PROSPECTS 5.0

PROSPECTS 5.0 Industry 5.0 Wiki October 2026 Patent Analysis

Human-Centric Robotics in Manufacturing

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1. EXECUTIVE SUMMARY

This patent landscape covers **11,351 patent families** that combine robotic and manipulator technologies (B25J) with a manufacturing, production or assembly context and an explicit human dimension: workers, people, collaborative robots (cobots) or human-robot interaction. Medical, rehabilitation, cleaning, agricultural harvesting and power grid applications were excluded so that the dataset reflects the shop floor, which is the focus of Industry 5.0. The main findings are summarised below.

- **A young and fast-growing field.** About 84% of all families (9,484) have a priority date in 2015 or later. Annual filings rose from 122 in 2010 to 890 in 2024, a compound annual growth rate of about 15%.
- **Recent years show a new growth phase.** After a plateau between 2018 and 2020 (around 715 families per year), filings moved to a higher level in 2021-2024 (on average 871 per year). Priority year 2025 already counts 1,118 families although it is still incomplete, and 1,206 families were published in 2026 up to 12 October, more than in the whole of 2025.
- **COVID-19 slowed growth but did not reverse it.** Priority filings were flat in 2020 (+0.4% compared with 2019) and then rose by 16.8% in 2021, which indicates a pause followed by a clear recovery.
- **China is the largest filing location.** 82.7% of families have at least one member filed in China, driven mainly by Chinese universities, which hold 9 of the 10 leading applicant positions.
- **Europe holds a strong, internationally oriented position.** The European Patent Office (EPO) is the second largest classifying office (2,696 documents, 29.7% of all CPC allocations), 685 families include a European patent (EP) filing, and European applicants account for about 20% of the records where the applicant country is recorded, second only to the United States. Germany is the fifth applicant country and the fourth inventor country. Established industrial players such as KUKA, ABB, Daimler/Mercedes-Benz, Siemens, Bosch and Comau, together with research organisations such as Fraunhofer, CEA and DLR, give Europe a solid base to lead the human-centric dimension of Industry 5.0.
- **Technology focus is shifting towards intelligence and human-robot coexistence.** The largest technology clusters are planning, learning and AI-based control (1,713 classification occurrences) and perception and sensing (1,629). Safety and human-robot coexistence (694) and exoskeletons and human-like hands (876) are substantial clusters, which match the worker-centred goals of Industry 5.0.

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2. INTRODUCTION

2.1. Background and Purpose

PROSPECTS 5.0 studies the practices, drivers, success factors and obstacles of the transition towards Industry 5.0. Industry 5.0 puts the worker at the centre of production and looks at how technology can support, protect and upskill people rather than replace them. Robots that work close to, or together with, people on the shop floor are one of the most visible technologies of this transition.

Patent data are a useful indicator of where technology development takes place, who drives it and in which direction it moves. The purpose of this report is to give the PROSPECTS 5.0 consortium an evidence-based picture of the patenting activity in human-centric robotics for manufacturing, with particular attention to recent trends and to the position of Europe.

2.2. Scope of the Analysis

The analysis is based only on the statistical outputs exported from Espacenet for the search described in Section 3. No external patent statistics or market data were added. All counts refer to patent families unless otherwise stated. The report covers:

- the evolution of filings over time, with a focus on 2015-2026 and on the COVID-19 period;
- the geographical distribution of filings, applicants, inventors and publication languages;
- the position of Europe in the landscape;
- the leading applicants and inventors;
- the main technology areas, based on IPC and CPC classifications.

2.3. Structure of the Report

Section 3 explains the search strategy, the reasons for the exclusions and the main limitations. Section 4 gives the key indicators. Section 5 analyses temporal trends and the COVID-19 period. Section 6 covers geography, Section 7 is dedicated to Europe, Section 8 to the key players and Section 9 to the technology focus. Section 10 presents the conclusions.

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3. METHODOLOGY

3.1. Data Source and Search Strategy

The data were retrieved from Espacenet, the free patent database of the European Patent Office, on 12 October 2026. The search combines one classification block with three keyword blocks. Keywords were searched in titles, abstracts and claims (ctxt field). The final query returned **11,351 results**. The exact query was:

```
(cl =/low "B25J" AND (ctxt any "manufact*" OR (ctxt any "production*" OR ctxt any "produce*" OR
ctxt any "producing") OR ctxt any "shopfloor" OR ctxt any "assembl*") AND (ctxt any "human" OR
ctxt any "person" OR ctxt any "worker" OR ctxt any "people" OR ctxt any "cobot" OR ctxt any
"collabora*" OR ctxt any "human-robot")) NOT (cl =/low "A61B34" OR cl =/low "A61H" OR cl =/low
"A47L" OR cl =/low "A01D46" OR ctxt = "energy grid")
```

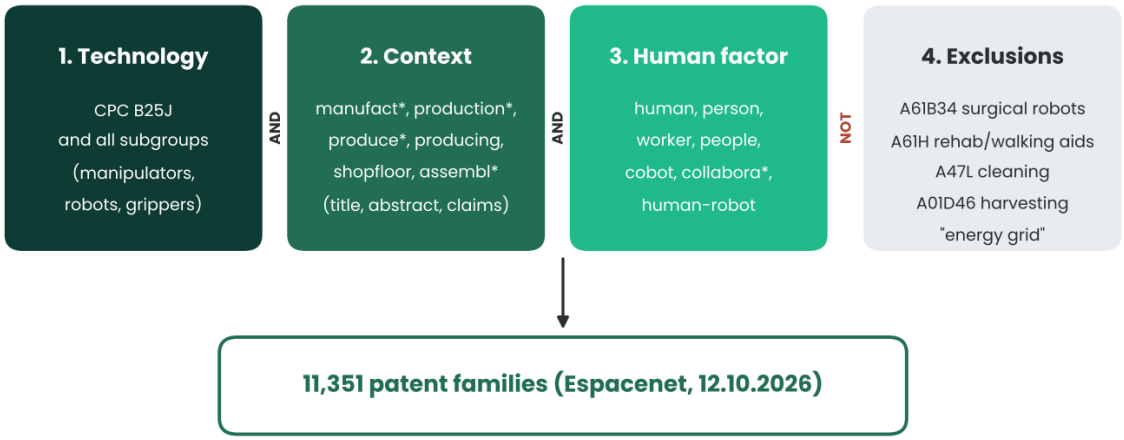


Figure 1 Structure of the search strategy

Table 1 Components of the search strategy

Block	Search elements	Purpose
1. Technology	CPC B25J and all lower subgroups (cl =/low)	Captures manipulators, industrial and collaborative robots, grippers, arms and their control systems.
2. Context	manufact*, production*, produce*, producing, shopfloor, assembl*	Limits the set to manufacturing, production and assembly environments.
3. Human factor	human, person, worker, people, cobot, collabora*, human-robot	Keeps inventions where people are involved, in line with the human-centric focus of Industry 5.0.
4. Exclusions	A61B34, A61H, A47L, A01D46, "energy grid"	Removes application areas outside the manufacturing shop floor (see Section 3.2).

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3.2. Rationale for the Exclusions

A first test of the query showed that the keywords "human", "person" and "assembl*" are very common in patent language. For example, "assembly" is often used for a component (a "gripper assembly" or "joint assembly") and "human" appears in many medical and service robot patents. As a result, a large share of the first results came from fields that are not related to manufacturing. These fields were excluded so that the trends in this report describe the industrial shop floor and are not distorted by other markets.

Table 2 Excluded classifications and reasons

Excluded	Field	Reason for exclusion
A61B34	Computer-aided surgery, surgical robots	Medical robots operate on patients in hospitals, not with workers in production. They contain "human" and "assembly" frequently but are a different market with its own regulation.
A61H	Physical therapy apparatus, rehabilitation and walking aids	Rehabilitation exoskeletons and walking aids target patients and the elderly. Industrial exoskeletons used by workers are still covered through B25J9/0006.
A47L	Domestic and floor cleaning	Household and cleaning robots belong to the consumer service domain, not to manufacturing.
A01D46	Harvesting of fruit and vegetables	Agricultural harvesting robots work in the field. Their use of "production" refers to crop production, not industrial production.
"energy grid" (exact phrase)	Power grid maintenance and live-line work	Robots for power line maintenance are a separate utility application. The phrase is searched as an exact expression so that patents that only mention "energy" or "grid" (for example "energy consumption" or "grid map") remain in the set.

The query was also corrected during the analysis. In an earlier version, the production terms were connected with AND, which required all three words to appear together and removed relevant documents. They are now connected with OR. The terms "cobot", "collabora*" and "human-robot" were added to capture collaborative robotics directly.

3.3. Interpretation Notes and Limitations

- **Counting unit.** Espacenet statistics count patent families. A family can have members in several countries, so the sum of country counts (15,792) is higher than the number of families.

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- **Publication lag.** Patent applications are normally published about 18 months after the priority date. Priority years 2025 and 2026 are therefore incomplete and will increase as more applications are published. Publication year 2026 covers 1 January to 12 October.
- **Applicant and inventor country.** These fields are populated in only part of the records (4,089 and 3,802 entries). Chinese national filings often do not carry an applicant country code, so China is under-represented in these two indicators. They are used here to compare the other regions, not to measure China.
- **Name variants.** Applicant names are shown as recorded. The same company can appear under several names (for example FANUC LTD and FANUC CORP). Where variants are combined in this report, this is stated.
- **Inventor names.** Common names (for example WANG WEI) can refer to several different people, so inventor rankings are indicative only.
- **Espacenet export limits.** The applicant and inventor lists contain the top 1,000 entries; the IPC and CPC lists contain the top 100 to 150 entries.

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4. OVERALL LANDSCAPE AND KEY INDICATORS

Table 3 summarises the main indicators of the dataset. The field is concentrated in time and in geography: most families are recent and most have a member in China. At the same time, the international filing routes (WO and EP) and the classification work of the EPO show that a significant part of the portfolio is designed for global markets.

Table 3 Key indicators of the patent landscape

Indicator	Value
Total patent families	11,351
Families with priority date 2015 or later	9,484 (83.6%)
Peak complete priority year	2023 (908 families)
Highest publication year	2026 (1,206 families, to 12 October)
Growth 2010-2024 (CAGR, priority year)	about 15% per year
Families with a CN member	9,387 (82.7%)
Families with a US member	1,391 (12.3%)
Families with an international (WO/PCT) application	973 (8.6%)
Families with a European patent (EP) application	685 (6.0%)
EPO share of CPC allocations	2,696 documents (29.7%), second after CN
European share of records with applicant country	821 of 4,089 (20.1%)
Most active applicant	Tsinghua University (66 families)

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5. TEMPORAL TRENDS

5.1. Long-term Evolution

Figure 2 shows the number of families by earliest priority year. Activity was very limited until the mid-2000s, with fewer than 60 families per year. Growth started around 2008 and accelerated sharply in 2015 and 2016, when annual filings grew by 87% (to 470) and by 73% (to 812). Since then the field has remained at a high level and has continued to grow.

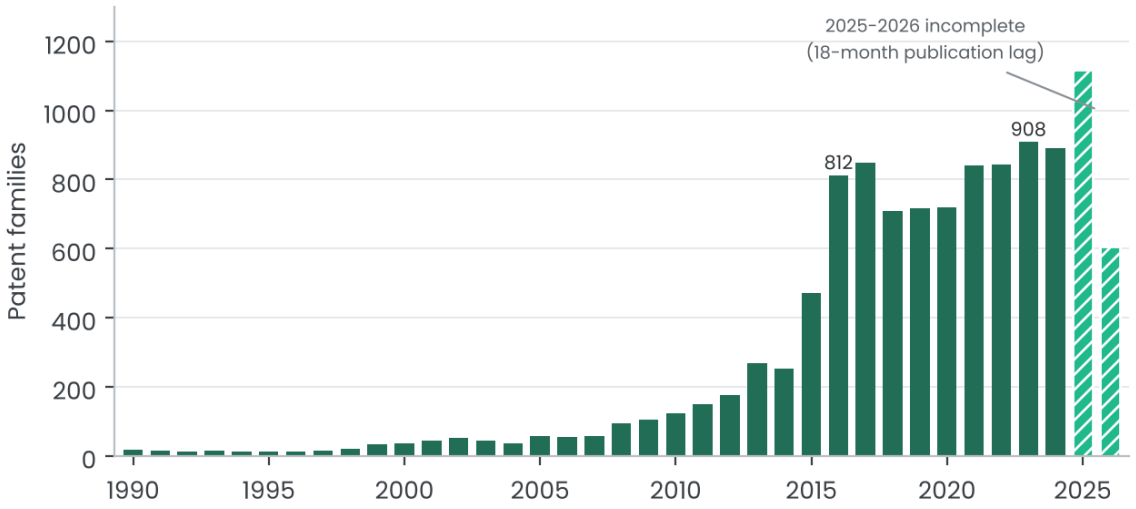


Figure 2 Patent families by earliest priority year, 1990-2026

The five-year comparison in Figure 3 makes the change of scale visible. The period 2016-2020 (3,806 families) was almost three times larger than 2011-2015 (1,314), and 2021-2025 has already reached 4,601 families even though 2025 is not yet complete. Only 898 families (about 8%) have a priority date before 2010.

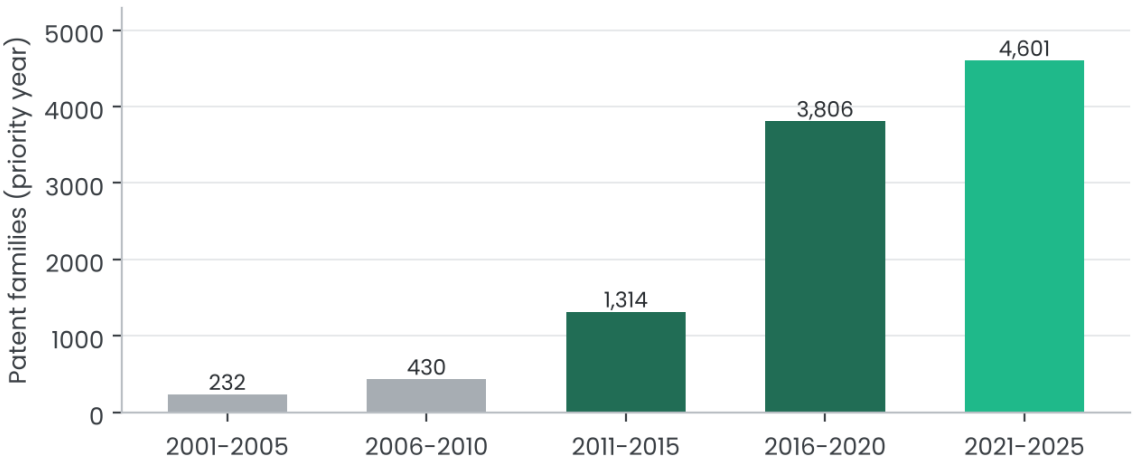


Figure 3 Patent families by five-year period (earliest priority year)

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5.2. Recent Trends (2015-2026)

Figure 4 compares priority years and publication years. The two curves move together with a delay of about one to two years, as expected from the publication lag. Table 4 gives the annual values and the year-on-year changes.

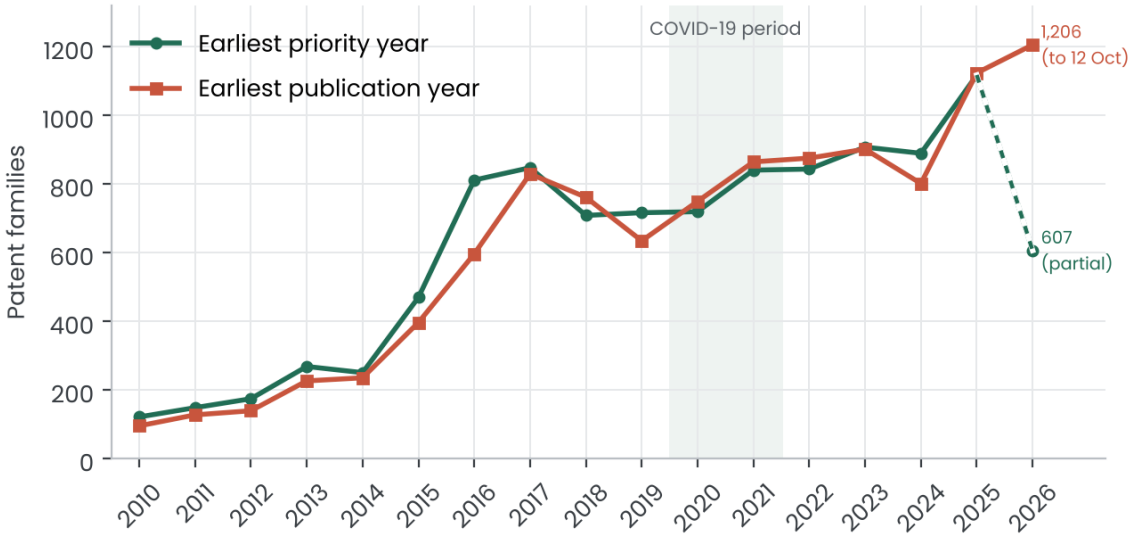


Figure 4 Patent families by earliest priority year and earliest publication year, 2010-2026

Table 4 Annual patent families and year-on-year change, 2015-2026

Year	Priority year	Change	Publication year	Change
2015	470	+87.3%	397	+68.2%
2016	812	+72.8%	597	+50.4%
2017	848	+4.4%	830	+39.0%
2018	709	-16.4%	762	-8.2%
2019	717	+1.1%	635	-16.7%
2020	720	+0.4%	750	+18.1%
2021	841	+16.8%	865	+15.3%
2022	844	+0.4%	876	+1.3%
2023	908	+7.6%	902	+3.0%
2024	890	-2.0%	802	-11.1%
2025	1,118*	+25.6%	1,124	+40.1%
2026	607*	n/a	1,206	+7.3%

* Incomplete because of the publication lag. **Publications from 1 January to 12 October 2026.**

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Three phases can be seen in the recent period:

- **2015-2017: breakthrough.** Filings jumped from 251 (2014) to 848 (2017). This is the period in which collaborative robots and human-robot interaction entered patenting at scale.
- **2018-2020: consolidation.** Priority filings fell back to about 710-720 per year and stayed stable for three years. Publication counts also dipped in 2019 (635).
- **2021 onwards: new growth phase.** Filings reached a new and higher level of 841-908 per year in 2021-2024. Priority year 2025 already shows 1,118 families despite being incomplete, and 2026 publications to mid-October (1,206) already exceed the full year 2025. Both indicators point to a further acceleration.

The small decline in 2024 (890 priority families, 802 publications) should be read with care. The 2024 priority figure is almost complete and very close to 2023, while the strong 2025 and 2026 values suggest that the dip in 2024 publications was temporary rather than the start of a downturn.

5.3. Impact of COVID-19

The data allow a careful reading of the COVID-19 period (2020-2021):

- In priority year 2020, filings were **flat** (720 families, +0.4% compared with 2019). The growth seen in previous years did not continue, but there was no drop either.
- In 2021, priority filings **rose by 16.8%** to 841, the strongest increase since 2016, and remained at this higher level afterwards.
- On the publication side, 2020 (+18.1%) and 2021 (+15.3%) were both growth years. The dip in 2019 publications took place before the pandemic.

Taken together, the pattern is consistent with a pause in new filings during the first pandemic year followed by a clear rebound. The pandemic did not interrupt interest in robots that work with people in production; if anything, the years after 2020 show a stronger level of activity. Patent statistics alone cannot prove the reasons for this change, but the timing of the rebound is noteworthy for the PROSPECTS 5.0 analysis of drivers of the Industry 5.0 transition.

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6. GEOGRAPHICAL DISTRIBUTION

6.1. Filing Offices

Figure 5shows the offices where family members were filed. China is by far the largest filing location, with 9,387 families (82.7%). The United States (1,391), international PCT applications (WO, 973), Japan (964), Korea (688) and the European Patent Office (685) follow. Germany (336) is the largest European national office, followed by Spain (108), France (89) and the United Kingdom (84).

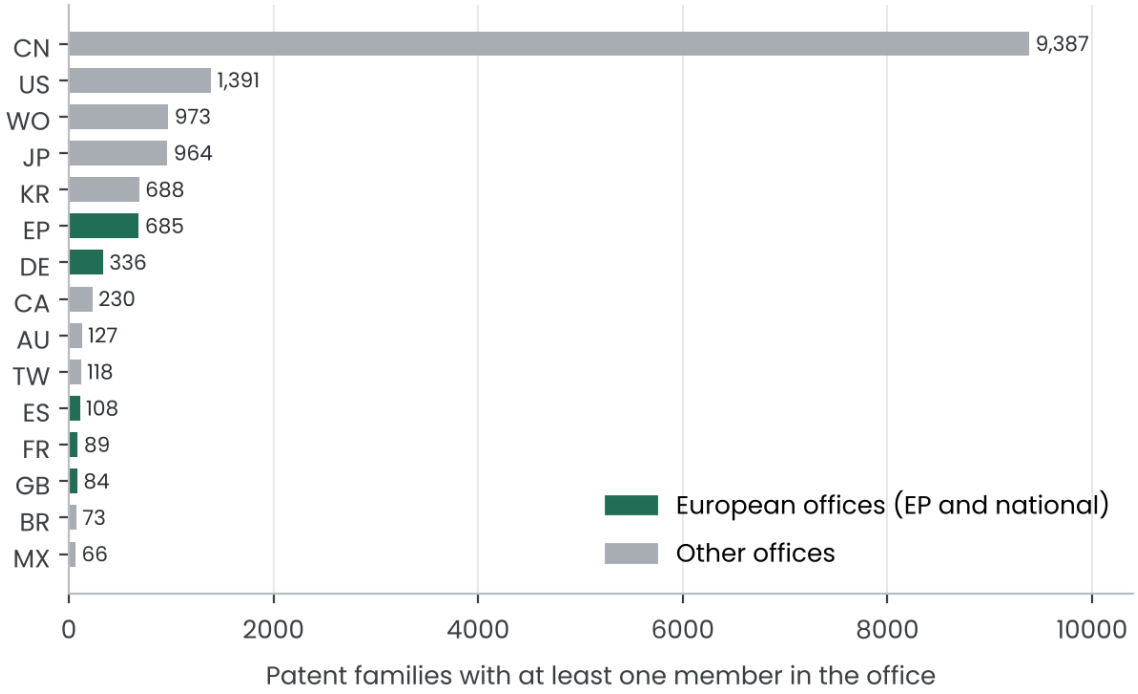


Figure 5 Top 15 filing offices by number of patent families

The large Chinese share reflects both strong domestic research activity and a filing practice in which many applications, especially from universities, are filed only in China. Filings in the US, at the EPO and through the PCT route are typically used for inventions intended for international markets, which makes them an important indicator of the global reach of a portfolio.

6.2. Applicant and Inventor Countries

When only the records with an applicant country code are considered (4,089 entries), the United States leads with 1,427 (34.9%), followed by Korea (648), China (423), Japan (333) and Germany (319). As explained in Section 3.3, China is under-represented here. The indicator is still useful to compare the other regions: taken together, European countries account for 821 records (20.1%), the second largest group after the United States.

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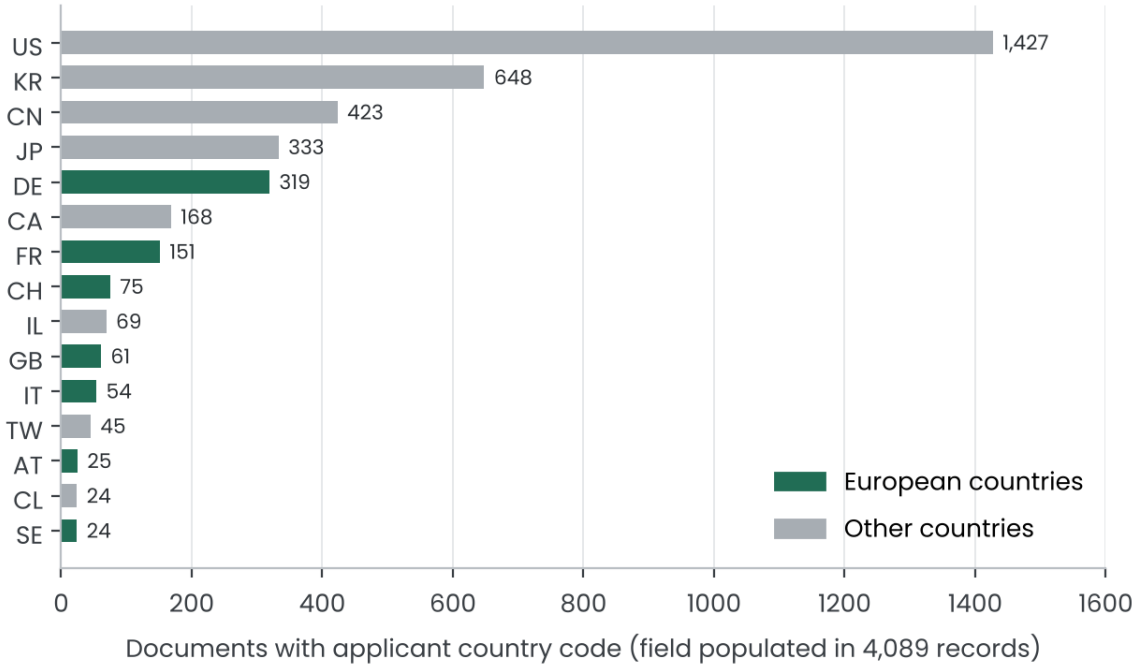


Figure 6 Top 15 applicant countries (records with a country code)

Table 5 Top 10 inventor countries (records with a country code)

Rank	Country	Records	Share
1	United States	1,400	36.8%
2	Korea	482	12.7%
3	China	431	11.3%
4	Germany	311	8.2%
5	Japan	274	7.2%
6	Canada	159	4.2%
7	France	119	3.1%
8	Israel	83	2.2%
9	United Kingdom	62	1.6%
10	India	51	1.3%

The inventor data confirm the picture: Germany is the fourth inventor country with 311 records, ahead of Japan, and European countries together account for 753 of 3,802 records (19.8%).

6.3. Publication Languages

Almost all families (99.7%) have an English-language publication, mainly through English abstracts, which makes the field easy to monitor internationally. Chinese is present in 82.5% of families. German (649 families, 5.7%) is the fifth language and French (432, 3.8%) the sixth, which reflects European activity.

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Table 6 Publication languages of patent families

Language	Families	Share	Rank
English	11,316	99.7%	1
Chinese	9,359	82.5%	2
Japanese	954	8.4%	3
Korean	670	5.9%	4
German	649	5.7%	5
French	432	3.8%	6
Spanish	117	1.0%	7
Russian	59	0.5%	8

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7. THE EUROPEAN POSITION

7.1. European Patent Footprint

Europe shows a distinct profile in this landscape. While its total volume is smaller than that of China, its activity is strongly oriented towards international protection and towards high-value industrial applications.

The European Patent Office is the main entry point to the European market: **685 families include an EP application**, which places the EPO sixth among all filing offices. National offices add further coverage, led by Germany (336), Spain (108), France (89), the United Kingdom (84), Austria (43) and Italy (42), as shown in Figure 7.

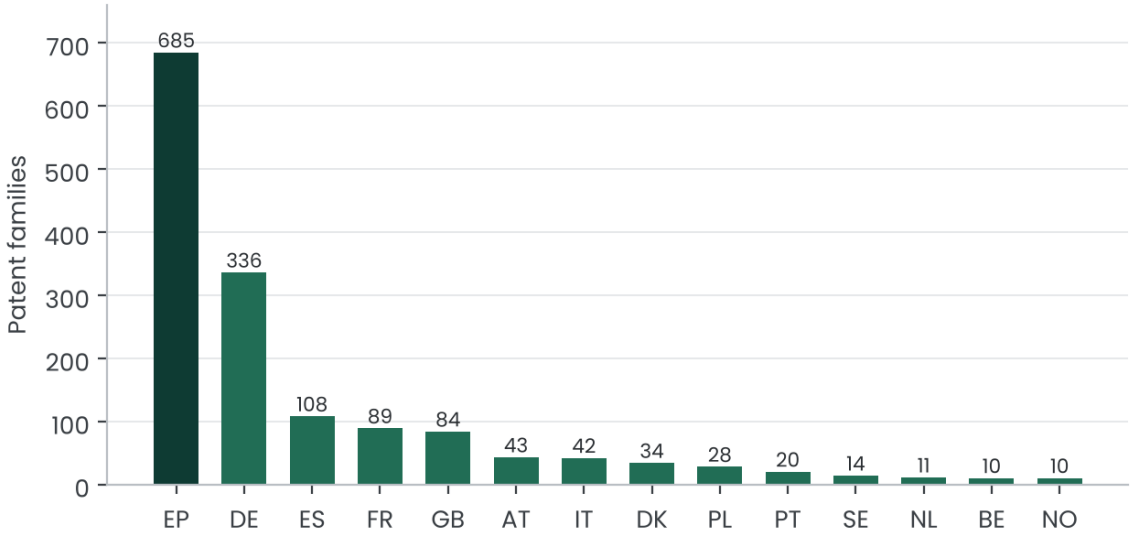


Figure 7 European filing offices by number of patent families

A second strong signal comes from the CPC assigning offices (Figure 8). The EPO classified **2,696 documents (29.7% of all CPC allocations)**, second only to the Chinese office and well ahead of the US office (1,404). This shows that a large part of the global portfolio passes through European examination and classification, which confirms the relevance of the European market for companies active in this field.

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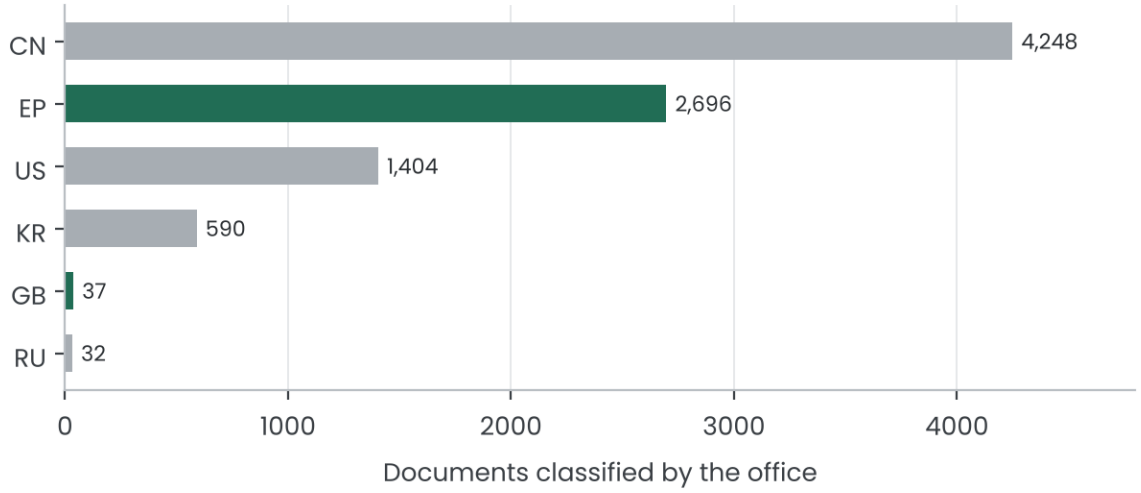


Figure 8 CPC assigning offices by number of classified documents

Table 7 Europe in the main indicators

Indicator	Europe	Position
Families with an EP application	685	6th filing office
Families with a German (DE) member	336	7th filing office
CPC allocations by the EPO	2,696 (29.7%)	2nd classifying office
Applicant records from European countries	821 (20.1%)	2nd region after US
Applicant records from Germany	319	5th country
Inventor records from European countries	753 (19.8%)	2nd region after US
Inventor records from Germany	311	4th country
Families with a German-language publication	649	5th language

7.2. European Applicants and Inventors

Among European applicants, Germany (319 records), France (151), Switzerland (75), the United Kingdom (61) and Italy (54) are the most active, followed by Austria (25) and Sweden (24). On the inventor side, Germany (311), France (119), the United Kingdom (62), Italy (47) and Sweden (42) lead.

Figure 9 groups the main European organisations found in the applicant list, with name variants combined. The ranking is led by robot manufacturers and automation suppliers (KUKA with 45 families, ABB with 35, Siemens with 23), followed by automotive manufacturers (Daimler/Mercedes-Benz with 27, Stellantis group companies with 9) and suppliers such as Bosch (9) and Comau (6). Research and technology organisations such as Fraunhofer (6), CEA (5) and DLR (5) are also present, as are aerospace (Airbus) and sensor and safety specialists (Sick).

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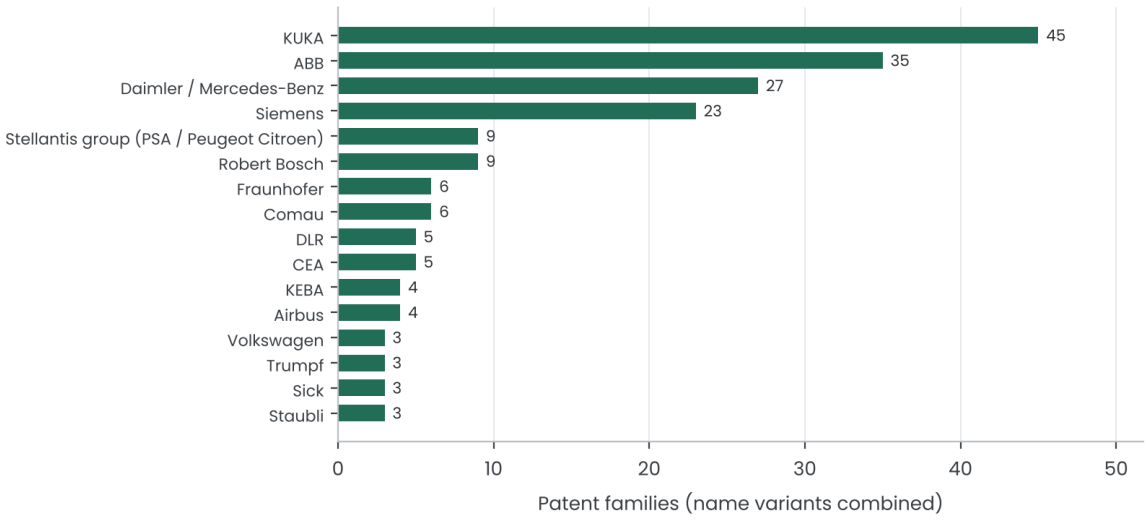


Figure 9 Main European applicants (name variants combined)

7.3. Strengths and Opportunities for Europe

The data point to several European strengths that are directly relevant for Industry 5.0:

- **International orientation.** A high share of European activity uses the EP route, and the EPO plays a central role in classifying the global portfolio. European inventions are therefore positioned for international markets.
- **Industry-driven innovation.** European patenting is led by companies that build and use robots in real factories, such as robot makers, automation suppliers and car manufacturers. This brings inventions close to deployment on the shop floor.
- **Strong research base.** Germany and France are among the leading inventor countries, and organisations such as Fraunhofer, CEA and DLR connect research with industry.
- **Alignment with Industry 5.0.** Safety and human-robot coexistence, worker-assisting exoskeletons and AI-based control are among the main technology clusters of this landscape (Section 9). These are areas in which the European focus on human-centric, safe and resilient production can make a visible difference.

These strengths give Europe a good basis to increase its share of patenting in the coming years, especially by translating its research and industrial expertise into more patent filings in the fast-growing clusters of AI-based control, perception and human-robot collaboration.

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8. KEY PLAYERS

8.1. Leading Applicants

Figure 10 lists the 25 most active applicants. The ranking is led by Chinese universities: Tsinghua University (66 families), South China University of Technology (57), Zhejiang University (57), Huazhong University of Science and Technology (48) and Zhejiang University of Technology (45). Nine of the top ten applicants are universities or research institutes, and 18 of the top 25 are academic or research organisations.

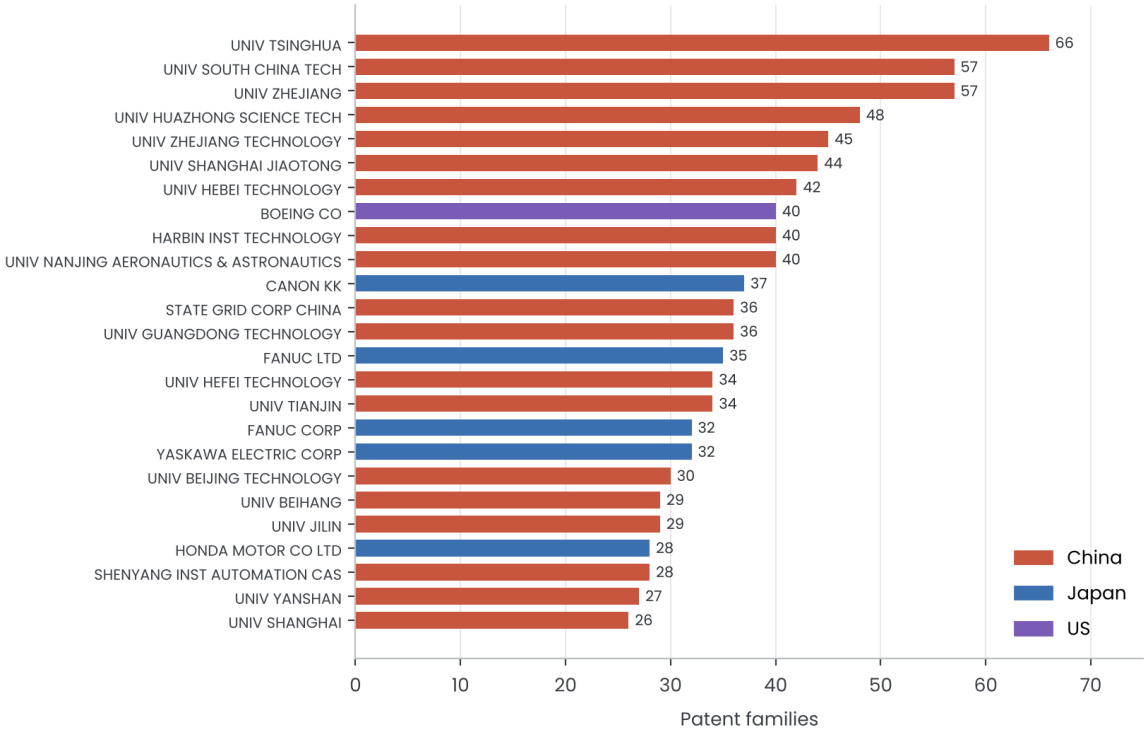


Figure 10 Top 25 applicants by number of patent families (names as recorded)

8.2. Industrial and Academic Profiles

Two different innovation models appear in the data:

- **Academic-led model (China).** Chinese universities and institutes such as Harbin Institute of Technology and Shenyang Institute of Automation dominate the top of the ranking. Industrial applicants from China are also present, for example State Grid (36) and the cobot manufacturer Suzhou Elite Robot (21).
- **Industry-led model (Japan, US, Korea and Europe).** Outside China, the most active applicants are companies. Japan is represented by robot makers and manufacturers such as FANUC (35 and 32 under two names), Yaskawa (32), Canon (37), Honda (28) and Kawasaki (24). The US is represented by Boeing (40), the largest industrial applicant, and by the humanoid robot developer

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Figure AI (19 and 2 under two names). Korea is represented by Hyundai (21) and Samsung (19), and Europe by the companies listed in Section 7.2.

The presence of newer companies such as Figure AI and NVIDIA (12) next to established robot makers shows that general-purpose and humanoid robots and AI computing are entering the field of human-centric manufacturing.

8.3. Inventors

The inventor ranking is led by WANG WEI (52 families), LI BO (35), ZHANG LEI (33), ZHANG WEI (32) and WANG LEI (31). WENZENG ZHANG (30) and ZHANG WENZENG (23) are likely to be the same person recorded in two name orders. As noted in Section 3.3, common names can refer to several individuals, so the inventor ranking should be read as an indication of the strong research community in China rather than as a ranking of individuals.

Table 8 Top 10 inventors by number of patent families (names as recorded)

Rank	Inventor	Families
1	WANG WEI	52
2	LI BO	35
3	ZHANG LEI	33
4	ZHANG WEI	32
5	WANG LEI	31
6	WENZENG ZHANG	30
7	WANG BIN	28
8	CHEN WEI	27
9	LI YANG / LIU TAO / LIU WEI / TIAN WEI	26 each
10	WANG JUN / WEI WEI	25 each

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9. TECHNOLOGY FOCUS

9.1. Core Robotics Groups

Within B25J, the largest IPC main group is B25J9 (programme-controlled manipulators), present in 6,183 families (54.5%). It is followed by B25J11 (manipulators not otherwise provided for, 3,129), B25J19 (accessories and safety devices, 2,824), B25J15 (gripping heads, 1,989), B25J13 (controls for manipulators, 1,473) and B25J5 (manipulators mounted on wheels or carriages, 1,411). The weight of B25J9 shows that control and programming are at the heart of the field.

Table 9 Main B25J IPC groups

IPC group	Description	Families	Share
B25J9	Programme-controlled manipulators	6,183	54.5%
B25J11	Manipulators not otherwise provided for	3,129	27.6%
B25J19	Accessories, e.g. monitoring, viewing and safety devices	2,824	24.9%
B25J15	Gripping heads and other end effectors	1,989	17.5%
B25J13	Controls for manipulators	1,473	13.0%
B25J5	Manipulators mounted on wheels or carriages	1,411	12.4%
B25J17	Joints	819	7.2%
B25J18	Arms	730	6.4%

9.2. Technology Clusters

To make the CPC data easier to interpret, the most frequent CPC subgroups were grouped into eight thematic clusters (Figure 11 and Table 10). Because one family can carry several codes, the values are classification occurrences and not unique families.

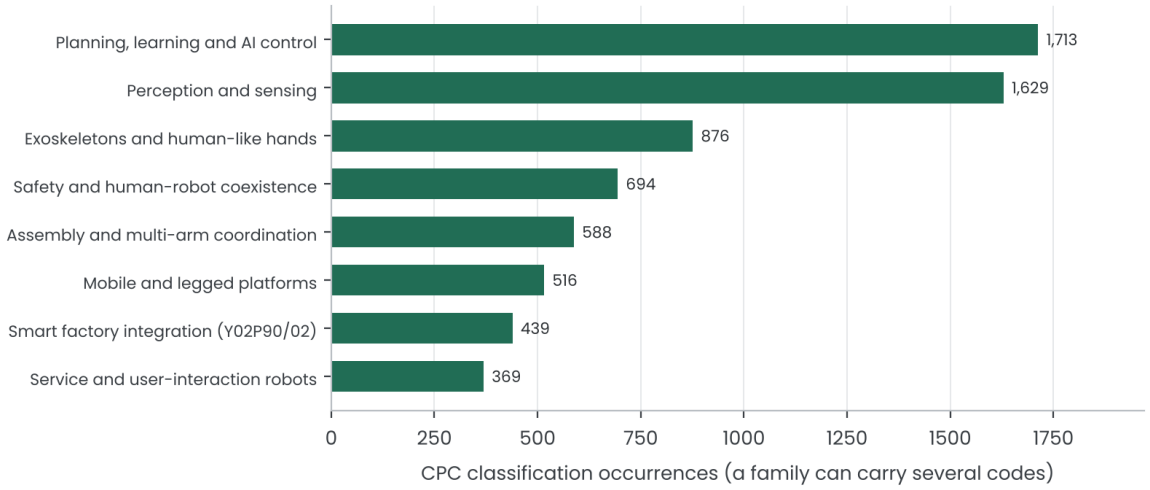


Figure 11 Technology clusters based on the most frequent CPC subgroups

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Table 10 CPC subgroups used for the technology clusters

Cluster	Main CPC subgroups (occurrences)	Total
Planning, learning and AI control	B25J9/1664 motion and path planning (557), B25J9/1602 control architecture (343), B25J9/163 learning and adaptive control (342), B25J9/161 hardware such as neural networks (328), G06N3/008 (77), G06N20/00 machine learning (66)	1,713
Perception and sensing	B25J9/1697 vision control (552), B25J19/02 sensing devices (283), B25J19/023 cameras (243), B25J9/1694 sensor fusion (228), B25J13/08 sensing controls (201), B25J13/085 force and torque sensors (122)	1,629
Exoskeletons and human-like hands	B25J9/0006 exoskeletons (652), B25J15/0009 multi-fingered hands (224)	876
Safety and human-robot coexistence	B25J9/1676 collision avoidance (170), B25J19/06 safety devices (162), B25J9/1666 collision-free planning (144), B25J9/1674 safety and monitoring (128), G05B2219/40202 human-robot coexistence (90)	694
Assembly and multi-arm coordination	B25J9/1682 dual-arm and multi-robot coordination (243), B25J9/1687 assembly tasks (223), B25J9/0084 several manipulators (122)	588
Mobile and legged platforms	B25J5/007 manipulators on wheels (410), B62D57/032 legged vehicles (106)	516
Smart factory integration	Y02P90/02 total factory control, smart factories (439)	439
Service and user-interaction robots	B25J11/008 service robots (211), B25J11/0005 communication with users (158)	369

The analysis of the clusters gives four main messages:

- **Intelligence is the main driver.** Planning, learning and AI-based control together with perception form the two largest clusters. Robots that work with people need to see, understand and adapt to a changing environment, and most inventions address these capabilities.
- **The worker is directly supported.** Exoskeletons (652 occurrences for B25J9/0006) are one of the largest single subgroups. After the exclusion of medical rehabilitation devices, these are mainly devices that assist workers with physical tasks, which is a core idea of Industry 5.0.
- **Safety is an established topic.** Collision avoidance, safety devices, monitoring and human-robot coexistence add up to 694 occurrences, which shows that safe shared workspaces are a major technical focus.

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- **Robots are becoming mobile and connected.** Mobile and legged platforms (516) and smart factory integration (439) show that robots are moving beyond fixed cells and becoming part of connected production systems.

9.3. Cross-domain Technologies

Figure 12 shows the most frequent IPC main groups outside B25J. Programme control systems (G05B19, 569 families) come first, followed by assembly methods (B23P19, 343), control of vehicle position (G05D1, 264), neural networks and AI computing models (G06N3, 247), conveying and handling (B65G47, 243) and welding auxiliary devices (B23K37, 237). Image analysis (G06T7), user interfaces (G06F3) and business and production management (G06Q10, G06Q50) also appear. The mix confirms that human-centric robotics is increasingly an interdisciplinary field that combines mechanics, automation, artificial intelligence and digital production management.

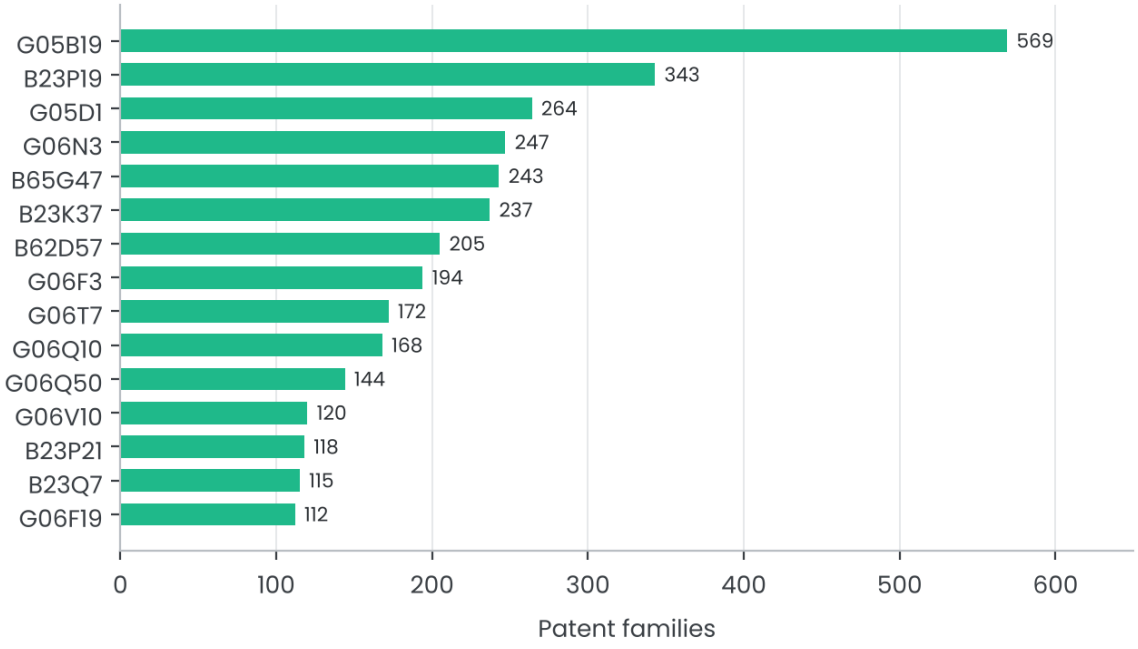


Figure 12 Top 15 IPC main groups outside B25J

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10. CONCLUSION

This patent landscape shows that robotics for human-centric manufacturing is a young, dynamic and still growing technology field. More than four out of five patent families have been filed since 2015, and the most recent data point to a new phase of growth: priority year 2025 already counts 1,118 families although it is incomplete, and publications in 2026 have exceeded the previous year before the end of October.

The COVID-19 period caused a pause rather than a decline. Filings were stable in 2020 and rose by 16.8% in 2021, after which they stayed at a higher level. Interest in robots that work with people in production has therefore remained strong through the crisis.

China is the largest filing location, with a model led by universities and a large domestic patent volume. Japan, the United States, Korea and Europe follow an industry-led model in which robot manufacturers, automation suppliers and end users drive patenting.

Europe holds a strong and internationally oriented position. The EPO is the second most important classifying office, 685 families include a European patent application, and European applicants and inventors form the second largest group after the United States among records with a country code. Germany stands out as a key inventor and applicant country, and European companies such as KUKA, ABB, Daimler/Mercedes-Benz, Siemens, Bosch and Comau, together with research organisations such as Fraunhofer, CEA and DLR, form a solid innovation base.

The technology focus is moving towards intelligent, perceptive and safe robots: AI-based planning and control, perception, safety and human-robot coexistence, worker-assisting exoskeletons and mobile platforms. These directions match the objectives of Industry 5.0 closely. For PROSPECTS 5.0, the results suggest that the coming years offer a clear window of opportunity for Europe to build on its industrial and research strengths and to take a leading role in safe, human-centric and resilient robotic production.

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PROSPECTS 5.0

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