%	28.4%

Overall, IPR-intensive industries have an above-average share in employment in Austria, the Czech Republic, Estonia, Germany, Hungary, Latvia, Lithuania, Malta, Portugal, Slovakia, Slovenia and Sweden.

In terms of GDP contribution, Bulgaria, the Czech Republic, Denmark, Germany, Finland, Hungary, Ireland, Italy, Malta, Romania, Slovakia and Slovenia have shares above the EU average.

Of the four non-EU countries, Norway has an above-EU average contribution to its GDP from IPR-intensive industries (probably reflecting the importance of its large oil sector). The other three countries all lie at or below the EU average in terms of contribution of IPR-intensive industries to employment and GDP⁷⁶.

⁷⁶ The figures for the UK calculated in this study are higher than those presented in the report published by the UK Intellectual Property Office in June 2022, entitled "Use of Intellectual Property Rights across UK industries 2017 to 2019". In that report, the share of GDP in IPR-intensive industries is calculated at 33.2%, while the employment share is 19.2%. Those differences are partly accounted for by the omission of copyright-, PVR- and GI-intensive industries in the UKIPO report, and partly by differences in the identification of IPR-intensive industries.

5. Origins of IPRs and job creation in the single market

It is important to bear in mind that the shares in GDP and employment shown in this report do not necessarily reflect the degree to which a country's economy is innovative. For example, a country may be a good location for patent-intensive manufacturing industries due to low costs, a favourable business climate or the availability of natural resources. That country may then have a high share of employment in patent-intensive industries even though the manufacturing firms that built the factories and created the jobs in its territory have their head offices and carry out their research and development (as opposed to production) elsewhere.

As discussed in this chapter, analysing the impact of IPRs at this more granular level is an important area for further research. What follows is an initial analysis of the **origins** of the IPRs whose contributions to the economies of the EU and its Member States are the subject of this report.

5.1 Origins of IPRs within the EU

So far, this report has examined where jobs and economic activity in IPR-intensive industries are created. As already noted, this is not necessarily a reflection of the relative “IP-creating power” of the Member States. In the single market, companies may have their head offices in one country, create their IPRs in another country and manufacture the resulting products in yet another. In particular, decisions as to where to site production facilities depend on many factors, including the cost and availability of labour with the necessary skills, the cost and availability of land, raw materials and other resources, the business environment and tax regime in the various countries and so on.

This chapter explores two basic questions:

- Which EU Member States create the IPRs analysed in this report?
- What proportion of jobs in IPR-intensive industries in each Member State is created by companies from other Member States?

This section and the next seek to provide some initial answers to these two questions.

Using the data on filings and employment, it is possible to explore where the TMs and designs filed at the EUIPO, the patent applications filed at the EPO and the PVRs filed at the CPVO originate (as

indicated by the nationality of the owner). The tables in this section show the number of patents, TMs, designs and PVRs originating in each Member State during the 2017–2019 period. It should be noted that in order to provide a complete picture of IPR-generating activities in each country, filings from companies in all industries are included in these tables. Therefore, the figures are not directly comparable with those in the previous chapters of this report, which analysed IPR-intensive industries only.⁷⁷

Table 36:
IPR filings by country of origin in all industries, 2017–2019
average

Country	PAT	PAT rank	TM	TM rank	DES	DES rank	PVR	PVR rank	EMPL (,000)	PATs per 1 000 empl.	TMs per 1 000 empl.	DES per 1 000 empl.	PVRs per 1 000 empl.
AT	2 279	8	3 532	7	2 238	7	20	8	4 236	0.54	0.83	0.53	0
BE	2 307	6	2 623	9	1 097	10	69	5	4 686	0.49	0.56	0.23	0.01
BG	33	24	777	18	581	14	n/a	n/a	3093	0.01	0.25	0.19	n/a
CY	49	21	694	19	64	26	n/a	n/a	388	0.13	1.79	0.16	n/a
CZ	219	14	1 229	13	1 014	11	18	9	5 131	0.04	0.24	0.20	0
DE	26 321	1	22 177	1	18 665	1	308	3	40 727	0.65	0.54	0.46	0.01
DK	2 296	7	2 216	10	1 715	8	84	4	2 739	0.84	0.81	0.63	0.03
EE	50	20	614	22	182	21	n/a	n/a	622	0.08	0.99	0.29	n/a
ES	1 779	9	10 352	3	3 455	5	45	7	19 118	0.09	0.54	0.18	0
FI	1 743	10	1 641	12	741	13	2	14	2 451	0.71	0.67	0.30	0
FR	10 440	2	8 797	4	6 068	3	340	2	26 646	0.39	0.33	0.23	0.01
GR	121	16	1 031	16	198	19	2	17	3 753	0.03	0.27	0.05	0
HR	14	27	198	27	58	27	n/a	n/a	1 628	0.01	0.12	0.04	n/a
HU	103	18	693	20	238	18	7	11	4 407	0.02	0.16	0.05	0
IE	789	11	1 189	14	462	16	4	13	2 181	0.36	0.55	0.21	0
IT	4 411	4	12 467	2	10 319	2	51	6	22 572	0.20	0.55	0.46	0
LT	30	25	464	23	99	24	n/a	n/a	1 318	0.02	0.35	0.08	n/a
LU	460	13	1 138	15	322	17	1	18	279	1.65	4.08	1.15	0
LV	16	26	238	26	66	25	1	19	868	0.02	0.27	0.08	0
MT	59	19	671	21	126	23	n/a	n/a	234	0.25	2.87	0.54	n/a
NL	7 042	3	5 183	5	2 760	6	871	1	8 536	0.82	0.61	0.32	0.10
PL	476	12	4 011	6	4 389	4	17	10	16 102	0.03	0.25	0.27	0
PT	214	15	1 871	11	864	12	n/a	n/a	4 594	0.05	0.41	0.19	n/a
RO	47	22	929	17	467	15	n/a	n/a	8 384	0.01	0.11	0.06	n/a
SE	4 078	5	3 444	8	1 637	9	5	12	4 894	0.83	0.70	0.33	0
SI	107	17	414	25	134	22	2	15	958	0.11	0.43	0.14	0
SK	45	23	449	24	195	20	2	16	2 526	0.02	0.18	0.08	0
EU27	65 528		89 042		58 154		1 849		193 071	0.34	0.46	0.30	0.01

Note: The table shows the mean number of annual filings per country of origin of the applicant calculated from the dataset of all the applications filed between 2017 and 2019. Applicants were linked with countries of origin based on the seat country as shown in the application. Calculations in this table take into account all the applications received by the respective IP offices, and not just those matched with ORBIS.

⁷⁷ As is the case throughout this report, the analysis is based on EU28-level filings. Future studies could include national filings as well to provide a more complete picture.

In absolute terms, Germany ranks first for patents, TMs and designs, followed by France, the Netherlands, Italy and Spain. There is some variation between the various IPRs. For example, while Spain is in third place for TMs and fifth place in designs, it is in ninth place for patents. The group made up of the largest economies is followed by a group of smaller, mostly northern European countries, including Austria, Belgium, Denmark and Sweden. The highest-placed among the 13 countries that joined the EU from 2004 onwards is Poland (sixth in TMs, fourth in designs and twelfth in patents), which is also the largest country in this group. The pattern for plant varieties differs from that for the other IPRs: the Netherlands is the leader, followed by France, Germany and Denmark.

Of course, all other things being equal, large countries will tend to have more IPR filings. Therefore, Table 36 also shows the number of IPR filings per 1 000 employees. This is the measure of IPR intensity employed throughout this report. The overall EU average is 0.46 EUTMs, 0.31 PATs, 0.30 RCDs and 0.01 PVRs per 1 000 employees. Viewed in this light, overall the countries above the EU average in terms of IPR creation per employee are Austria, Denmark, Finland, Germany, Luxembourg, Malta, the Netherlands and Sweden. Denmark and the Netherlands are the only Member States above the EU average for all four IPRs. Austria, Germany, Luxembourg and Sweden are above the EU average for three of the four IPRs considered.

Some countries have areas of particular strength. For example, Cyprus and Estonia are above the EU average for TMs, but below it for other IPRs.

5.2 Job creation in the single market

Chapter 4 of this report revealed that many of the more recent Member States have relatively high proportions of IPR-intensive industries in employment and GDP. Section 2.1, however, showed that the IPRs being applied for at the EUIPO and EPO for the most part originate in the older Member States. Thus, it appears that while many companies continue to develop their IPRs at home, the resulting production is often located in other Member States, particularly those that joined the EU from 2004 onwards. Indeed, cross-border job creation can be considered a positive manifestation of the single market.

This pattern of job creation in the single market is further illustrated by the extent to which jobs in each Member State are created by companies based in other Member States or countries outside the EU.

Data on foreign ownership in each Member State is available from Eurostat's foreign affiliates statistics (FATS).⁷⁸ In Table 37, this information has been combined with the matched database in order to determine how many jobs in IPR-intensive industries in each Member State have been created by companies from outside that country. It should be noted that due to data limitations, it has not been possible to carry out this analysis for all 27 Member States. As the UK was still a Member State between 2017 and 2019, jobs created by UK companies in other Member States, and jobs created by the EU27 in the UK are an integral part of the data. Therefore, in contrast to the remainder of this report, the figures in this subsection refer to the EU28 as it existed prior to Brexit.

⁷⁸ For a detailed explanation, see ec.europa.eu/eurostat/web/structural-business-statistics/global-value-chains/foreign-affiliates.

Overall, 21.6% of jobs in IPR-intensive industries in the EU28 were generated by companies from other countries – 12.3% by companies from other EU Member States, and 9.3% by companies from outside the EU. In general, the Member States that joined the EU in 2004 and 2007 are recipients of many jobs created by companies beyond their borders.

Thus, 41% of all IPR-intensive employment in Romania is in non-Romanian-owned firms. Of those jobs, 29% are in companies based in other EU countries, while 12% are in companies with their head offices outside the EU. Other Member States in which more than 30% of IPR-intensive job creation originates beyond their borders are the Czech Republic, Estonia, Hungary, Luxembourg, Poland and Slovakia.

The highest share of jobs in IPR-intensive industries generated by companies from outside the EU is to be found in Ireland, at 17%. Ireland, Cyprus, Malta and the Netherlands are the only current Member States in which more jobs are created by companies from third countries than by companies based in other EU Member States.

Table 37:

Jobs in EU Member States attributed to foreign companies in all IPR-intensive industries, 2017–2019 average

	Jobs attributed to companies based in:		Total employment in IPR-intensive industries*	Other EU share	Non-EU share	Total non-domestic share
	Other EU Member States	Non-EU countries				
AT	213 020	128 074	1 206 794	17.7%	10.6%	28.3%
BE	84 786	69 018	1 146 655	7.4%	6.0%	13.4%
BG	144 007	83 401	937 989	15.4%	8.9%	24.2%
CY	1 304	2 581	93 724	1.4%	2.8%	4.1%
CZ	451 021	238 857	1 866 080	24.2%	12.8%	37.0%
DE	1 213 767	1 156 802	13 529 936	9.0%	8.5%	17.5%
DK	113 038	72 279	768 166	14.7%	9.4%	24.1%
EE	30 119	12 210	110 269	27.3%	11.1%	38.4%
ES	633 125	267 763	4 684 686	13.5%	5.7%	19.2%
FI	79 388	62 070	619 200	12.8%	10.0%	22.8%
FR	631 004	522 361	6 894 944	9.2%	7.6%	16.7%
GR	47 776	10 446	862 969	5.5%	1.2%	6.7%
HR	75 192	26 535	426 998	17.6%	6.2%	23.8%
HU	298 946	175 936	1 327 542	22.5%	13.3%	35.8%
IE	50 876	78 115	452 064	11.3%	17.3%	28.5%
IT	448 506	320 167	6 462 899	6.9%	5.0%	11.9%
LT	56 353	36 137	404 768	13.9%	8.9%	22.9%
LU	15 081	5 548	62 834	24.0%	8.8%	32.8%
LV	52 559	16 249	259 125	20.3%	6.3%	26.6%
MT	779	1 183	61 659	1.3%	1.9%	3.2%
NL	223 559	250 919	2 168 852	10.3%	11.6%	21.9%

	Jobs attributed to companies based in:		Total employment in IPR-intensive industries*	Other EU share	Non-EU share	Total non-domestic share
	Other EU Member States	Non-EU countries				
PL	782 633	353 879	3 136 412	25.0%	11.3%	36.2%
PT	160 169	64 887	1 362 636	11.8%	4.8%	16.5%
RO	552 911	235 147	1 930 356	28.6%	12.2%	40.8%
SE	238 328	197 663	1 456 539	16.4%	13.6%	29.9%
SI	52 805	18 079	300 993	17.5%	6.0%	23.5%
SK	192 852	88 238	784 241	24.6%	11.3%	35.8%
UK	634 325	1 175 624	7 688 177	8.3%	15.3%	23.5%
EU28	7 478 228	5 670 167	61 007 506	12.3%	9.3%	21.6%

*IPR-intensive industries included in FATS. Thus, there is a small difference compared with the main results in chapters 3 and 4.

These figures show that there are significant flows of job creation between EU Member States, and also to some degree between the EU and non-EU countries. However, to provide some perspective, even in Romania, the country with the highest share of non-domestic companies in IPR-intensive industries, the proportion of jobs in non-Romanian firms is 41%, so that almost 60% of such jobs are still generated by domestic companies. In the largest economies in the EU, the majority of jobs in IPR-intensive industries are generated domestically: 83% in France, 82% in Germany, 81% in Spain and 88% in Italy.

Table 38 indicates the share of jobs attributed to non-domestic companies in industries which are intensive in TMs, patents and designs. As compared with the overall EU average of 21.6% for industries intensive in any one of the six IPRs, industries which are intensive in patents and designs account for a higher proportion of jobs in subsidiaries of foreign companies. Hungary, Romania and Slovakia register non-domestic shares for patents of more than 50%. Due to limited data availability, it is not possible to calculate precisely the share of jobs in subsidiaries of non-domestic companies for the other IPRs studied in this report. However, it can be inferred from available results that the share for copyright, GIs and PVRs is below the overall average of 21.5% for all IPR-intensive industries.

Table 38:

Jobs in IPR-intensive industries attributed to non-domestic companies by EU Member State, 2017–2019 average, by IP right

	Patents			Trade marks			Designs		
	Other EU share	Non-EU share	Total non-domestic share	Other EU share	Non-EU share	Total non-domestic share	Other EU share	Non-EU share	Total non-domestic share
AT	20%	15%	36%	18%	10%	28%	20%	12%	32%
BE	12%	11%	23%	6%	5%	12%	10%	9%	19%
BG	17%	13%	30%	15%	8%	23%	15%	9%	25%
CY	1%	1%	1%	2%	3%	5%	1%	1%	2%
CZ	32%	17%	49%	20%	11%	32%	29%	14%	43%
DE	10%	11%	21%	9%	9%	17%	9%	10%	19%
DK	18%	11%	29%	15%	10%	25%	18%	10%	28%
EE	32%	12%	44%	30%	12%	42%	33%	10%	42%
ES	20%	8%	28%	12%	6%	17%	15%	6%	22%
FI	15%	13%	28%	12%	11%	22%	13%	11%	24%
FR	13%	11%	24%	9%	8%	17%	12%	10%	22%
GR	6%	2%	8%	6%	1%	7%	6%	2%	7%
HR	17%	7%	24%	18%	6%	24%	18%	6%	24%
HU	33%	20%	53%	19%	12%	31%	29%	17%	46%
IE	11%	14%	25%	11%	19%	30%	11%	14%	25%
IT	9%	8%	16%	7%	5%	12%	7%	5%	12%
LT	14%	12%	26%	13%	9%	22%	14%	10%	24%
LU	26%	6%	32%	26%	11%	37%	35%	8%	43%
LV	20%	6%	26%	21%	7%	28%	20%	6%	26%
MT	0%	0%	0%	2%	2%	4%	0%	0%	0%
NL	13%	18%	31%	10%	12%	22%	12%	13%	25%
PL	30%	14%	44%	21%	10%	32%	27%	11%	38%
PT	18%	8%	26%	10%	5%	15%	13%	4%	17%
RO	38%	18%	56%	25%	10%	35%	32%	13%	45%
SE	19%	18%	37%	16%	12%	28%	20%	17%	36%
SI	23%	8%	31%	15%	6%	21%	21%	7%	28%
SK	38%	19%	57%	20%	8%	29%	30%	14%	43%
UK	11%	18%	30%	8%	15%	23%	10%	16%	26%
EU28	16%	13%	28%	11%	9%	20%	14%	10%	25%

Table 39 shows the cross-border flows of jobs within the single market from a different perspective, namely by looking at the origin of the more than five million jobs created in EU Member States by companies from other Member States. Thus, German companies create 1.7 million jobs – about 33% of the total – in other Member States. French companies create 1.2 million jobs elsewhere in the EU, and so on. The top of the list is dominated by the large Member States, although Austrian and Scandinavian companies also create significant numbers of jobs in other Member States.

Table 39:

Jobs in EU Member States attributed to companies from other Member States (IPR-intensive industries, 2017–2019 average)

Member State	Jobs in the rest of EU attributed to companies based in the Member State	Share of all EU cross-border jobs
AT	194 094	3.8%
BE	55 049	1.1%
BG	n/a	n/a
CY	1 245	0.0%
CZ	15 479	0.3%
DE	1 673 488	32.7%
DK	219 657	4.3%
EE	n/a	n/a
ES	109 547	2.1%
FI	121 036	2.4%
FR	1 238 780	24.2%
GR	3 692	0.1%
HR	7 619	0.1%
HU	3 094	0.1%
IE	12 438	0.2%
IT	358 788	7.0%
LT	14 046	0.3%
LU	33 781	0.7%
LV	2 724	0.1%
MT	n/a	n/a
NL	n/a	n/a
PL	16 255	0.3%
PT	38 014	0.7%
RO	2 925	0.1%
SE	354 339	6.9%
SI	7 420	0.1%
SK	3 565	0.1%
UK	636 279	12.4%
EU28	5 123 356	100%

6. Technology focus: Climate change mitigation technologies and green EU trade marks

This chapter focuses on an area that is of particular importance for the future of the EU economy: innovation in technologies that help mitigate the effects of climate change and products that are considered green, i.e. sustainable or related to protection of the environment.

Climate change clearly presents a challenge of unparalleled scale and complexity. This is why the EU and its Member States have made climate change a central element of internal and external EU policy. In 2020, the European Commission developed the Sustainable Europe Investment Plan, which aims to attract at least €1 trillion of public and private investment over the next decade to finance the green transition. With the European Green Deal, which became legally binding in 2021, the EU has also set out a roadmap for a climate-neutral Europe with ambitious targets for the coming decades.⁷⁹

To make all of this a success, new and far-reaching inventions and products are needed to curb emissions, such as CO₂, without a negative impact on economic development. In addition, environmentally friendly innovation offers an opportunity to make the European economy more sustainable and inclusive, while creating considerable opportunities for future economic growth and trade. According to recent estimates, the global market volume of the green and sustainable technology sector exceeded €4 trillion in 2020, and revenues for environmental technology and resource efficiency are expected to grow to close to €10 trillion euros by 2030.⁸⁰ This corresponds to an annual growth rate of 7.3%. In this context, climate change mitigation technologies (CCMTs) and green products are expected to transform a large array of businesses in the coming years, and are in fact already widespread across many industries in the EU.

⁷⁹ See europarl.europa.eu/news/en/headlines/society/20180703STO07129/eu-responses-to-climate-change

⁸⁰ See BMU (2021) GreenTech made in Germany 2021 Umwelttechnik-Atlas für Deutschland. bmu.de/fileadmin/Daten_BMU/Pool/Broschueren/greentech_atlas_2021_bf.pdf

The present chapter uses patent and TM data to identify IPR-intensive industries that are active in sustainable innovation. The purpose is threefold: first, to document the activity of EU companies in patenting CCMT inventions at the EPO and registering green EUTMs at the EUIPO; second, to identify the IPR-intensive industries in the EU that are leading innovation in CCMTs and green products; and third, to analyse the economic characteristics of those industries and assess their overall contributions to EU employment, output, trade and wages, following the same approach as in previous chapters.⁸¹

6.1 Trends in CCMT patents and green EUTMs

Several studies have shown that Europe belongs to the leading centres of inventive activity in different areas of sustainable technology, such as low-carbon energy technologies (see EPO/IEA, 2021: Patents and the energy transition), plastic recycling (EPO, 2021: Patents for tomorrow's plastics) or batteries (EPO/IEA 2020, Innovation in batteries and electricity storage). Companies operating in CCMTs and related business areas frequently rely on IPRs to protect the value of their innovations. A recent study by the EUIPO (2021, Green EU trade marks: Analysis of goods and services specifications, 1996–2020) shows that this growing interest from European companies in sustainability is also reflected in the EUTMs. The box outlines the methodology used for identifying green patents and TMs, respectively.

⁸¹ The economies of Iceland, Norway, Switzerland and the UK have not been considered in this chapter.

Box: Identifying sustainable innovation

CCMT patents

In order to facilitate the identification of inventions that cover technical solutions related to controlling, reducing or preventing emissions of greenhouse gases, the EPO has developed the “Y02/Y04S” tagging scheme. Established by the EPO’s patent examiners with the help of external experts in the field, this scheme allows structured access to more than three million patent documents disclosing technical information on CCMTs relating to buildings, greenhouse gas capture and storage, renewable-energy generation, transmission and distribution, industrial production activity and transportation, waste or wastewater treatment and smart grid technologies.⁸²

The EPO’s Y02/Y04S tagging scheme for CCMT-related patent documents

Y02B	CCMTs relating to buildings
Y02C	Greenhouse gas capture and storage
Y02D	Energy use reduction in ICT
Y02E	Energy generation, storage and distribution
Y02P	CCMTs in production
Y02T	CCMTs relating to transportation
Y02W	CCMTs in waste and wastewater treatment
Y04S	Smart grids

Green TMs

The EUIPO has developed a methodology which uses information provided in the EUIPO register to identify those TMs that claim protection for products related to environmental protection and sustainability.⁸³ In particular, they analyse goods and services specifications of EUTMs for the presence of approximately 900 terms that have been identified as “green”. These terms have been classified in 35 categories which are further organised into 9 groups:

Green EUTM groups:

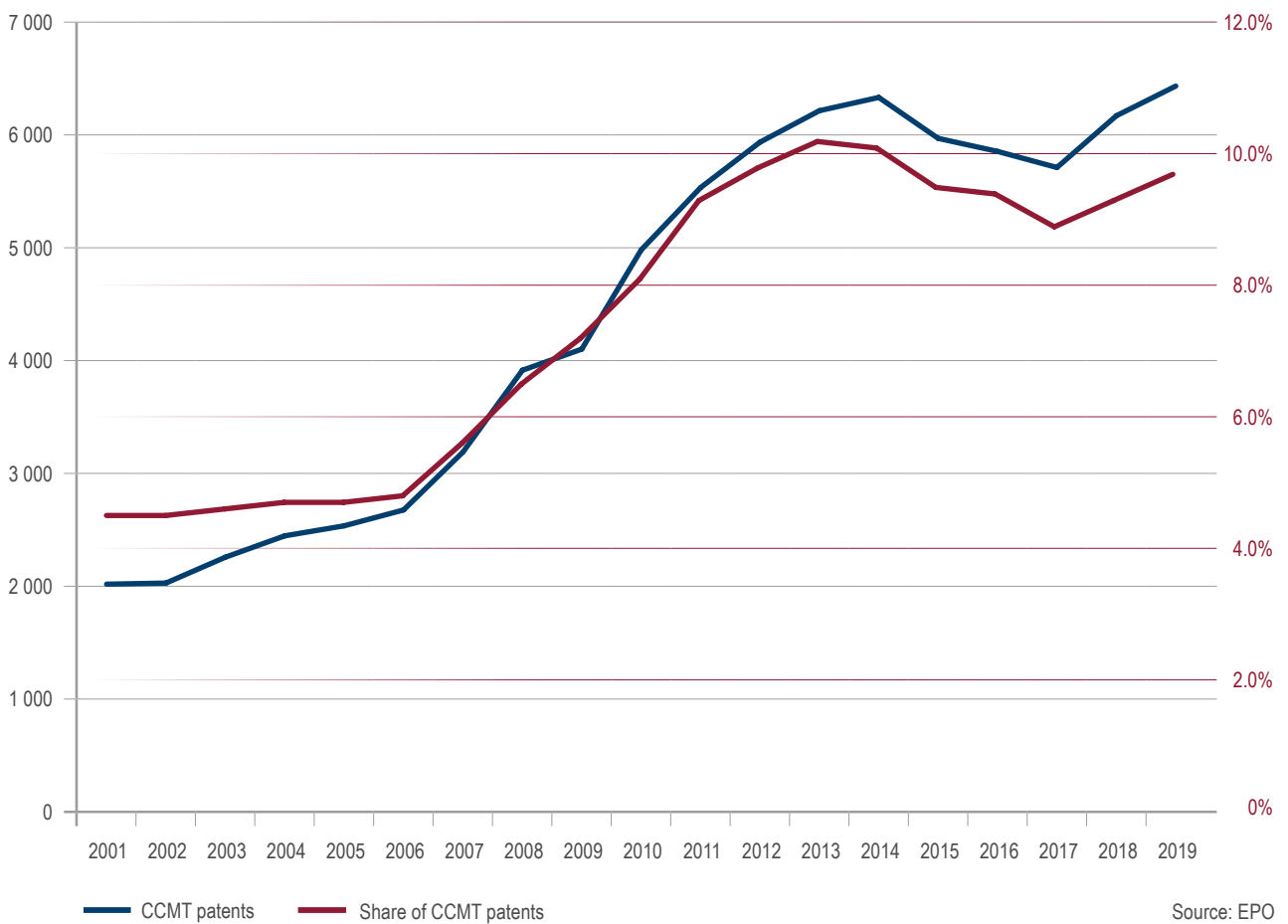
Energy production
 Transportation
 Energy conservation
 Reuse/recycling
 Pollution control
 Waste management
 Agriculture
 Environmental awareness
 Climate change

⁸² This information is available free of charge via the EPO’s Espacenet online database. It can be used to identify the latest technological developments in CCMTs and to generate statistics for evidence-based decision-making.

⁸³ See EUIPO (2021), Green EU trade marks: Analysis of goods and services specifications, 1996–2020.

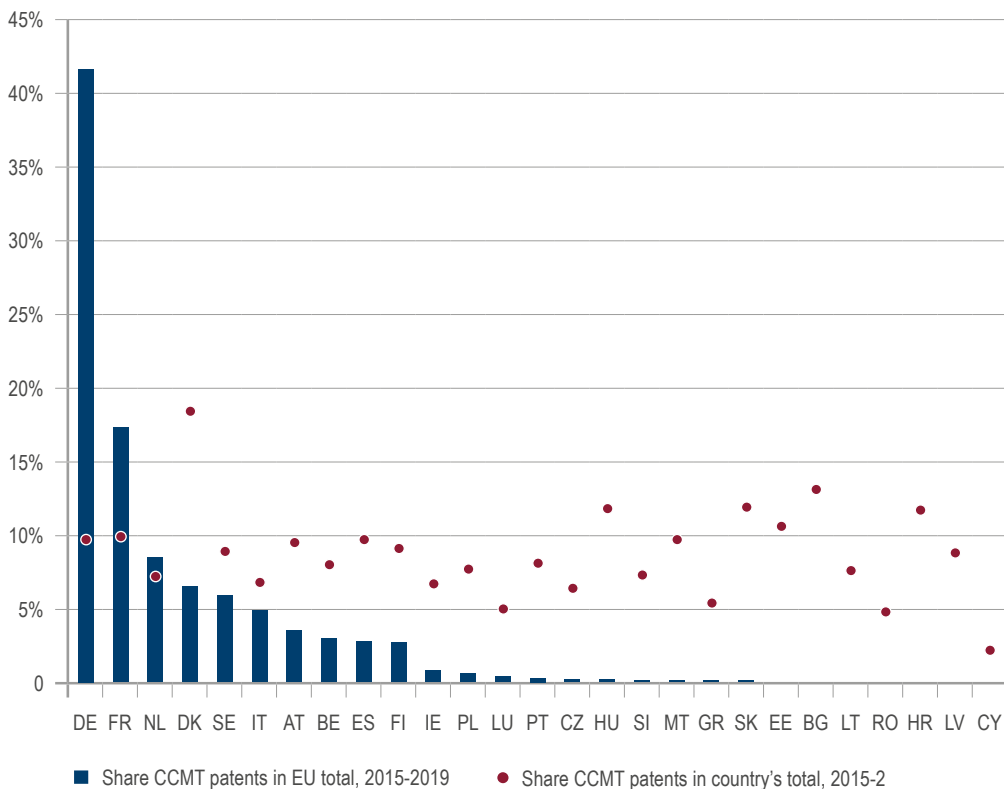
Figure 4, created using the Y02/Y04S tagging scheme, depicts the number of CCMT-related patent applications submitted to the EPO by EU applicants. It shows that such applications have grown strongly since the beginning of the 21st century, from around 2 000 in 2001 to over 6 300 in 2014. The growth in CCMT patent applications significantly exceeded the increase in the total number of patent applications at the EPO, such that its share in total patenting activity reached 10.3%, i.e. more than one in ten patent applications at the EPO, by 2013. After declining for several years until 2017, the number of CCMT patent applications resumed growth and reached a new all-time high in 2019.

Figure 4:
Number and share of CCMT patent applications filed by EU applicants at the EPO between 2001 and 2019



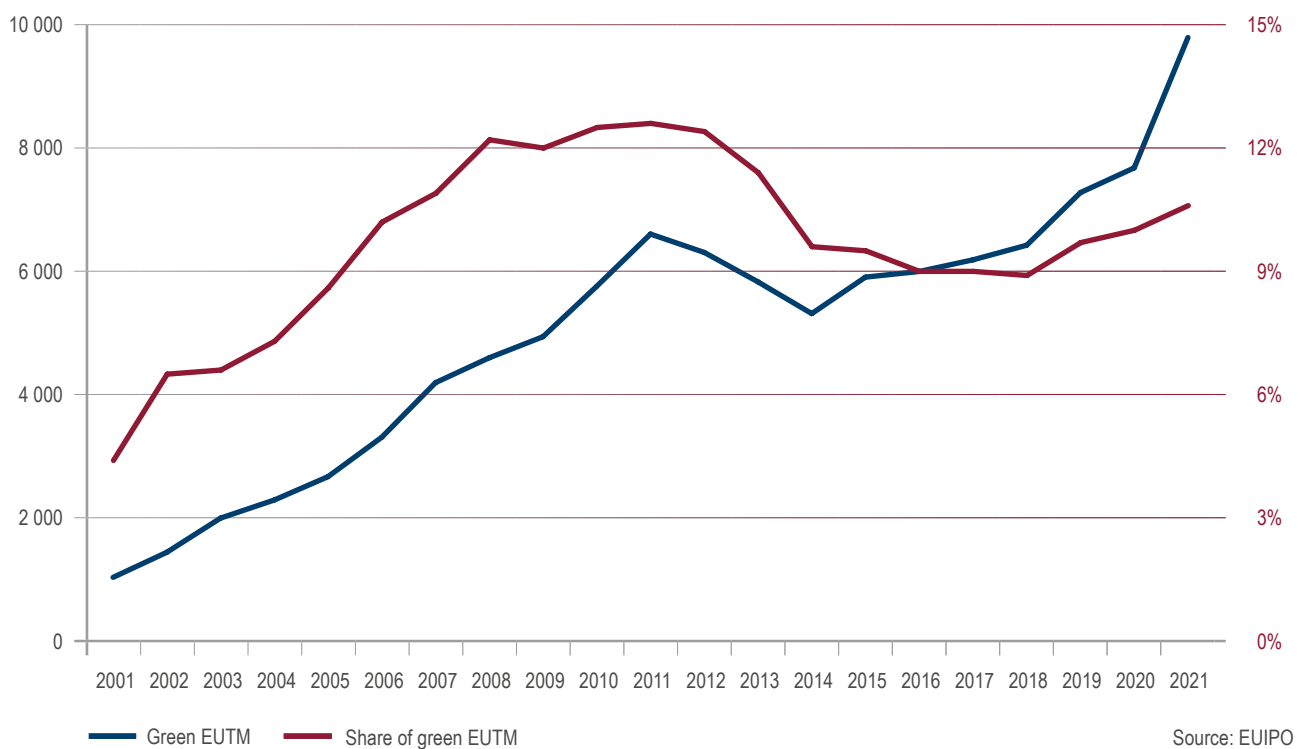
The distribution of CCMT patent applications in the 2015–2019 period is very skewed, as shown in Figure 5. Germany, accounting for 41.7% of all CCMT patent applications from EU Member States, is clearly the dominant country. France comes second, with 17.3%, followed by the Netherlands (8.5%), Denmark (6.5%) and Sweden (5.9%). With regard to the importance of CCMT patent applications within each country's patent portfolio, Denmark is the clear leader: patent applications for sustainable inventions represent 18.5% of patents filed by Danish companies. In many other, larger patenting countries, such as Germany, France, Austria or Spain, the share is closer to 10%. In Italy (6.9%) and the Netherlands (7.3%) the importance of CCMT patent applications is lower.

Figure 5:
Distribution of CCMT patent applications by EU Member State,
2015–2019



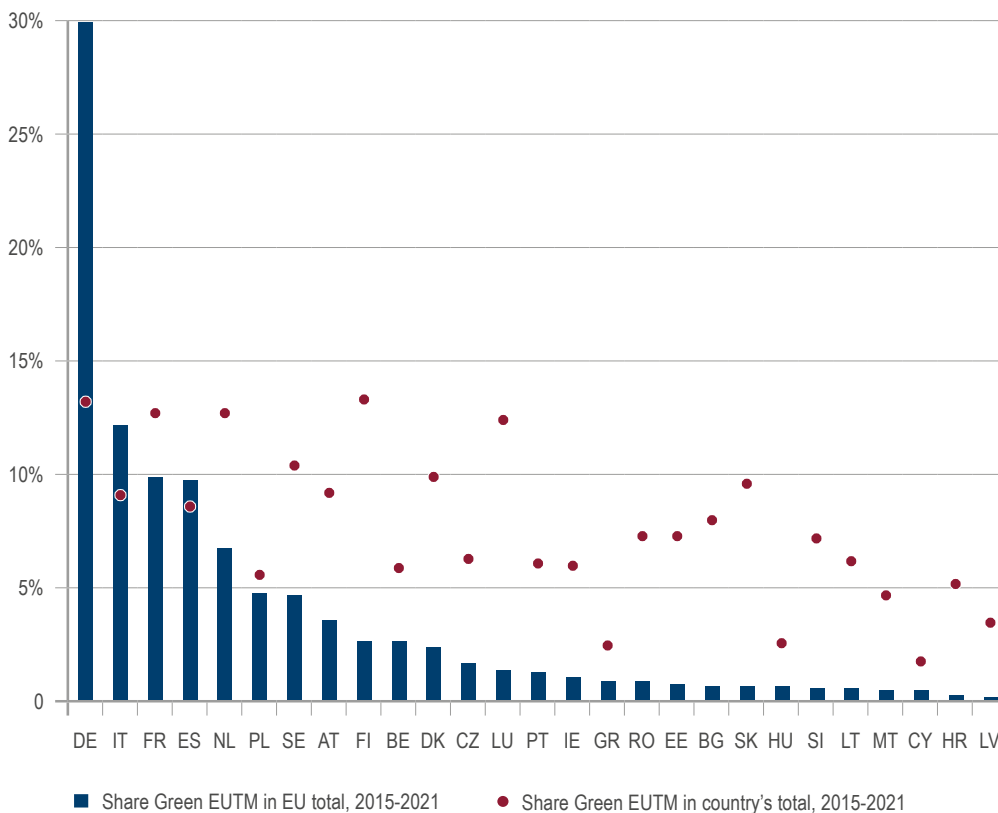
A similar trend can be observed in green EUTMs of EU applicants, as shown in Figure 6. The absolute number increased steadily from fewer than 2 000 at the beginning of the century to over 6 600 applications in 2011, before decreasing for two consecutive years. The share of green TMs in all applications also increased from less than 5% to almost 13% by 2011, but declined afterwards to less than 9% in 2018. However, growth has picked up again in more recent years with the number of EUTM applications with green terms and its share increasing to almost 10 000 EUTMs and 11%, respectively. In general, trends in TMs seem to precede those in patent applications by three years, possibly because TM applications respond faster to changes in the market than patent applications, which are largely determined by R&D investments.

Figure 6:
Number and share of green EUTMs between 2001 and 2021



Germany is also the leading country when it comes to green EUTMs, with a share of almost 30% of all green EUTMs of EU applicants between 2015 and 2021 (see Figure 7). Although smaller than the share in CCMT patent applications, it is still almost three times higher than the share of the second country in this list, France (12.1%). Germany, with 13.2%, also has one of the highest shares of green EUTMs in its overall EUTM portfolio in the same period, and is only second to Finland (13.3%) in this respect. Among the larger EUTM applicant countries, France, the Netherlands and Finland have shares of green TMs in their overall TM portfolios above 10%, while the importance of green TMs is lowest among Polish (5.6%) and Belgian (5.9%) applicants.

Figure 7:
Distribution of green EUTMs by EU Member State, 2015–2021



Source: EUIPO

6.2 CCMT patent- and green TM-intensive industries in the EU

Applying the methodology set out in Appendix 10, 394 out of 615 NACE classes in the matched database for the 27 EU member states and the UK had at least one CCMT patent application filed with the EPO during the 2013–2017 period. Overall, 10.4% of the total of European patents considered in the analysis were related to CCMTs (compared with 9.4% in the 2019 study and 5.9% in the 2016 study). Compared with the previous study, published in 2019, and with the 2016 study, the number of industries which applied for a CCMT patent increased by 20 NACE classes and by 163 NACE classes respectively. Furthermore, there were 492 NACE classes that had at least one green EUTM filed between 2013 and 2017. In total, 7.2% of the EUTMs considered in the analysis were green. These figures support the view that sustainable technologies and products have a transversal effect and can be important for a wide range of economic activities across many industry sectors.

In order to identify industries which can be considered intensive users of CCMT patents and green TMs, the following criteria are applied. First, only those industries which are intensive in patents/TMs are selected. In the next step, to account for the importance of CCMT patents/green TMs within the overall patent/TM portfolio of the industry concerned, the CCMT patent share/green EUTM share is calculated for each NACE class. The set of CCMT patent-intensive/green TM-intensive industries is then defined as those industries which are patent-intensive/TM-intensive and in which the CCMT patent share/green TM share are above the overall average for all industries with at least one CCMT

patent/green TM.⁸⁴ Application of the criteria reveals that while CCMT patents are used in many NACE classes, the majority are concentrated in relatively few of those classes. For example, over 23% of all CCMT patents belong to only three NACE classes. The distribution of green TMs is less skewed, with the top three classes accounting for less than 10% of all green EUTMs.

There are 43 NACE classes that are patent intensive and have a CCMT share above the EU average of 10.3%. They account for 61.1% of all CCMT patents in the matched sample. The 90 TM-intensive industries with a share of green TMs of at least 11.0% account for 35.7 % of all green TMs. Since 23 of them are intensive in both CCMT patents and green TMs, there are, in total, 110 NACE classes that make intensive use of patents or TMs to protect sustainable innovation (illustrated in Figure 8). These industries together account for 77.3% of all CCMT patents and 43.4% of all green TMs in the matched sample.

Figure 8:
Overlap between CCMT patent-intensive and green
TM-intensive industries

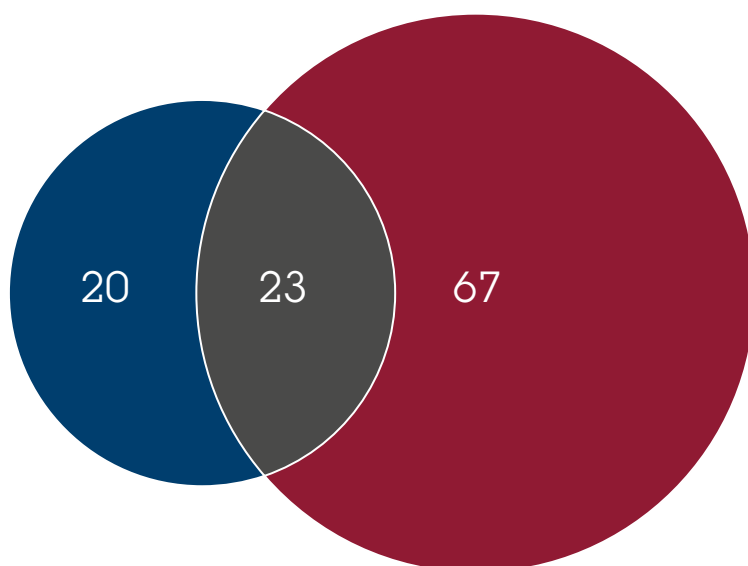


Table 40 shows the ten patent-intensive and TM-intensive industries with the highest shares of CCMT-patents and green TMs, respectively. CCMT patents and green TMs may account for a significant part of an industry's patent and TM portfolios. With a share of almost 85%, 27.20 *Manufacture of batteries and accumulators* is the NACE class with the highest share of CCMT patents, while 49.50 *Transport via pipeline*, with a share of almost 89%, is the industry with the highest share of green TMs. Most of the NACE classes shown in the table are intensive users of both green TMs and CCMT patents, so that many industries are present in both top 10 lists. Interestingly, most of the top NACE classes belong to the most polluting industries: energy and transportation. However, these industries also offer the highest potential for climate change mitigation and greenhouse gas reduction.

⁸⁴ The intermediate steps in the CCMT identification approach, together with a list of NACE classes meeting the identification criteria, can be found in Appendix 10.

Table 40:
Top 10 CCTM patent-intensive (top panel) and green TM-
intensive (bottom panel) industries in the EU

NACE code	NACE description	CCMT patent share	Patent-intensity rank	Green TM-intensive
27.20	Manufacture of batteries and accumulators	84.7%	79	Y
07.29	Mining of other non-ferrous metal ores	78.5%	146	N
35.11	Production of electricity	63.7%	120	Y
35.12	Transmission of electricity	58.9%	148	Y
33.16	Repair and maintenance of aircraft and spacecraft	52.7%	123	N
35.21	Manufacture of gas	49.8%	84	Y
45.19	Sale of other motor vehicles	36.3%	65	N
25.21	Manufacture of central heating radiators and boilers	30.4%	139	Y
28.11	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines	29.4%	6	Y
20.11	Manufacture of industrial gases	27.9%	10	Y

NACE code	NACE description	Green TM share	TM-intensity rank	CCMT patent-intensive
49.50	Transport via pipeline	88.5%	262	N
35.21	Manufacture of gas	68.9%	113	Y
27.20	Manufacture of batteries and accumulators	62.5%	167	Y
35.11	Production of electricity	54.0%	250	Y
25.21	Manufacture of central heating radiators and boilers	49.8%	143	Y
27.51	Manufacture of electric domestic appliances	44.5%	94	N
28.21	Manufacture of ovens, furnaces and furnace burners	40.9%	165	Y
47.43	Retail sale of audio and video equipment in specialised stores	39.0%	216	N
35.12	Transmission of electricity	35.0%	170	Y
30.91	Manufacture of motorcycles	33.0%	44	Y

6.3 Contribution of CCMT patent- and green TM-intensive industries to the EU's economy

As shown in Table 41, CCMT patent- and green TM-intensive industries accounted for 9.3% of total EU employment in the 2017–2019 period. Compared with the previous studies, the contribution of these industries increased slowly but steadily over the years, from 8.9% in 2008–2013 to 9.0% in 2014–2016 to 9.3% in 2017–2019. In absolute terms, the growth of employment in the relevant NACE classes outperformed overall EU labour force developments, registering an 8.9% increase over the previous study. Employment development in industries that are exclusively CCMT patent intensive was more dynamic compared with green TM-intensive NACE classes. The Czech Republic, with 15.8% of employment in 2017–2019, followed by Germany (12.8%) and Slovakia (12.0%),

showed the highest contributions of industries investing in sustainable innovation, as measured by their ownership of CCMT patents.

Table 41:
Contributions of CCMT patent- and green TM-intensive industries to EU employment, GDP and wage premium

	2008–2010	2011–2013	2014–2016	2017–2019
Share in EU employment (direct)	8.9%	8.9%	9.0%	9.3%
Share in EU GDP	13.7%	13.6%	13.7%	14.0%
Average personnel costs (€ per week)	not calculated	not calculated	not calculated	959

The contribution of CCMT patent-intensive industries to the EU's GDP in the 2017–2019 period was 14.0%, far higher than their contribution to EU employment. This shows the high level of productivity of industries that are investing in sustainable innovation in the EU. These industries have also increased their importance for the European economy, since their share in EU GDP increased from 13.6% to 13.7% in the earlier periods. As was the case with employment, GDP growth of CCMT patent-intensive industries was more dynamic than in green TM-intensive industries over the recent periods. On the country level, the Czech Republic, with 21.2% for 2017–2019, Germany (19.4%) and Hungary (18.9%) were the Member States with the highest contributions by such industries to their GDP.

CCMT patent- and green TM-intensive industries paid an average weekly wage of €959 between 2017 and 2019, which exceeds the average wage in all IPR-intensive industries by 14.2% and that in non-IPR-intensive industries by 60.7%. This figure is higher than the wage premium associated with TM-intensive industries.

Table 42 shows the importance of CCMT patent- and green TM-intensive industries to the EU's external trade in goods and services. The share in EU exports attributable to these industries was almost 40% and significantly higher than their contributions to EU GDP or employment. The share in EU imports was calculated at 43.3%. Over the past decade, CCMT patent- and green TM-intensive industries have shifted from a significant deficit in the EU's external trade to a trade surplus of over €36 billion in the most recent period. This is yet another indication that these industries are a significant source of competitive advantage for the EU economy.

Table 42:
Contributions of CCMT patent- and green TM-intensive industries to EU trade

	2008–2010	2011–2013	2014–2016	2017–2019
Share in EU imports	43.9%	45.4%	45.6%	43.3%
Share in EU exports	39.4%	40.9%	40.2%	39.9%
EU trade balance (€ million)	-68 423	-21 397	23 000	36 539

7. Appendix: List of all 357 IPR-intensive industries

Table 43:
List of all 357 IPR-intensive industries

NACE code	NACE description	TM	DES	PAT	CR	GI	PVR
01.00	Crop and animal production, hunting and related service activities						●
06.10	Extraction of crude petroleum	●		●			
07.10	Mining of iron ores	●	●	●			
07.29	Mining of other non-ferrous metal ores			●			
08.11	Quarrying of ornamental and building stone, limestone, gypsum, chalk and slate	●					
08.91	Mining of chemical and fertiliser minerals	●		●			
08.99	Other mining and quarrying n.e.c.	●					
09.10	Support activities for petroleum and natural gas extraction	●		●			
10.20	Processing and preserving of fish, crustaceans and molluscs	●					
10.31	Processing and preserving of potatoes	●					
10.32	Manufacture of fruit and vegetable juice	●	●				
10.39	Other processing and preserving of fruit and vegetables	●					
10.41	Manufacture of oils and fats	●	●				
10.42	Manufacture of margarine and similar edible fats	●	●	●			
10.51	Operation of dairies and cheese making	●	●			●	
10.52	Manufacture of ice cream	●					
10.61	Manufacture of grain mill products	●					●
10.62	Manufacture of starches and starch products	●		●			
10.72	Manufacture of rusks and biscuits; manufacture of preserved pastry goods and cakes	●	●				
10.73	Manufacture of macaroni, noodles, couscous and similar farinaceous products	●	●				
10.81	Manufacture of sugar	●					
10.82	Manufacture of cocoa, chocolate and sugar confectionery	●	●				
10.83	Processing of tea and coffee	●	●	●			
10.84	Manufacture of condiments and seasonings	●					
10.85	Manufacture of prepared meals and dishes	●					
10.86	Manufacture of homogenised food preparations and dietetic food	●	●	●			
10.89	Manufacture of other food products n.e.c.	●	●				

NACE code	NACE description	TM	DES	PAT	CR	GI	PVR
10.91	Manufacture of prepared feeds for farm animals	●					
10.92	Manufacture of prepared pet foods	●	●				
11.01	Distilling, rectifying and blending of spirits	●	●			●	
11.02	Manufacture of wine from grape	●				●	
11.03	Manufacture of cider and other fruit wines	●	●				
11.04	Manufacture of other non-distilled fermented beverages	●	●				
11.05	Manufacture of beer	●	●			●	
11.06	Manufacture of malt	●					
11.07	Manufacture of soft drinks; production of mineral waters and other bottled waters	●	●				
12.00	Manufacture of tobacco products	●	●	●			
13.10	Preparation and spinning of textile fibres	●	●				●
13.20	Weaving of textiles	●	●				
13.30	Finishing of textiles	●					
13.91	Manufacture of knitted and crocheted fabrics	●					
13.92	Manufacture of made-up textile articles, except apparel	●	●				
13.93	Manufacture of carpets and rugs	●	●	●			
13.94	Manufacture of cordage, rope, twine and netting	●	●	●			
13.95	Manufacture of non-wovens and articles made from non-wovens, except apparel	●	●	●			
13.96	Manufacture of other technical and industrial textiles	●	●	●			
13.99	Manufacture of other textiles n.e.c.	●	●	●			
14.11	Manufacture of leather clothes	●	●				
14.12	Manufacture of workwear	●	●				
14.13	Manufacture of other outerwear	●	●				
14.14	Manufacture of underwear		●				
14.19	Manufacture of other wearing apparel and accessories	●	●				
14.20	Manufacture of articles of fur	●					
14.31	Manufacture of knitted and crocheted hosiery	●	●				
14.39	Manufacture of other knitted and crocheted apparel	●	●				
15.12	Manufacture of luggage, handbags and the like, saddlery and harness	●	●				
15.20	Manufacture of footwear	●	●				
16.21	Manufacture of veneer sheets and wood-based panels		●				
16.22	Manufacture of assembled parquet floors		●				
16.23	Manufacture of other builders' carpentry and joinery		●				
16.29	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials	●	●				
17.11	Manufacture of pulp				●		
17.12	Manufacture of paper and paperboard	●	●	●	●		
17.21	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard		●				
17.22	Manufacture of household and sanitary goods and of toilet requisites	●	●	●			
17.23	Manufacture of paper stationery	●	●				
17.24	Manufacture of wallpaper	●	●	●			
17.29	Manufacture of other articles of paper and paperboard	●	●	●			
18.11	Printing of newspapers	●			●		

NACE code	NACE description	TM	DES	PAT	CR	GI	PVR
18.12	Other printing				●		
18.13	Pre-press and pre-media services	●			●		
18.14	Binding and related services				●		
18.20	Reproduction of recorded media	●			●		
19.20	Manufacture of refined petroleum products	●					
20.11	Manufacture of industrial gases	●	●	●			
20.12	Manufacture of dyes and pigments	●		●			
20.13	Manufacture of other inorganic basic chemicals	●		●			
20.14	Manufacture of other organic basic chemicals			●			
20.15	Manufacture of fertilisers and nitrogen compounds	●					
20.16	Manufacture of plastics in primary forms	●		●			
20.17	Manufacture of synthetic rubber in primary forms	●		●			
20.20	Manufacture of pesticides and other agrochemical products	●	●	●			
20.30	Manufacture of paints, varnishes and similar coatings, printing ink and mastics	●		●			
20.41	Manufacture of soap and detergents, cleaning and polishing preparations	●	●	●			
20.42	Manufacture of perfumes and toilet preparations	●	●	●			
20.51	Manufacture of explosives		●	●			
20.52	Manufacture of glues	●		●			
20.53	Manufacture of essential oils	●	●				●
20.59	Manufacture of other chemical products n.e.c.	●	●	●	●		
20.60	Manufacture of man-made fibres	●	●	●			
21.10	Manufacture of basic pharmaceutical products	●	●	●			
21.20	Manufacture of pharmaceutical preparations	●		●			
22.11	Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber tyres	●	●	●			
22.19	Manufacture of other rubber products		●	●			
22.21	Manufacture of plastic plates, sheets, tubes and profiles	●	●	●			
22.22	Manufacture of plastic packing goods	●	●	●			
22.23	Manufacture of builders' ware of plastic	●	●	●			
22.29	Manufacture of other plastic products	●	●	●			
23.11	Manufacture of flat glass	●	●	●			
23.13	Manufacture of hollow glass	●	●				
23.14	Manufacture of glass fibres	●		●			
23.19	Manufacture and processing of other glass, including technical glassware	●	●	●			
23.20	Manufacture of refractory products	●		●			
23.31	Manufacture of ceramic tiles and flags	●	●				
23.32	Manufacture of bricks, tiles and construction products, in baked clay		●				
23.41	Manufacture of ceramic household and ornamental articles	●	●				
23.42	Manufacture of ceramic sanitary fixtures	●	●				
23.43	Manufacture of ceramic insulators and insulating fittings	●		●			
23.44	Manufacture of other technical ceramic products	●		●			
23.49	Manufacture of other ceramic products	●	●	●			
23.52	Manufacture of lime and plaster	●					
23.61	Manufacture of concrete products for construction purposes		●				
23.62	Manufacture of plaster products for construction purposes	●	●				

NACE code	NACE description	TM	DES	PAT	CR	GI	PVR
23.64	Manufacture of mortars	●					
23.65	Manufacture of fibre cement	●					
23.69	Manufacture of other articles of concrete, plaster and cement	●	●	●			
23.70	Cutting, shaping and finishing of stone		●				
23.91	Production of abrasive products	●		●			
23.99	Manufacture of other non-metallic mineral products n.e.c.	●		●			
24.20	Manufacture of tubes, pipes, hollow profiles and related fittings, of steel			●			
24.31	Cold drawing of bars			●			
24.32	Cold rolling of narrow strip	●		●			
24.33	Cold forming or folding		●				
24.34	Cold drawing of wire	●		●			
24.41	Precious metals production	●	●	●			
24.42	Aluminium production		●	●			
24.43	Lead, zinc and tin production		●				
24.45	Other non-ferrous metal production	●	●	●			
24.46	Processing of nuclear fuel			●			
24.52	Casting of steel			●			
25.12	Manufacture of doors and windows of metal		●	●			
25.21	Manufacture of central heating radiators and boilers	●	●	●			
25.30	Manufacture of steam generators, except central heating hot water boilers			●			
25.40	Manufacture of weapons and ammunition	●	●	●			
25.71	Manufacture of cutlery	●	●	●			
25.72	Manufacture of locks and hinges	●	●	●			
25.73	Manufacture of tools	●	●	●			
25.91	Manufacture of steel drums and similar containers	●	●				
25.92	Manufacture of light metal packaging		●				
25.93	Manufacture of wire products, chain and springs		●	●			
25.94	Manufacture of fasteners and screw machine products	●	●	●			
25.99	Manufacture of other fabricated metal products n.e.c.	●	●	●			
26.11	Manufacture of electronic components	●	●	●			
26.12	Manufacture of loaded electronic boards			●			
26.20	Manufacture of computers and peripheral equipment	●	●	●	●		
26.30	Manufacture of communication equipment	●	●	●	●		
26.40	Manufacture of consumer electronics	●	●	●	●		
26.51	Manufacture of instruments and appliances for measuring, testing and navigation	●	●	●			
26.52	Manufacture of watches and clocks	●	●	●			
26.60	Manufacture of irradiation, electromedical and electrotherapeutic equipment	●	●	●			
26.70	Manufacture of optical instruments and photographic equipment	●	●	●	●		
26.80	Manufacture of magnetic and optical media	●	●	●			
27.11	Manufacture of electric motors, generators and transformers			●			
27.12	Manufacture of electricity distribution and control apparatus		●	●			
27.20	Manufacture of batteries and accumulators	●	●	●			
27.31	Manufacture of fibre optic cables				●		

NACE code	NACE description	TM	DES	PAT	CR	GI	PVR
27.32	Manufacture of other electronic and electric wires and cables			●			
27.33	Manufacture of wiring devices		●	●			
27.40	Manufacture of electric lighting equipment	●	●	●			
27.51	Manufacture of electric domestic appliances	●	●	●			
27.52	Manufacture of non-electric domestic appliances	●	●				
27.90	Manufacture of other electrical equipment	●	●	●			
28.11	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines	●	●	●			
28.12	Manufacture of fluid power equipment		●	●			
28.13	Manufacture of other pumps and compressors	●	●	●			
28.14	Manufacture of other taps and valves	●	●	●			
28.15	Manufacture of bearings, gears, gearing and driving elements			●			
28.21	Manufacture of ovens, furnaces and furnace burners	●	●	●			
28.22	Manufacture of lifting and handling equipment			●			
28.23	Manufacture of office machinery and equipment (except computers and peripheral equipment)	●	●	●	●		
28.24	Manufacture of power-driven hand tools		●	●			
28.25	Manufacture of non-domestic cooling and ventilation equipment	●		●			
28.29	Manufacture of other general-purpose machinery n.e.c.	●	●	●			
28.30	Manufacture of agricultural and forestry machinery	●	●	●			
28.41	Manufacture of metal forming machinery	●		●			
28.49	Manufacture of other machine tools	●	●	●			
28.91	Manufacture of machinery for metallurgy	●	●	●			
28.92	Manufacture of machinery for mining, quarrying and construction	●	●	●			
28.93	Manufacture of machinery for food, beverage and tobacco processing	●	●	●			
28.94	Manufacture of machinery for textile, apparel and leather production	●	●	●			
28.95	Manufacture of machinery for paper and paperboard production	●		●			
28.96	Manufacture of plastics and rubber machinery	●		●			
28.99	Manufacture of other special-purpose machinery n.e.c.	●	●	●			
29.10	Manufacture of motor vehicles		●	●			
29.20	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers		●	●			
29.31	Manufacture of electrical and electronic equipment for motor vehicles			●			
29.32	Manufacture of other parts and accessories for motor vehicles		●	●			
30.11	Building of ships and floating structures			●			
30.12	Building of pleasure and sporting boats	●	●				
30.20	Manufacture of railway locomotives and rolling stock			●			
30.30	Manufacture of air and spacecraft and related machinery			●			
30.40	Manufacture of military fighting vehicles			●			
30.91	Manufacture of motorcycles	●	●	●			
30.92	Manufacture of bicycles and invalid carriages	●	●	●			
30.99	Manufacture of other transport equipment n.e.c.	●	●	●			
31.01	Manufacture of office and shop furniture	●	●				
31.02	Manufacture of kitchen furniture		●				
31.03	Manufacture of mattresses	●	●				

NACE code	NACE description	TM	DES	PAT	CR	GI	PVR
31.09	Manufacture of other furniture		●				
32.11	Striking of coins	●	●		●		
32.12	Manufacture of jewellery and related articles	●	●		●		
32.13	Manufacture of imitation jewellery and related articles	●	●				
32.20	Manufacture of musical instruments	●	●		●		
32.30	Manufacture of sports goods	●	●	●			
32.40	Manufacture of games and toys	●	●		●		
32.50	Manufacture of medical and dental instruments and supplies	●	●	●			
32.91	Manufacture of brooms and brushes	●	●	●			
32.99	Other manufacturing n.e.c.	●	●	●			
33.16	Repair and maintenance of aircraft and spacecraft			●			
33.19	Repair of other equipment	●					
33.20	Installation of industrial machinery and equipment			●			
35.11	Production of electricity	●		●			
35.12	Transmission of electricity	●		●			
35.21	Manufacture of gas	●		●			
41.10	Development of building projects	●					
42.91	Construction of water projects			●			
45.19	Sale of other motor vehicles			●			
45.31	Wholesale trade of motor vehicle parts and accessories	●		●			
45.40	Sale, maintenance and repair of motorcycles and related parts and accessories	●	●				
46.11	Agents involved in the sale of agricultural raw materials, live animals, textile raw materials and semi-finished goods	●	●				●
46.12	Agents involved in the sale of fuels, ores, metals and industrial chemicals	●					
46.13	Agents involved in the sale of timber and building materials	●					
46.14	Agents involved in the sale of machinery, industrial equipment, ships and aircraft	●	●	●			
46.15	Agents involved in the sale of furniture, household goods, hardware and ironmongery	●	●				
46.16	Agents involved in the sale of textiles, clothing, fur, footwear and leather goods	●	●				
46.17	Agents involved in the sale of food, beverages and tobacco	●					
46.18	Agents specialised in the sale of other particular products	●	●				
46.19	Agents involved in the sale of a variety of goods	●	●				
46.21	Wholesale of grain, unmanufactured tobacco, seeds and animal feeds	●					●
46.22	Wholesale of flowers and plants	●					●
46.24	Wholesale of hides, skins and leather	●					
46.31	Wholesale of fruit and vegetables	●					
46.32	Wholesale of meat and meat products	●					
46.33	Wholesale of dairy products, eggs and edible oils and fats	●					
46.34	Wholesale of beverages	●					
46.35	Wholesale of tobacco products	●					
46.36	Wholesale of sugar and chocolate and sugar confectionery	●	●				
46.37	Wholesale of coffee, tea, cocoa and spices	●					
46.38	Wholesale of other food, including fish, crustaceans and molluscs	●					
46.39	Non-specialised wholesale of food, beverages and tobacco	●					

NACE code	NACE description	TM	DES	PAT	CR	GI	PVR
46.41	Wholesale of textiles	●	●				
46.42	Wholesale of clothing and footwear	●	●				
46.43	Wholesale of electrical household appliances	●	●	●	●		
46.44	Wholesale of china and glassware and cleaning materials	●	●				
46.45	Wholesale of perfume and cosmetics	●	●				
46.46	Wholesale of pharmaceutical goods	●		●			
46.47	Wholesale of furniture, carpets and lighting equipment	●	●				
46.48	Wholesale of watches and jewellery	●	●				
46.49	Wholesale of other household goods	●	●				
46.51	Wholesale of computers, computer peripheral equipment and software	●			●		
46.52	Wholesale of electronic and telecommunications equipment and parts	●	●	●	●		
46.62	Wholesale of machine tools	●					
46.64	Wholesale of machinery for the textile industry and of sewing and knitting machines	●		●			
46.65	Wholesale of office furniture	●	●				
46.66	Wholesale of other office machinery and equipment	●			●		
46.69	Wholesale of other machinery and equipment	●	●	●			
46.71	Wholesale of solid, liquid and gaseous fuels and related products	●					
46.72	Wholesale of metals and metal ores		●				
46.73	Wholesale of wood, construction materials and sanitary equipment	●	●				
46.74	Wholesale of hardware, plumbing and heating equipment and supplies	●	●				
46.75	Wholesale of chemical products	●		●			
46.76	Wholesale of other intermediate products	●	●		●		
46.90	Non-specialised wholesale trade	●	●				
47.29	Other retail sale of food in specialised stores	●					
47.41	Retail sale of computers, peripheral units and software in specialised stores	●			●		
47.42	Retail sale of telecommunications equipment in specialised stores			●			
47.43	Retail sale of audio and video equipment in specialised stores	●			●		
47.51	Retail sale of textiles in specialised stores	●	●				
47.59	Retail sale of furniture, lighting equipment and other household articles in specialised stores		●				
47.61	Retail sale of books in specialised stores				●		
47.62	Retail sale of newspapers and stationery in specialised stores				●		
47.63	Retail sale of music and video recordings in specialised stores				●		
47.64	Retail sale of sporting equipment in specialised stores	●					
47.65	Retail sale of games and toys in specialised stores	●					
47.72	Retail sale of footwear and leather goods in specialised stores	●					
47.74	Retail sale of medical and orthopaedic goods in specialised stores	●					
47.75	Retail sale of cosmetic and toilet articles in specialised stores	●					
47.77	Retail sale of watches and jewellery in specialised stores		●				
47.78	Other retail sale of new goods in specialised stores	●	●		●		
47.91	Retail sale via mail order houses or via Internet	●	●				
47.99	Other retail sale not in stores, stalls or markets	●					
49.50	Transport via pipeline	●					

NACE code	NACE description	TM	DES	PAT	CR	GI	PVR
50.10	Sea and coastal passenger water transport	●					
50.30	Inland passenger water transport	●					
55.90	Other accommodation	●					
58.11	Book publishing	●			●		
58.12	Publishing of directories and mailing lists	●			●		
58.13	Publishing of newspapers				●		
58.14	Publishing of journals and periodicals	●			●		
58.19	Other publishing activities	●			●		
58.21	Publishing of computer games	●	●		●		
58.29	Other software publishing	●		●	●		
59.11	Motion picture, video and television programme production activities	●			●		
59.12	Motion picture, video and television programme post-production activities	●			●		
59.13	Motion picture, video and television programme distribution activities	●			●		
59.14	Motion picture projection activities				●		
59.20	Sound recording and music publishing activities	●	●		●		
60.10	Radio broadcasting	●			●		
60.20	Television programming and broadcasting activities	●			●		
61.10	Wired telecommunications activities				●		
61.20	Wireless telecommunications activities	●			●		
61.30	Satellite telecommunications activities	●			●		
61.90	Other telecommunications activities	●		●	●		
62.01	Computer programming activities	●			●		
62.02	Computer consultancy activities	●			●		
62.03	Computer facilities management activities	●			●		
62.09	Other information technology and computer service activities	●			●		
63.11	Data processing, hosting and related activities	●			●		
63.12	Web portals	●			●		
63.91	News agency activities				●		
63.99	Other information service activities n.e.c.	●			●		
66.00	Activities auxiliary to financial services and insurance activities	●					
68.10	Buying and selling of own real estate	●	●	●			
68.20	Renting and operating of own or leased real estate	●					
70.21	Public relations and communication activities	●			●		
70.22	Business and other management consultancy activities	●					
71.12	Engineering activities and related technical consultancy			●			
72.11	Research and experimental development on biotechnology	●	●	●			●
72.19	Other research and experimental development on natural sciences and engineering	●	●	●			●
72.20	Research and experimental development on social sciences and humanities	●		●			
73.11	Advertising agencies	●			●		
73.12	Media representation	●			●		
73.20	Market research and public opinion polling	●		●			
74.10	Specialised design activities	●	●		●		
74.20	Photographic activities				●		

NACE code	NACE description	TM	DES	PAT	CR	GI	PVR
74.30	Translation and interpretation activities				●		
74.90	Other professional, scientific and technical activities n.e.c.	●	●	●			
77.12	Renting and leasing of trucks	●					
77.21	Renting and leasing of recreational and sports goods	●					
77.22	Renting of video tapes and disks				●		
77.29	Renting and leasing of other personal and household goods				●		
77.31	Renting and leasing of agricultural machinery and equipment						●
77.33	Renting and leasing of office machinery and equipment (including computers)				●		
77.35	Renting and leasing of air transport equipment	●					
77.39	Renting and leasing of other machinery, equipment and tangible goods n.e.c.	●			●		
77.40	Leasing of intellectual property and similar products, except copyrighted works	●	●	●			●
79.11	Travel agency activities	●					
79.12	Tour operator activities	●					
79.90	Other reservation service and related activities	●			●		
82.11	Combined office administrative service activities	●	●				
82.19	Photocopying, document preparation and other specialised office support activities				●		
82.30	Organisation of conventions and trade shows	●					
82.91	Activities of collection agencies and credit bureaus	●					
85.52	Cultural education				●		
90.01	Performing arts				●		
90.02	Support activities to performing arts				●		
90.03	Artistic creation				●		
90.04	Operation of arts facilities				●		
91.01	Library and archives activities				●		
91.02	Museums activities				●		
91.03	Operation of historical sites and buildings and similar visitors attractions				●		
92.00	Gambling and betting activities	●					
93.00	Sports activities and amusement and recreation activities	●					
93.21	Activities of amusement parks and theme parks				●		
93.29	Other amusement and recreation activities				●		
94.12	Activities of professional membership organisations				●		
94.99	Activities of other membership organisations n.e.c.				●		

8. Appendix: Methodology and data

8.1 Data matching methodology: detailed description

IP property registers are valuable sources of data for analysing individual companies, industries or countries. However, researchers using such data face many challenges. The two main ones are:

Lack of harmonised names

IP registers tend to have many double or multiple entries for the same applicant, as filers do not always use their existing identification numbers but rather create a new ID with the same or slightly changed applicant data on each subsequent filing. In these circumstances it is very difficult to tabulate the list of the biggest filers, as the filings of one company could be distributed over many different IDs in the registers. Duplicates can also arise as a result of the different registration routes. At the EUIPO, for example, applicants can choose between direct applications and the international route (Madrid Protocol).

Lack of comprehensive information about applicants

The ownership data stored in the IP registers is very limited and usually consists of name, address and contact details. It does not include information that would allow for IP-related economic research.

In recent years, efforts have been made to harmonise names in IP registers (mostly patent registers) and to match them with company register data.⁸⁵ The present study has benefited from the experience and knowledge gained by researchers and organisations involved in these efforts. However, due to the extended geographical reach of the study (EU) and the scope of the IPRs it covers (patents, TMs, designs and PVRs), the results of previous harmonisation and matching projects could not be directly applied and a new methodology of name harmonisation and data matching had to be developed and implemented.

The algorithms used in the first phase – name harmonisation – were based to a large extent on the KUL Leuven/Eurostat methodology.⁸⁶

The second phase consisted of matching cleaned and harmonised EUIPO, CPVO and PATSTAT

⁸⁵ Examples include the KUL Leuven/Eurostat methodology for harmonising names in the PATSTAT database, the OECD's HAN database, the UK IPO's OFLIP database, Ribeiro et al. 2010 and Dorner and Harhoff (2018)

⁸⁶ Data Production Methods for Harmonised Patent Statistics: Patentee Name Harmonisation, Eurostat 2006.

data (IPR owners' datasets) with the ORBIS database. ORBIS is a source of comprehensive demographic and financial data gathered from national company registers. It is commonly used to analyse the economic performance of business entities. The information available in ORBIS is sourced in each country from various information providers which deliver data collected by national or local public institutions to meet legal or administrative requirements.

The name harmonisation and matching process consisted of the following stages:

- capitalisation and cleaning of names (double spaces, non-printable characters)
- normalisation of special characters using NFKD⁸⁷ and transliteration equivalence (Greek)
- extraction of national legal information
- cleaning of national non-distinctive and weak words
- correction of postcodes

These processes were applied to IPR owners in the ORBIS, EUIPO, PATSTAT and CPVO databases.

8.1.1 Data pre-processing

Before name harmonisation and data matching could be carried out, the data first had to be pre-processed, i.e. problems relating to the use of different cases in names (upper, lower or title case) had to be eliminated. Even if the content of the name string in the various datasets was the same, it would not be treated as such if two different case conventions were used. To deal with this problem, applicant names in the EUIPO, EPO, CPVO and ORBIS datasets were converted to upper case.

By default, IP registers can record applicant names using the alphabets of their official country languages, such as Latin, Greek and Bulgarian Cyrillic. In the case of the Latin alphabet, several specific extensions are used to represent national characters, letters with tone and other diacritics. Nevertheless, applicants or their legal representatives sometimes file new applications with the name already converted into its basic Latin equivalent, without any specific national characters. In such cases, automatic algorithms cannot recognise this basic Latin form of the name as equivalent to the original one. This problem was dealt with by applying the Unicode normalisation transformation procedure. This enabled automatic conversion of names into normalised basic Unicode forms.

Greek names had to be treated specifically in order to ensure that names that may have been transliterated differently in the different registers were represented identically. For example, "αυ" (alpha-upsilon) may have been transliterated as "av", "af", "au" or "ay".

In a further pre-processing step, all characters other than a-zA-Z0-9&@\$+ were replaced with a space, and full stops were removed. Leading and trailing whitespaces were also removed, and multiple whitespaces reduced to one space.

⁸⁷ Normalization Form Compatibility Composition, a specification of Unicode Equivalence.

8.1.2 Legal form cleaning

After the initial data pre-processing, proper name cleaning was carried out in order to eliminate any non-distinctive information that could impede the correct grouping of individual IDs and the subsequent matching with the external data source. The key part of the name cleaning was the standardisation and division of the name field into base and legal form denominations. Due to the specific challenge of processing owner data from 28 different countries, it was essential to avoid a situation in which character strings that indicate legal forms in some countries but are a distinctive part of the names in others were erroneously deleted. That is why it was decided to deal with legal form denominations on a country-by-country basis. A dictionary was created, containing regular expressions (regex) allowing identification and removal of legal forms typical in each EU Member State.⁸⁸ Regex is a very powerful way to capture in one line several variations of a string describing the same legal form. Thus, with limited lines of code, it was possible to capture, remove and assign to a separate column the standardised versions of almost all the legal form denominations used in every EU Member State.

Legal form cleaning was done by filtering only the regex legal form relevant for the given country and looping the names of applicants having their seat in that same country over each regex.

For some countries (BE, DE and PL), an additional step was needed. In the case of Belgium, the purpose was mainly to look for cases where the legal form was indicated in both French and Dutch. Cleaning only one legal form denomination was not effective in those cases as the same legal form could be indicated in the second official language and still be part of the name field after cleaning. For Germany and Poland, the second cleaning loop was designed to deal with composite legal forms such as GMBH CO KG or Spółka z ograniczoną odpowiedzialnością spółka komandytowo-akcyjna, which are composed of two or more legal forms that are also used in the legal context as separate stand-alone legal forms. In some countries, legal form descriptions are separated by other words which are distinctive to the companies. In such cases, as a first step before the legal form cleaning, the legal form was standardised as the final part of the string, leaving all other words as an integral part of the normalised name.

The legal form cleaning procedure was conducted on the four datasets (EUIPO, EPO, CPVO and ORBIS) separately.

After completion of this step, there were separate tables (four tables for each country, corresponding to the four data sources) containing the normalised name field, without legal form denominations, for each company present in the original EUIPO, EPO, CPVO and ORBIS datasets. A further column was then added, containing the standardised legal forms derived from the information present in the original name field and deleted from the normalised name field during the cleaning process.

8.1.3 Preparing data for matching algorithm

As with legal form cleaning, the direct preparation for matching and the matching phases were carried out on a country-by-country basis. For each country, the tables containing the results from the previous step (legal form cleaning) were the starting point.

⁸⁸ In cases of bilingual countries such as Belgium, legal forms specific to the Flemish and Walloon regions were included, and each name was processed twice, checking for the presence of Flemish-specific and Walloon-specific legal forms.

As a first step, each country was assigned a code specific to that country/language, and non-distinctive words were removed from the normalised names. The list of non-distinctive words was based on a calculation of the presence of words within company names, e.g. the words “the”, “of” or “Irish” in the case of Ireland.

In the next step, the “trading as” denominations within each of three datasets were examined. “Trading as” indications are also country/language-specific. If a name contained the “trading as” type of denomination, two additional fields were created, NormCompany_short being the part preceding the “trading as” string, and TradingAs being the part after the trading as expression. For example, the name “European Union Intellectual Property Office trading as EUIPO” would be converted into three fields: the normalised field EUROPEAN UNION INTELLECTUAL PROPERTY OFFICE TRADING AS EUIPO, the NormCompany_short field EUROPEAN UNION INTELLECTUAL PROPERTY OFFICE and the TradingAs field EUIPO. After creating these two additional fields, a check was carried out to determine whether companies that could not be matched/grouped on the basis of the normalised name had a match with other IDs based on the NormCompany/NormCompany_short comparison.

A substantial number of applicants in the IP registers are natural persons. It was decided not to filter them out of the respective datasets to allow for matching if there was a corresponding ID in ORBIS. However, there is no separate field in PATSTAT for indicating whether or not an applicant is a natural person. In addition, natural persons’ names are formatted differently in IPR repositories than in ORBIS. To resolve this problem, the separate words in the applicant name and entity name in all data repositories were ordered alphabetically before matching.

After this step, all the spaces between the words were removed, forming a normalised name, thus creating one string composed of all the words left from the name after the processing in the previous stages.

The last step in the process of data preparation for the final match consisted of grouping each of the datasets from the EPO, EUIPO, CPVO and ORBIS by normalised name. In doing so, the individual record ID numbers, address and legal form information were retained in the concatenated format.

8.1.4 Matching EUIPO, PATSTAT and CPVO datasets with ORBIS

The aim of the procedure was to match IPR owners’ datasets with ORBIS. In the first iteration, possible matches were checked using NormCompany IPR owners’ datasets and the NormCompany field from ORBIS. All the matches were assigned to a separate dataset, and subsequent search iterations were performed for matches using the TradingAs and NormCompany_short fields originally stemming from each of the four datasets. This was done by first taking the NormCompany_short field from the ORBIS dataset and checking for matches with the NormCompany IPR owners’ datasets. In the case of a match, the matched records were assigned to a matched dataset. Then, a match between TradingAs fields with the NormCompany in the IPR owners’ datasets was carried out for those records that had not been matched in the preceding stages.

8.1.5 Post-match data processing (disambiguation)

After the initial matching phase described above, one-to-one matches (where one IPR owner's dataset record matched with one ORBIS record) were filtered out, and one-to-many matches (where one IPR owner's dataset record matched several ORBIS records) were selected for further processing. At this stage, additional information (other than the company name) was used. This information was either available in the original four datasets or had been created in the process of legal form cleaning.

The ORBIS dataset contains a field called DUO (domestic ultimate owner). As a first step, all the companies from the ORBIS dataset were grouped by their normalised name and a check was carried out to establish how many unique DUO numbers corresponded to each group. If there was only one DUO number associated with several ORBIS firms with the same normalised name, then the record associated with that company was taken as a potential match. Before matching those records, the completeness of the DUO company record was compared with that of the other companies in the group, in terms of turnover and employment reported. The IPR owner's dataset record was matched to one relevant ORBIS record (DUO or subsidiary) only, namely the one with the highest turnover and employment figures within the group.

In the next step, groups of ORBIS records with the same normalised name and the same Bureau van Dijk (BvD) ID root were identified. Sometimes ORBIS branches or subsidiaries have the same number as the parent company, with additional digits separated from the root number with a hyphen. This hyphen and all digits following the hyphen were stripped off to check whether all the ORBIS companies with the same normalised name had the same root BvD ID number. If so, the IPR owner's dataset record was linked with the company whose BvD ID number was the root number for all ORBIS companies with the same normalised name.

Subsequently, the algorithm checked whether, of the ORBIS companies with the same normalised name, there was only one company with the same legal form as at least one company in the IPR owner's dataset.

In a final attempt to find a unique match, the address, postcode and legal form information in the IPR owner's dataset record were compared with those in the various ORBIS records matched to it. If based on those criteria only one ORBIS record matched the IPR owner's dataset record, it was added to the matched dataset.

The final stage of the disambiguation process consisted of concatenating the initial matched dataset (one-to-one matches between IPR owners' datasets and ORBIS records) with the datasets created during the various stages of the disambiguation process described above. The resulting dataset contained all the records with a one-to-one relationship between IPR owners' datasets and ORBIS tables. The matched records which still had one-to-many relationships following the disambiguation process were disregarded.

For some countries and specific IPRs, the number of companies found was not considered to be sufficient and an additional manual matching exercise was performed. A random manual check on automatic matching confirmed the reliability of the results.

8.1.6 Preparing the final concordance tables

After finalising the disambiguation process and the manual check, various concordance tables were created, serving as a bridge between the data stored in the various data repositories needed for economic analysis of the IPRs. The link between IP register and ORBIS records in the concordance tables is one-to-one.

There are three main concordance tables:

- The ORBIS-EPO concordance table: the primary key was the person_id number from the tIs206_person table of PATSTAT and the BvD ID number from the ORBIS dataset. This table was used to link the patent information in PATSTAT to the demographic and financial data on the European companies in the ORBIS dataset.
- The ORBIS-EUIPO concordance table: the primary key was the owner_code from the dim_owner table of the EUIPO's data warehouse and the BvD ID number from the ORBIS dataset. This table was used to link trade mark and design information in the EUIPO register to demographic and financial data on European companies in the ORBIS dataset.
- The ORBIS-CPVO concordance table: a primary key for the CPVO (created ad hoc) and the BvD ID number from the ORBIS dataset. This table was used to link plant varieties registered at the CPVO with demographic and financial data on European companies in the ORBIS dataset.

8.2 Patent-intensive industries

Table 44:
Patent-intensive industries

NACE code	NACE description	Patents per 1 000 employees
77.40	Leasing of intellectual property and similar products, except copyrighted works	107.92
26.30	Manufacture of communication equipment	41.94
72.11	Research and experimental development on biotechnology	27.65
23.11	Manufacture of flat glass	20.61
28.91	Manufacture of machinery for metallurgy	18.55
28.11	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines	15.86
72.19	Other research and experimental development on natural sciences and engineering	15.54
26.11	Manufacture of electronic components	15.47
27.51	Manufacture of electric domestic appliances	15.37
20.11	Manufacture of industrial gases	14.60
28.23	Manufacture of office machinery and equipment (except computers and peripheral equipment)	14.36
30.99	Manufacture of other transport equipment n.e.c.	13.19
22.11	Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber tyres	12.88
26.60	Manufacture of irradiation, electromedical and electrotherapeutic equipment	12.63

NACE code	NACE description	Patents per 1 000 employees
26.70	Manufacture of optical instruments and photographic equipment	12.10
23.43	Manufacture of ceramic insulators and insulating fittings	11.30
28.95	Manufacture of machinery for paper and paperboard production	11.29
28.30	Manufacture of agricultural and forestry machinery	11.01
24.34	Cold drawing of wire	10.81
28.94	Manufacture of machinery for textile, apparel and leather production	10.41
25.72	Manufacture of locks and hinges	10.17
24.45	Other non-ferrous metal production	9.91
21.10	Manufacture of basic pharmaceutical products	9.87
28.99	Manufacture of other special-purpose machinery n.e.c.	9.61
30.40	Manufacture of military fighting vehicles	9.39
26.20	Manufacture of computers and peripheral equipment	9.33
28.93	Manufacture of machinery for food, beverage and tobacco processing	8.97
46.52	Wholesale of electronic and telecommunications equipment and parts	8.84
27.40	Manufacture of electric lighting equipment	8.72
06.10	Extraction of crude petroleum	8.59
30.30	Manufacture of air and spacecraft and related machinery	8.52
20.59	Manufacture of other chemical products n.e.c.	8.44
28.15	Manufacture of bearings, gears, gearing and driving elements	7.09
26.51	Manufacture of instruments and appliances for measuring, testing and navigation	6.95
28.49	Manufacture of other machine tools	6.51
23.44	Manufacture of other technical ceramic products	6.29
29.32	Manufacture of other parts and accessories for motor vehicles	6.03
20.16	Manufacture of plastics in primary forms	5.99
28.13	Manufacture of other pumps and compressors	5.97
21.20	Manufacture of pharmaceutical preparations	5.82
20.51	Manufacture of explosives	5.80
32.99	Other manufacturing n.e.c.	5.61
27.90	Manufacture of other electrical equipment	5.59
28.14	Manufacture of other taps and valves	5.45
32.50	Manufacture of medical and dental instruments and supplies	5.34
10.62	Manufacture of starches and starch products	5.23
20.42	Manufacture of perfumes and toilet preparations	5.18
23.14	Manufacture of glass fibres	5.15
23.19	Manufacture and processing of other glass, including technical glassware	5.14
09.10	Support activities for petroleum and natural gas extraction	5.14
28.92	Manufacture of machinery for mining, quarrying and construction	5.03
29.31	Manufacture of electrical and electronic equipment for motor vehicles	5.02
28.29	Manufacture of other general-purpose machinery n.e.c.	4.96
32.30	Manufacture of sports goods	4.76
26.40	Manufacture of consumer electronics	4.60
30.91	Manufacture of motorcycles	4.39
30.92	Manufacture of bicycles and invalid carriages	4.02
12.00	Manufacture of tobacco products	4.01

NACE code	NACE description	Patents per 1 000 employees
28.96	Manufacture of plastics and rubber machinery	3.99
47.42	Retail sale of telecommunications equipment in specialised stores	3.82
28.41	Manufacture of metal forming machinery	3.76
28.22	Manufacture of lifting and handling equipment	3.74
10.86	Manufacture of homogenised food preparations and dietetic food	3.69
30.20	Manufacture of railway locomotives and rolling stock	3.65
45.19	Sale of other motor vehicles	3.58
28.21	Manufacture of ovens, furnaces and furnace burners	3.47
20.60	Manufacture of man-made fibres	3.45
20.20	Manufacture of pesticides and other agrochemical products	3.44
20.52	Manufacture of glues	3.39
74.90	Other professional, scientific and technical activities n.e.c.	3.26
25.30	Manufacture of steam generators, except central heating hot water boilers	3.19
20.17	Manufacture of synthetic rubber in primary forms	3.16
73.20	Market research and public opinion polling	3.15
17.24	Manufacture of wallpaper	3.13
46.43	Wholesale of electrical household appliances	3.08
20.13	Manufacture of other inorganic basic chemicals	3.01
25.73	Manufacture of tools	3.00
20.14	Manufacture of other organic basic chemicals	2.94
27.20	Manufacture of batteries and accumulators	2.85
27.12	Manufacture of electricity distribution and control apparatus	2.72
33.20	Installation of industrial machinery and equipment	2.54
13.95	Manufacture of non-wovens and articles made from non-wovens, except apparel	2.53
22.22	Manufacture of plastic packing goods	2.45
35.21	Manufacture of gas	2.45
10.42	Manufacture of margarine and similar edible fats	2.44
71.12	Engineering activities and related technical consultancy	2.40
27.11	Manufacture of electric motors, generators and transformers	2.39
23.69	Manufacture of other articles of concrete, plaster and cement	2.38
72.20	Research and experimental development on social sciences and humanities	2.34
28.12	Manufacture of fluid power equipment	2.34
27.33	Manufacture of wiring devices	2.32
25.40	Manufacture of weapons and ammunition	2.25
61.90	Other telecommunications activities	2.24
26.52	Manufacture of watches and clocks	2.24
25.93	Manufacture of wire products, chain and springs	2.22
17.12	Manufacture of paper and paperboard	2.19
23.49	Manufacture of other ceramic products	2.14
25.94	Manufacture of fasteners and screw machine products	2.10
23.99	Manufacture of other non-metallic mineral products n.e.c.	2.09
46.64	Wholesale of machinery for the textile industry and of sewing and knitting machines	1.95
46.46	Wholesale of pharmaceutical goods	1.95
23.20	Manufacture of refractory products	1.94

NACE code	NACE description	Patents per 1 000 employees
28.25	Manufacture of non-domestic cooling and ventilation equipment	1.93
25.71	Manufacture of cutlery	1.93
22.29	Manufacture of other plastic products	1.90
29.10	Manufacture of motor vehicles	1.87
20.30	Manufacture of paints, varnishes and similar coatings, printing ink and mastics	1.85
27.32	Manufacture of other electronic and electric wires and cables	1.85
24.41	Precious metals production	1.84
24.52	Casting of steel	1.81
25.99	Manufacture of other fabricated metal products n.e.c.	1.73
22.19	Manufacture of other rubber products	1.71
26.80	Manufacture of magnetic and optical media	1.67
20.12	Manufacture of dyes and pigments	1.63
08.91	Mining of chemical and fertiliser minerals	1.62
22.21	Manufacture of plastic plates, sheets, tubes and profiles	1.59
46.14	Agents involved in the sale of machinery, industrial equipment, ships and aircraft	1.53
24.42	Aluminium production	1.49
28.24	Manufacture of power-driven hand tools	1.46
35.11	Production of electricity	1.42
45.31	Wholesale trade of motor vehicle parts and accessories	1.41
20.41	Manufacture of soap and detergents, cleaning and polishing preparations	1.39
33.16	Repair and maintenance of aircraft and spacecraft	1.37
46.69	Wholesale of other machinery and equipment	1.35
10.83	Processing of tea and coffee	1.35
17.22	Manufacture of household and sanitary goods and of toilet requisites	1.33
42.91	Construction of water projects	1.27
46.75	Wholesale of chemical products	1.26
30.11	Building of ships and floating structures	1.24
13.96	Manufacture of other technical and industrial textiles	1.24
13.99	Manufacture of other textiles n.e.c.	1.22
13.94	Manufacture of cordage, rope, twine and netting	1.18
32.91	Manufacture of brooms and brushes	1.16
29.20	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers	1.14
23.91	Production of abrasive products	1.13
24.32	Cold rolling of narrow strip	1.12
24.20	Manufacture of tubes, pipes, hollow profiles and related fittings, of steel	1.08
24.46	Processing of nuclear fuel	1.08
25.21	Manufacture of central heating radiators and boilers	1.07
22.23	Manufacture of builders' ware of plastic	1.06
24.31	Cold drawing of bars	1.06
07.10	Mining of iron ores	1.05
58.29	Other software publishing	1.02
13.93	Manufacture of carpets and rugs	1.01
26.12	Manufacture of loaded electronic boards	0.99
07.29	Mining of other non-ferrous metal ores	0.98

NACE code	NACE description	Patents per 1 000 employees
25.12	Manufacture of doors and windows of metal	0.97
35.12	Transmission of electricity	0.96
17.29	Manufacture of other articles of paper and paperboard	0.96
68.10	Buying and selling of own real estate	0.95

8.3 TM-intensive industries

Table 45:
TM-intensive industries

NACE code	NACE description	EUTMs per 1 000 employees
77.40	Leasing of intellectual property and similar products, except copyrighted works	512.41
11.04	Manufacture of other non-distilled fermented beverages	90.10
58.21	Publishing of computer games	74.67
17.24	Manufacture of wallpaper	73.92
10.86	Manufacture of homogenised food preparations and dietetic food	65.33
72.11	Research and experimental development on biotechnology	51.36
26.80	Manufacture of magnetic and optical media	48.53
30.99	Manufacture of other transport equipment n.e.c.	46.02
11.01	Distilling, rectifying and blending of spirits	45.79
20.42	Manufacture of perfumes and toilet preparations	42.95
11.02	Manufacture of wine from grape	42.78
21.10	Manufacture of basic pharmaceutical products	42.53
32.40	Manufacture of games and toys	40.68
32.30	Manufacture of sports goods	39.84
26.52	Manufacture of watches and clocks	37.16
32.99	Other manufacturing n.e.c.	36.07
63.12	Web portals	36.00
59.20	Sound recording and music publishing activities	35.73
23.43	Manufacture of ceramic insulators and insulating fittings	34.71
10.89	Manufacture of other food products n.e.c.	33.16
59.13	Motion picture, video and television programme distribution activities	33.15
58.19	Other publishing activities	33.12
58.29	Other software publishing	32.13
10.42	Manufacture of margarine and similar edible fats	31.52
14.19	Manufacture of other wearing apparel and accessories	31.15
20.20	Manufacture of pesticides and other agrochemical products	30.85
46.41	Wholesale of textiles	29.03
18.11	Printing of newspapers	27.88
20.59	Manufacture of other chemical products n.e.c.	27.82
46.49	Wholesale of other household goods	27.75
08.99	Other mining and quarrying n.e.c.	27.68
46.45	Wholesale of perfume and cosmetics	27.57

NACE code	NACE description	EUTMs per 1 000 employees
46.42	Wholesale of clothing and footwear	27.53
30.92	Manufacture of bicycles and invalid carriages	27.35
11.03	Manufacture of cider and other fruit wines	26.38
47.91	Retail sale via mail order houses or via Internet	26.23
12.00	Manufacture of tobacco products	25.63
06.10	Extraction of crude petroleum	25.58
46.37	Wholesale of coffee, tea, cocoa and spices	25.57
10.92	Manufacture of prepared pet foods	25.52
20.41	Manufacture of soap and detergents, cleaning and polishing preparations	24.86
63.99	Other information service activities n.e.c.	24.66
11.06	Manufacture of malt	24.10
30.91	Manufacture of motorcycles	23.82
14.11	Manufacture of leather clothes	23.42
46.48	Wholesale of watches and jewellery	22.96
11.05	Manufacture of beer	22.27
59.11	Motion picture, video and television programme production activities	22.08
10.83	Processing of tea and coffee	21.94
46.16	Agents involved in the sale of textiles, clothing, fur, footwear and leather goods	21.60
26.60	Manufacture of irradiation, electromedical and electrotherapeutic equipment	21.00
10.73	Manufacture of macaroni, noodles, couscous and similar farinaceous products	20.79
26.40	Manufacture of consumer electronics	20.77
62.09	Other information technology and computer service activities	20.76
46.34	Wholesale of beverages	20.48
20.52	Manufacture of glues	20.33
13.99	Manufacture of other textiles n.e.c.	20.29
72.19	Other research and experimental development on natural sciences and engineering	19.86
20.30	Manufacture of paints, varnishes and similar coatings, printing ink and mastics	19.73
11.07	Manufacture of soft drinks; production of mineral waters and other bottled waters	19.67
46.38	Wholesale of other food, including fish, crustaceans and molluscs	19.45
58.11	Book publishing	19.43
46.75	Wholesale of chemical products	19.15
77.35	Renting and leasing of air transport equipment	19.04
26.70	Manufacture of optical instruments and photographic equipment	19.00
24.41	Precious metals production	18.85
10.32	Manufacture of fruit and vegetable juice	18.85
62.01	Computer programming activities	18.73
82.30	Organisation of conventions and trade shows	18.70
68.10	Buying and selling of own real estate	18.63
08.91	Mining of chemical and fertiliser minerals	18.50
25.71	Manufacture of cutlery	18.12
26.20	Manufacture of computers and peripheral equipment	17.86
13.95	Manufacture of non-wovens and articles made from non-wovens, except apparel	17.78
20.15	Manufacture of fertilisers and nitrogen compounds	17.58
18.20	Reproduction of recorded media	17.56
46.90	Non-specialised wholesale trade	17.54

NACE code	NACE description	EUTMs per 1 000 employees
21.20	Manufacture of pharmaceutical preparations	17.34
46.14	Agents involved in the sale of machinery, industrial equipment, ships and aircraft	16.95
74.90	Other professional, scientific and technical activities n.e.c.	16.84
46.47	Wholesale of furniture, carpets and lighting equipment	16.66
20.11	Manufacture of industrial gases	16.43
28.93	Manufacture of machinery for food, beverage and tobacco processing	16.36
46.11	Agents involved in the sale of agricultural raw materials, live animals, textile raw materials and semi-finished goods	16.13
10.91	Manufacture of prepared feeds for farm animals	15.95
46.43	Wholesale of electrical household appliances	15.83
20.53	Manufacture of essential oils	15.73
72.20	Research and experimental development on social sciences and humanities	15.51
07.10	Mining of iron ores	15.48
74.10	Specialised design activities	15.45
31.03	Manufacture of mattresses	15.44
70.21	Public relations and communication activities	15.23
27.40	Manufacture of electric lighting equipment	15.20
27.51	Manufacture of electric domestic appliances	15.17
28.99	Manufacture of other special-purpose machinery n.e.c.	14.97
46.46	Wholesale of pharmaceutical goods	14.95
13.94	Manufacture of cordage, rope, twine and netting	14.91
46.18	Agents specialised in the sale of other particular products	14.72
46.17	Agents involved in the sale of food, beverages and tobacco	14.20
10.84	Manufacture of condiments and seasonings	14.17
26.30	Manufacture of communication equipment	14.12
20.60	Manufacture of man-made fibres	14.03
46.52	Wholesale of electronic and telecommunications equipment and parts	13.91
46.44	Wholesale of china and glassware and cleaning materials	13.76
23.11	Manufacture of flat glass	13.67
61.90	Other telecommunications activities	13.63
10.82	Manufacture of cocoa, chocolate and sugar confectionery	13.54
09.10	Support activities for petroleum and natural gas extraction	13.45
58.14	Publishing of journals and periodicals	13.27
28.91	Manufacture of machinery for metallurgy	13.14
14.12	Manufacture of workwear	13.12
46.76	Wholesale of other intermediate products	12.67
35.21	Manufacture of gas	12.64
27.90	Manufacture of other electrical equipment	12.53
63.11	Data processing, hosting and related activities	12.21
10.41	Manufacture of oils and fats	12.15
70.22	Business and other management consultancy activities	12.05
46.15	Agents involved in the sale of furniture, household goods, hardware and ironmongery	12.05
32.12	Manufacture of jewellery and related articles	12.03
58.12	Publishing of directories and mailing lists	11.96
23.49	Manufacture of other ceramic products	11.96
13.20	Weaving of textiles	11.80

NACE code	NACE description	EUTMs per 1 000 employees
79.90	Other reservation service and related activities	11.71
46.35	Wholesale of tobacco products	11.66
32.20	Manufacture of musical instruments	11.61
23.69	Manufacture of other articles of concrete, plaster and cement	11.56
10.72	Manufacture of rusks and biscuits; manufacture of preserved pastry goods and cakes	11.54
32.50	Manufacture of medical and dental instruments and supplies	11.52
46.33	Wholesale of dairy products, eggs and edible oils and fats	11.41
26.11	Manufacture of electronic components	11.41
24.45	Other non-ferrous metal production	11.08
10.52	Manufacture of ice cream	10.99
32.11	Striking of coins	10.94
92.00	Gambling and betting activities	10.94
26.51	Manufacture of instruments and appliances for measuring, testing and navigation	10.81
59.12	Motion picture, video and television programme post-production activities	10.78
32.91	Manufacture of brooms and brushes	10.75
46.22	Wholesale of flowers and plants	10.73
10.61	Manufacture of grain mill products	10.70
13.93	Manufacture of carpets and rugs	10.57
15.12	Manufacture of luggage, handbags and the like, saddlery and harness	10.51
46.39	Non-specialised wholesale of food, beverages and tobacco	10.29
25.21	Manufacture of central heating radiators and boilers	10.28
17.22	Manufacture of household and sanitary goods and of toilet requisites	10.23
28.14	Manufacture of other taps and valves	10.16
28.23	Manufacture of office machinery and equipment (except computers and peripheral equipment)	10.13
23.99	Manufacture of other non-metallic mineral products n.e.c.	10.07
25.72	Manufacture of locks and hinges	10.06
46.19	Agents involved in the sale of a variety of goods	9.94
46.13	Agents involved in the sale of timber and building materials	9.94
17.29	Manufacture of other articles of paper and paperboard	9.75
46.36	Wholesale of sugar and chocolate and sugar confectionery	9.72
23.41	Manufacture of ceramic household and ornamental articles	9.63
46.12	Agents involved in the sale of fuels, ores, metals and industrial chemicals	9.47
46.74	Wholesale of hardware, plumbing and heating equipment and supplies	9.38
73.11	Advertising agencies	9.31
13.92	Manufacture of made-up textile articles, except apparel	9.25
46.65	Wholesale of office furniture	9.24
28.95	Manufacture of machinery for paper and paperboard production	9.07
32.13	Manufacture of imitation jewellery and related articles	9.02
23.19	Manufacture and processing of other glass, including technical glassware	8.95
60.10	Radio broadcasting	8.94
13.10	Preparation and spinning of textile fibres	8.94
13.96	Manufacture of other technical and industrial textiles	8.93
28.21	Manufacture of ovens, furnaces and furnace burners	8.91
45.31	Wholesale trade of motor vehicle parts and accessories	8.89
27.20	Manufacture of batteries and accumulators	8.86

NACE code	NACE description	EUTMs per 1 000 employees
46.64	Wholesale of machinery for the textile industry and of sewing and knitting machines	8.82
28.29	Manufacture of other general-purpose machinery n.e.c.	8.71
35.12	Transmission of electricity	8.60
14.31	Manufacture of knitted and crocheted hosiery	8.60
15.20	Manufacture of footwear	8.58
46.69	Wholesale of other machinery and equipment	8.51
23.14	Manufacture of glass fibres	8.49
47.29	Other retail sale of food in specialised stores	8.43
47.51	Retail sale of textiles in specialised stores	8.38
24.34	Cold drawing of wire	8.31
23.44	Manufacture of other technical ceramic products	8.30
20.12	Manufacture of dyes and pigments	8.27
23.62	Manufacture of plaster products for construction purposes	8.21
10.39	Other processing and preserving of fruit and vegetables	8.19
20.17	Manufacture of synthetic rubber in primary forms	8.13
20.16	Manufacture of plastics in primary forms	8.10
22.11	Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber tyres	8.09
45.40	Sale, maintenance and repair of motorcycles and related parts and accessories	8.06
10.62	Manufacture of starches and starch products	8.05
25.99	Manufacture of other fabricated metal products n.e.c.	8.05
14.20	Manufacture of articles of fur	8.03
08.11	Quarrying of ornamental and building stone, limestone, gypsum, chalk and slate	8.02
50.10	Sea and coastal passenger water transport	7.96
82.91	Activities of collection agencies and credit bureaus	7.94
79.12	Tour operator activities	7.92
46.21	Wholesale of grain, unmanufactured tobacco, seeds and animal feeds	7.91
46.31	Wholesale of fruit and vegetables	7.91
22.29	Manufacture of other plastic products	7.87
79.11	Travel agency activities	7.82
28.30	Manufacture of agricultural and forestry machinery	7.75
23.91	Production of abrasive products	7.75
73.12	Media representation	7.72
30.12	Building of pleasure and sporting boats	7.71
46.71	Wholesale of solid, liquid and gaseous fuels and related products	7.66
28.49	Manufacture of other machine tools	7.62
73.20	Market research and public opinion polling	7.57
25.73	Manufacture of tools	7.57
17.12	Manufacture of paper and paperboard	7.55
13.91	Manufacture of knitted and crocheted fabrics	7.47
14.39	Manufacture of other knitted and crocheted apparel	7.45
22.21	Manufacture of plastic plates, sheets, tubes and profiles	7.40
28.13	Manufacture of other pumps and compressors	7.36
46.32	Wholesale of meat and meat products	7.31
47.75	Retail sale of cosmetic and toilet articles in specialised stores	7.31
23.65	Manufacture of fibre cement	7.23

NACE code	NACE description	EUTMs per 1 000 employees
61.30	Satellite telecommunications activities	7.21
19.20	Manufacture of refined petroleum products	7.19
23.42	Manufacture of ceramic sanitary fixtures	7.13
47.43	Retail sale of audio and video equipment in specialised stores	7.13
62.03	Computer facilities management activities	7.10
68.20	Renting and operating of own or leased real estate	7.09
10.51	Operation of dairies and cheese making	7.08
10.31	Processing and preserving of potatoes	6.96
23.31	Manufacture of ceramic tiles and flags	6.94
60.20	Television programming and broadcasting activities	6.88
10.20	Processing and preserving of fish, crustaceans and molluscs	6.86
46.51	Wholesale of computers, computer peripheral equipment and software	6.82
41.10	Development of building projects	6.78
27.52	Manufacture of non-electric domestic appliances	6.77
47.64	Retail sale of sporting equipment in specialised stores	6.76
82.11	Combined office administrative service activities	6.75
25.94	Manufacture of fasteners and screw machine products	6.74
66.00	Activities auxiliary to financial services and insurance activities	6.74
47.99	Other retail sale not in stores, stalls or markets	6.72
47.65	Retail sale of games and toys in specialised stores	6.72
23.20	Manufacture of refractory products	6.66
93.00	Sports activities and amusement and recreation activities	6.61
22.22	Manufacture of plastic packing goods	6.57
46.24	Wholesale of hides, skins and leather	6.57
20.13	Manufacture of other inorganic basic chemicals	6.56
28.41	Manufacture of metal forming machinery	6.43
46.62	Wholesale of machine tools	6.38
24.32	Cold rolling of narrow strip	6.36
47.41	Retail sale of computers, peripheral units and software in specialised stores	6.32
23.64	Manufacture of mortars	6.16
17.23	Manufacture of paper stationery	6.13
31.01	Manufacture of office and shop furniture	6.09
28.25	Manufacture of non-domestic cooling and ventilation equipment	6.03
28.96	Manufacture of plastics and rubber machinery	6.02
46.73	Wholesale of wood, construction materials and sanitary equipment	6.00
25.91	Manufacture of steel drums and similar containers	5.98
62.02	Computer consultancy activities	5.96
35.11	Production of electricity	5.94
14.13	Manufacture of other outerwear	5.94
47.78	Other retail sale of new goods in specialised stores	5.92
18.13	Pre-press and pre-media services	5.91
77.39	Renting and leasing of other machinery, equipment and tangible goods n.e.c.	5.88
23.52	Manufacture of lime and plaster	5.77
47.74	Retail sale of medical and orthopaedic goods in specialised stores	5.74
77.21	Renting and leasing of recreational and sports goods	5.73

NACE code	NACE description	EUTMs per 1 000 employees
61.20	Wireless telecommunications activities	5.71
22.23	Manufacture of builders' ware of plastic	5.71
10.81	Manufacture of sugar	5.68
28.92	Manufacture of machinery for mining, quarrying and construction	5.68
49.50	Transport via pipeline	5.67
28.94	Manufacture of machinery for textile, apparel and leather production	5.61
33.19	Repair of other equipment	5.60
10.85	Manufacture of prepared meals and dishes	5.57
25.40	Manufacture of weapons and ammunition	5.48
16.29	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials	5.43
47.72	Retail sale of footwear and leather goods in specialised stores	5.42
50.30	Inland passenger water transport	5.39
77.12	Renting and leasing of trucks	5.34
46.66	Wholesale of other office machinery and equipment	5.32
13.30	Finishing of textiles	5.28
23.13	Manufacture of hollow glass	5.23
28.11	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines	5.19
55.90	Other accommodation	5.13

8.4 Design-intensive industries

Table 46:
Design-intensive industries

NACE code	NACE description	Designs per 1 000 employees
77.40	Leasing of intellectual property and similar products, except copyrighted works	128.00
27.40	Manufacture of electric lighting equipment	47.21
25.71	Manufacture of cutlery	46.30
46.47	Wholesale of furniture, carpets and lighting equipment	39.81
14.39	Manufacture of other knitted and crocheted apparel	35.37
46.15	Agents involved in the sale of furniture, household goods, hardware and ironmongery	33.70
46.48	Wholesale of watches and jewellery	33.60
27.51	Manufacture of electric domestic appliances	27.80
30.99	Manufacture of other transport equipment n.e.c.	24.25
17.24	Manufacture of wallpaper	23.91
28.14	Manufacture of other taps and valves	21.71
32.99	Other manufacturing n.e.c.	21.20
32.40	Manufacture of games and toys	21.12
14.14	Manufacture of underwear	20.77
23.42	Manufacture of ceramic sanitary fixtures	20.28
15.20	Manufacture of footwear	19.70
32.30	Manufacture of sports goods	19.48
32.12	Manufacture of jewellery and related articles	19.23

NACE code	NACE description	Designs per 1 000 employees
32.91	Manufacture of brooms and brushes	18.13
26.52	Manufacture of watches and clocks	18.01
25.72	Manufacture of locks and hinges	18.00
46.49	Wholesale of other household goods	17.50
46.42	Wholesale of clothing and footwear	15.76
31.09	Manufacture of other furniture	14.71
30.92	Manufacture of bicycles and invalid carriages	14.04
74.10	Specialised design activities	13.44
46.44	Wholesale of china and glassware and cleaning materials	13.15
14.12	Manufacture of workwear	13.12
11.04	Manufacture of other non-distilled fermented beverages	13.06
14.11	Manufacture of leather clothes	12.65
12.00	Manufacture of tobacco products	12.34
26.40	Manufacture of consumer electronics	12.12
23.19	Manufacture and processing of other glass, including technical glassware	11.96
30.91	Manufacture of motorcycles	11.90
26.80	Manufacture of magnetic and optical media	11.89
23.41	Manufacture of ceramic household and ornamental articles	11.47
14.19	Manufacture of other wearing apparel and accessories	11.31
25.99	Manufacture of other fabricated metal products n.e.c.	11.20
31.01	Manufacture of office and shop furniture	11.19
20.41	Manufacture of soap and detergents, cleaning and polishing preparations	10.80
46.43	Wholesale of electrical household appliances	10.71
31.02	Manufacture of kitchen furniture	9.95
23.13	Manufacture of hollow glass	9.48
14.31	Manufacture of knitted and crocheted hosiery	9.42
25.21	Manufacture of central heating radiators and boilers	9.42
15.12	Manufacture of luggage, handbags and the like, saddlery and harness	9.17
07.10	Mining of iron ores	9.16
32.11	Striking of coins	9.02
46.65	Wholesale of office furniture	8.68
24.42	Aluminium production	8.41
22.29	Manufacture of other plastic products	8.11
11.07	Manufacture of soft drinks; production of mineral waters and other bottled waters	7.98
28.24	Manufacture of power-driven hand tools	7.83
24.45	Other non-ferrous metal production	7.80
47.91	Retail sale via mail order houses or via Internet	7.41
46.90	Non-specialised wholesale trade	7.19
28.30	Manufacture of agricultural and forestry machinery	6.90
22.22	Manufacture of plastic packing goods	6.78
32.13	Manufacture of imitation jewellery and related articles	6.76
20.42	Manufacture of perfumes and toilet preparations	6.74
46.52	Wholesale of electronic and telecommunications equipment and parts	6.71
10.42	Manufacture of margarine and similar edible fats	6.38
46.41	Wholesale of textiles	6.29

NACE code	NACE description	Designs per 1 000 employees
13.92	Manufacture of made-up textile articles, except apparel	6.28
28.93	Manufacture of machinery for food, beverage and tobacco processing	6.28
27.90	Manufacture of other electrical equipment	6.26
26.70	Manufacture of optical instruments and photographic equipment	6.25
13.99	Manufacture of other textiles n.e.c.	6.04
26.60	Manufacture of irradiation, electromedical and electrotherapeutic equipment	6.02
20.51	Manufacture of explosives	6.00
22.19	Manufacture of other rubber products	5.93
17.22	Manufacture of household and sanitary goods and of toilet requisites	5.84
32.50	Manufacture of medical and dental instruments and supplies	5.80
28.23	Manufacture of office machinery and equipment (except computers and peripheral equipment)	5.73
27.52	Manufacture of non-electric domestic appliances	5.63
26.11	Manufacture of electronic components	5.62
32.20	Manufacture of musical instruments	5.45
26.30	Manufacture of communication equipment	5.44
16.29	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials	5.35
22.11	Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber tyres	5.23
23.31	Manufacture of ceramic tiles and flags	5.16
29.32	Manufacture of other parts and accessories for motor vehicles	4.60
11.03	Manufacture of cider and other fruit wines	4.59
23.69	Manufacture of other articles of concrete, plaster and cement	4.57
26.20	Manufacture of computers and peripheral equipment	4.56
46.74	Wholesale of hardware, plumbing and heating equipment and supplies	4.51
10.32	Manufacture of fruit and vegetable juice	4.47
21.10	Manufacture of basic pharmaceutical products	4.46
10.83	Processing of tea and coffee	4.45
25.73	Manufacture of tools	4.44
23.49	Manufacture of other ceramic products	4.29
10.82	Manufacture of cocoa, chocolate and sugar confectionery	4.27
27.33	Manufacture of wiring devices	4.22
72.19	Other research and experimental development on natural sciences and engineering	4.16
46.45	Wholesale of perfume and cosmetics	4.15
11.01	Distilling, rectifying and blending of spirits	4.07
23.70	Cutting, shaping and finishing of stone	4.06
22.23	Manufacture of builders' ware of plastic	4.04
23.11	Manufacture of flat glass	4.02
20.59	Manufacture of other chemical products n.e.c.	3.75
28.92	Manufacture of machinery for mining, quarrying and construction	3.64
74.90	Other professional, scientific and technical activities n.e.c.	3.58
28.99	Manufacture of other special-purpose machinery n.e.c.	3.55
20.11	Manufacture of industrial gases	3.53
68.10	Buying and selling of own real estate	3.48
24.33	Cold forming or folding	3.44
26.51	Manufacture of instruments and appliances for measuring, testing and navigation	3.34
13.94	Manufacture of cordage, rope, twine and netting	3.33

NACE code	NACE description	Designs per 1 000 employees
46.11	Agents involved in the sale of agricultural raw materials, live animals, textile raw materials and semi-finished goods	3.28
47.77	Retail sale of watches and jewellery in specialised stores	3.28
46.16	Agents involved in the sale of textiles, clothing, fur, footwear and leather goods	3.18
27.12	Manufacture of electricity distribution and control apparatus	3.15
10.92	Manufacture of prepared pet foods	3.14
46.76	Wholesale of other intermediate products	3.00
10.73	Manufacture of macaroni, noodles, couscous and similar farinaceous products	2.99
46.18	Agents specialised in the sale of other particular products	2.98
82.11	Combined office administrative service activities	2.92
10.51	Operation of dairies and cheese making	2.92
13.93	Manufacture of carpets and rugs	2.92
46.14	Agents involved in the sale of machinery, industrial equipment, ships and aircraft	2.90
13.96	Manufacture of other technical and industrial textiles	2.89
14.13	Manufacture of other outerwear	2.81
20.60	Manufacture of man-made fibres	2.78
22.21	Manufacture of plastic plates, sheets, tubes and profiles	2.77
23.32	Manufacture of bricks, tiles and construction products, in baked clay	2.75
10.72	Manufacture of rusks and biscuits; manufacture of preserved pastry goods and cakes	2.74
13.95	Manufacture of non-wovens and articles made from non-wovens, except apparel	2.73
13.20	Weaving of textiles	2.73
16.22	Manufacture of assembled parquet floors	2.72
24.41	Precious metals production	2.71
47.59	Retail sale of furniture, lighting equipment and other household articles in specialised stores	2.71
10.41	Manufacture of oils and fats	2.66
29.10	Manufacture of motor vehicles	2.64
17.12	Manufacture of paper and paperboard	2.61
72.11	Research and experimental development on biotechnology	2.54
25.93	Manufacture of wire products, chain and springs	2.52
25.12	Manufacture of doors and windows of metal	2.49
30.12	Building of pleasure and sporting boats	2.48
28.21	Manufacture of ovens, furnaces and furnace burners	2.46
46.73	Wholesale of wood, construction materials and sanitary equipment	2.42
17.23	Manufacture of paper stationery	2.41
28.91	Manufacture of machinery for metallurgy	2.41
25.92	Manufacture of light metal packaging	2.38
58.21	Publishing of computer games	2.38
47.51	Retail sale of textiles in specialised stores	2.37
10.89	Manufacture of other food products n.e.c.	2.31
28.13	Manufacture of other pumps and compressors	2.31
27.20	Manufacture of batteries and accumulators	2.30
28.29	Manufacture of other general-purpose machinery n.e.c.	2.29
10.86	Manufacture of homogenised food preparations and dietetic food	2.26
46.19	Agents involved in the sale of a variety of goods	2.24
17.21	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard	2.23
59.20	Sound recording and music publishing activities	2.20

NACE code	NACE description	Designs per 1 000 employees
45.40	Sale, maintenance and repair of motorcycles and related parts and accessories	2.17
47.78	Other retail sale of new goods in specialised stores	2.13
46.69	Wholesale of other machinery and equipment	2.07
46.72	Wholesale of metals and metal ores	2.04
17.29	Manufacture of other articles of paper and paperboard	2.03
16.23	Manufacture of other builders' carpentry and joinery	1.99
31.03	Manufacture of mattresses	1.97
28.49	Manufacture of other machine tools	1.96
16.21	Manufacture of veneer sheets and wood-based panels	1.95
13.10	Preparation and spinning of textile fibres	1.94
28.11	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines	1.94
25.91	Manufacture of steel drums and similar containers	1.93
28.12	Manufacture of fluid power equipment	1.92
24.43	Lead, zinc and tin production	1.90
11.05	Manufacture of beer	1.88
20.20	Manufacture of pesticides and other agrochemical products	1.87
20.53	Manufacture of essential oils	1.86
28.94	Manufacture of machinery for textile, apparel and leather production	1.83
25.40	Manufacture of weapons and ammunition	1.80
29.20	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers	1.75
23.61	Manufacture of concrete products for construction purposes	1.75
25.94	Manufacture of fasteners and screw machine products	1.74
46.36	Wholesale of sugar and chocolate and sugar confectionery	1.69
23.62	Manufacture of plaster products for construction purposes	1.65

8.5 PVR-intensive industries

Table 47:
PVR-intensive industries

NACE code	NACE description	PVRs per 1 000 employees
77.40	Leasing of intellectual property and similar products, except copyrighted works	10.76
46.22	Wholesale of flowers and plants	5.86
72.11	Research and experimental development on biotechnology	5.31
46.21	Wholesale of grain, unmanufactured tobacco, seeds and animal feeds	3.84
72.19	Other research and experimental development on natural sciences and engineering	1.27
46.11	Agents involved in the sale of agricultural raw materials, live animals, textile raw materials and semi-finished goods	1.16
01.00 (p)	Horticulture	0.53
77.31	Renting and leasing of agricultural machinery and equipment	0.41
10.61	Manufacture of grain mill products	0.24
20.53	Manufacture of essential oils	0.22
13.10	Preparation and spinning of textile fibres	0.17

9. Appendix: Copyright-intensive industries according to the WIPO methodology

As explained in chapter 3, the copyright-intensive industries presented there were selected on the basis of the WIPO methodology. This appendix sets out the standard WIPO methodology as outlined by WIPO (2015) in more detail.

WIPO divides copyright-intensive industries into four main categories:

- core
- inter-dependent
- partial
- non-dedicated support

9.1 Core copyright industries

Core copyright-intensive industries as defined by WIPO are industries that are wholly engaged in the creation, production, manufacture, performance, broadcast, communication, exhibition, distribution or sale of works and other protected subject-matter.

According to WIPO, core copyright industries “as a category would not exist or would be significantly different without copyright in works or other subject-matter”. Therefore, all of the value added and employment generated in these industries should be considered to be copyright’s contribution to the economy.

Thus, in all, the 49 industries listed below are defined as core copyright intensive by WIPO.

Table 48:
List of core copyright-intensive industries according to WIPO

NACE code	NACE description
58.11	Book publishing
58.13	Publishing of newspapers
58.14	Publishing of journals and periodicals
58.19	Other publishing activities
58.21	Publishing of computer games
58.29	Other software publishing
59.11	Motion picture, video and television programme production activities
59.12	Motion picture, video and television programme post-production activities
59.13	Motion picture, video and television programme distribution activities
59.14	Motion picture projection activities
59.20	Sound recording and music publishing activities
60.10	Radio broadcasting
60.20	Television programming and broadcasting activities
61.20	Wireless telecommunications activities
62.01	Computer programming activities
62.02	Computer consultancy activities
62.03	Computer facilities management activities
62.09	Other information technology and computer service activities
63.12	Web portals
63.91	News agency activities
63.99	Other information service activities n.e.c.
73.11	Advertising agencies
73.12	Media representation
74.10	Specialised design activities
74.20	Photographic activities
74.30	Translation and interpretation activities
90.01	Performing arts
90.02	Support activities to performing arts
90.03	Artistic creation
91.01	Library and archives activities
93.29	Other amusement and recreation activities
18.11	Printing of newspapers
18.12	Other printing
18.13	Pre-press and pre-media services
18.14	Binding and related services
18.20	Reproduction of recorded media
47.61	Retail sale of books in specialised stores
47.62	Retail sale of newspapers and stationery in specialised stores
47.63	Retail sale of music and video recordings in specialised stores
61.10	Wired telecommunications activities
61.30	Satellite telecommunications activities

NACE code	NACE description
61.90	Other telecommunications activities
63.11	Data processing, hosting and related activities
79.90	Other reservation service and related activities
82.19	Photocopying, document preparation and other specialised office support activities
85.52	Cultural education
90.04	Operation of arts facilities
93.21	Activities of amusement parks and theme parks
94.12	Activities of professional membership organisations

9.2 Non-core copyright industries

In addition to the core copyright industries, WIPO also defines three groups of industries whose activity is related to copyright industries to some degree: inter-dependent, partial and non-dedicated support industries. Because these industries are only partly engaged in copyright-related activities, only part of their employment and value added should be considered copyright intensive. The definitions of the three groups are as follows:

Inter-dependent copyright industries are industries that are engaged in the production, manufacture and sale of equipment whose function is wholly or primarily to facilitate the creation, production or use of works and other protected subject-matter.

Partial copyright industries are industries in which some activities are related to works and other protected subject-matter and may involve creation, production and manufacturing, performance, broadcast, communication and exhibition or distribution and sale.

Non-dedicated support industries are industries in which some activities are related to facilitating the broadcast, communication, distribution or sale of works and other protected subject-matter, and whose activities have not been included in the core copyright industries.

In order to capture the fact that only a portion of each non-core industry's activities can be related to copyright, each industry is assigned a factor. This factor is used to scale that industry's employment and value added when tabulating the total contribution of the non-core copyright industries to the economy. The copyright factors assigned to each industry in inter-dependent, partial and non-dedicated support industries have been adopted from a Dutch study entitled "The Economic Contribution of Copyright-Based Industries in the Netherlands"⁸⁹ and a Finnish study entitled "Economic Contribution of Copyright-Based Industries in Finland 2005–2008",⁹⁰ both published in 2011. These studies are considered authoritative by many authors and are available from WIPO.

Table 49 shows the inter-dependent industries and the factors assigned to each.

⁸⁹ wipo.int/export/sites/www/copyright/en/performance/pdf/econ_contribution_cr_nl.pdf.

⁹⁰ wipo.int/export/sites/www/copyright/en/performance/pdf/econ_contribution_cr_fi.pdf.

Table 49:
Inter-dependent copyright-intensive industries

NACE code	NACE description	Factor
17.11	Manufacture of pulp	25.0%
17.12	Manufacture of paper and paperboard	25.0%
20.59	Manufacture of other chemical products n.e.c.	25.0%
28.23	Manufacture of office machinery and equipment (except computers and peripheral equipment)	30.0%
26.20	Manufacture of computers and peripheral equipment	30.0%
26.30	Manufacture of communication equipment	30.0%
26.40	Manufacture of consumer electronics	30.0%
26.70	Manufacture of optical instruments and photographic equipment	30.0%
27.31	Manufacture of fibre optic cables	30.0%
32.20	Manufacture of musical instruments	35.0%
46.43	Wholesale of electrical household appliances	19.0%
46.76	Wholesale of other intermediate products	25.0%
46.51	Wholesale of computers, computer peripheral equipment and software	30.0%
46.52	Wholesale of electronic and telecommunications equipment and parts	25.0%
46.66	Wholesale of other office machinery and equipment	30.0%
47.43	Retail sale of audio and video equipment in specialised stores	33.3%
47.41	Retail sale of computers, peripheral units and software in specialised stores	33.3%
47.78	Other retail sale of new goods in specialised stores	33.3%
77.33	Renting and leasing of office machinery and equipment (including computers)	35.0%
77.39	Renting and leasing of other machinery, equipment and tangible goods n.e.c.	20.0%
77.22	Renting of video tapes and disks	20.0%
77.29	Renting and leasing of other personal and household goods	20.0%

Based on the average of these 22 industries' factors, it can be concluded that 28% of their employment and value added can be considered copyright-related.

Table 50 shows the 42 industries classified by WIPO as partially copyright-intensive industries and their factors.

Table 50:
Partial copyright-intensive industries

NACE code	NACE description	Factor
13.91	Manufacture of knitted and crocheted fabrics	0.55%
14.31	Manufacture of knitted and crocheted hosiery	0.55%
14.39	Manufacture of other knitted and crocheted apparel	0.55%
16.29	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials	0.55%
23.11	Manufacture of flat glass	0.55%
23.13	Manufacture of hollow glass	0.55%
23.19	Manufacture and processing of other glass, including technical glassware	0.55%
25.71	Manufacture of cutlery	0.55%
25.99	Manufacture of other fabricated metal products n.e.c.	0.55%

NACE code	NACE description	Factor
47.53	Retail sale of carpets, rugs, wall and floor coverings in specialised stores	0.55%
47.59	Retail sale of furniture, lighting equipment and other household articles in specialised stores	0.55%
13.93	Manufacture of carpets and rugs	1.9%
17.23	Manufacture of paper stationery	1.9%
17.24	Manufacture of wallpaper	1.9%
13.92	Manufacture of made-up textile articles, except apparel	2.7%
14.11	Manufacture of leather clothes	2.7%
14.12	Manufacture of workwear	2.7%
14.13	Manufacture of other outerwear	2.7%
14.14	Manufacture of underwear	2.7%
14.19	Manufacture of other wearing apparel and accessories	2.7%
15.20	Manufacture of footwear	2.7%
46.41	Wholesale of textiles	2.7%
46.42	Wholesale of clothing and footwear	2.7%
47.51	Retail sale of textiles in specialised stores	2.7%
47.71	Retail sale of clothing in specialised stores	2.7%
47.72	Retail sale of footwear and leather goods in specialised stores	2.7%
46.44	Wholesale of china and glassware and cleaning materials	5.0%
46.47	Wholesale of furniture, carpets and lighting equipment	5.0%
46.48	Wholesale of watches and jewellery	5.0%
46.49	Wholesale of other household goods	5.0%
31.01	Manufacture of office and shop furniture	6.7%
31.02	Manufacture of kitchen furniture	6.7%
31.03	Manufacture of mattresses	6.7%
31.09	Manufacture of other furniture	6.7%
71.11	Architectural activities	9.0%
71.12	Engineering activities and related technical consultancy	9.0%
32.11	Striking of coins	33.5%
32.12	Manufacture of jewellery and related articles	33.5%
94.99	Activities of other membership organisations n.e.c.	41.0%
32.40	Manufacture of games and toys	46.0%
91.02	Museums activities	50.0%
91.03	Operation of historical sites and buildings and similar visitor attractions	50.0%

Only the portion of these industries' activities which is attributable to copyrighted works and other protected subject-matter, ranging from 0.55% to 50%, should be included in their employment and value added contributions. For example, museums activities and the manufacture of games and toys have a significant copyright component, whereas only a very small portion of employment and value added in industries such as the manufacture of carpets or wholesale of furniture is directly related to copyright activities or copyrighted materials.

Finally, the non-dedicated support industries are shown in Table 51.

Table 51:
Non-dedicated copyright-intensive support industries

NACE code	NACE description	Factor
46.1	Wholesale on a fee or contract basis	6%
46.4	Wholesale of household goods	6%
46.6	Wholesale of other machinery, equipment and supplies	6%
46.9	Non-specialised wholesale trade	6%
47.1	Retail sale in non-specialised stores	6%
47.4	Retail sale of information and communication equipment in specialised stores	6%
47.5	Retail sale of other household equipment in specialised stores	6%
47.7	Retail sale of other goods in specialised stores	6%
47.8	Retail sale via stalls and markets	6%
47.9	Retail trade not in stores, stalls or markets	6%
49.1	Passenger rail transport, interurban	6%
49.2	Freight rail transport	6%
49.3	Other passenger land transport	6%
49.4	Freight transport by road and removal services	6%
50.1	Sea and coastal passenger water transport	6%
50.2	Sea and coastal freight water transport	6%
50.3	Inland passenger water transport	6%
50.4	Inland freight water transport	6%
51.1	Passenger air transport	6%
51.2	Freight air transport and space transport	6%
52.1	Warehousing and storage	6%
52.2	Support activities for transportation	6%
53.1	Postal activities under universal service obligation	6%
53.2	Other postal and courier activities	6%
79.1	Travel agency and tour operator activities	6%
79.9	Other reservation service and related activities	6%

The inclusion of the above industries is attributable to backward linkages, generally business services and delivery modes. For example, it is estimated that 6% of employment and value added in postal and courier services is generated by deliveries of copyrighted materials, such as magazines, manuscripts and audiovisual recordings.

In this study, only core and non-core industries with a factor of at least 20% are included as copyright intensive.

10. Appendix: Identification of CCMT patent- and green TM-intensive industries

10.1 Patent data

- The starting point for the calculation of CCMT patent shares was the dataset of 166 358 relevant granted patents as described in section 2.3.
- As a next step, the dataset was reduced to a set of 17 310 CCMT relevant patents⁹¹
- This dataset was then merged with a concordance table linking patent applicants' data to company information in ORBIS. A match was found for 14 583 unique CCMT patent applications, i.e. 84.25% of the total relevant CCMT applications.
- Where a patent has multiple owners some of whom have their seats outside of the EU, their associated fraction of patents was discounted. The total sum of the patent fractions corresponding to the subset of CCMT-relevant patents matched with ORBIS data amounts to 14 221.93. This represents 10.2% of the total number of European patents in the matched dataset. Of the 615 NACE classes, 394 (375 in the previous study) had a CCMT patent application filed and then granted.
- The matching and assignment of company units to NACE industries was carried out in the same way as described in Appendix 8.

10.2 TM data

- The starting point for the calculation of green TM shares was the dataset of 387 917 relevant EUTMs (1 146 224 trade mark classes) as described in section 2.4.
- As a next step, the dataset was reduced to a set of 27 828 relevant green EUTMs.⁹²

⁹¹ Defined as patents associated with the following IPC classes: Y02B, Y02C, Y02E, Y02P, Y02T, Y02W and Y04S.

⁹² See EUIPO (2021), Green EU trade marks: Analysis of goods and services specifications, 1996-2020.

- This dataset was then merged with a concordance table linking TM applicants' data to company information in ORBIS. A match was found for 22 244 unique green EUTMs, i.e. 79.93% of the total number of relevant green EUTM applications.
- Where a EUTM has multiple owners some of whom have their seats outside of the EU, their associated fraction of EUTM was discounted. The total sum of the EUTM fractions corresponding to the subset of green EUTMs matched with ORBIS data amounts to 22 235.83. This represents 7.53% of the total number of EUTMs in the matched dataset. Of the 615 NACE 492 classes, had a green EUTM application.
- The matching and assignment of company units to NACE industries was carried out in the same way as described in Appendix 8.

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