

Patent Technology Analysis of Floor Cleaning Machines

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Abstract: This paper focuses on the floor cleaning machine industry, with data retrieved and analyzed from the Himmpat commercial database (as of September 10, 2025) for patents related to floor cleaning machines. It reveals the industry's development trends and technical characteristics, covering technological overview, patent status, patent technology themes, and major applicants. The study concludes that China holds a significant competitive advantage in the floor cleaning machine sector and has cultivated leading enterprises. Local governments should enhance support and services for these enterprises to promote the formation of industrial clusters. Meanwhile, Chinese enterprises have deficiencies in specific technical field layouts. They need to conduct in-depth exploration of relevant areas, increase R&D investment, and gather talents to consolidate their advantages and lead the industry's high-quality development.

1. Introduction to the Technology of the Floor Cleaning Machine Industry

In recent years, the global market scale of floor cleaning machines has expanded continuously. From 2020 to 2023, the proportion of floor cleaning machines in the entire cleaning appliance market increased from 5% to 36%. In 2024, global sales of automatic floor cleaning machines reached 22.2 billion US dollars, and this figure is projected to hit 32.55 billion US dollars by 2031, with a compound annual growth rate (CAGR) of 5.7% (2025 - 2031)^[1]. As one of the world's largest consumer markets, China's floor cleaning robot market is also expanding steadily, and is expected to reach 25 billion US dollars by 2025. While the market size is constantly expanding, technological innovation has become the core element of enterprise competition^[2]. Companies have increased R&D investment to enhance product performance and competitiveness through patented technologies, catering to consumers' increasingly diverse demands. In the early stages, patented technologies for floor cleaning machines primarily focused on improving basic performance metrics such as suction power and battery life—for instance, optimizing motor design and battery technology to boost these key attributes. However, with the continuous upgrading of consumer needs, after 2020, the technological development of floor cleaning machines gradually shifted toward multi-task collaboration, and products with integrated functions such as washing and mopping in one and sterilization appeared. Besides the innovation of mechanical structures, breakthroughs in materials science have also brought new opportunities for the development of floor cleaning machines. The application of materials for the main body of the machine and the roller brush has become an important development direction. Additionally, with the growth of smart home ecosystems, floor cleaning machines have evolved from standalone devices to integrated

components of whole-house smart systems, enabling seamless linkage for whole-house intelligent cleaning. In summary, after years of development, the floor cleaning machine industry has undergone multiple rounds of technological innovation, with related technologies showing a vibrant, multi-faceted development pattern.

Patents, as a key indicator of an industry's innovation capability, reflect enterprises' investment in and achievements of technological R&D. An in-depth analysis of the patent technology path in the floor cleaning machine industry is conducive to understanding the industry's development trends and technological innovation directions, providing references for enterprises' R&D decisions, and offering theoretical support and practical guidance for industrial upgrading.

This study uses the Himmpat commercial database for patent retrieval (retrieval deadline: September 10, 2025). By retrieving and analyzing patents related to floor cleaning machines, it aims to clarify the development process and future trends of technologies in this field. It should be noted that due to the unique disclosure system of patent applications—patents are generally published and included in databases 18 months after filing—some patents applied for between 2024 and 2025 have not been included in the analysis sample.

2. Overview of Patents

To ensure data accuracy, this study expanded the International Patent Classification (hereafter referred to as IPC) and keywords related to floor cleaning machines, and excluded patent data outside the scope of this analysis (e.g., window-cleaning robots, textile cleaning equipment). Since floor cleaning machine technology began to develop on a large scale only in recent years, the patent data analyzed was limited to applications filed after 2000. The trend of patent applications is shown in Figure 1.

2.1. Trend of Patent Applications

Due to the significant gap between the number of global and Chinese patents and those of other countries, global and Chinese data are plotted on the left vertical axis (solid line), while data from other major countries are plotted on the right vertical axis (dashed line). It can be seen that in the initial stage, the number of patent applications in China was relatively small, and research on floor cleaning machine technology was concentrated in the United States, Japan, and South Korea—particularly in Japan, a major home appliance manufacturing country. As a latecomer, China gradually gained momentum, surpassed Japan in 2012, and has since gradually gained commercial influence in the field. Notably, the global trend of patent applications is highly consistent with that of China. The number of patent applications in Japan has shown a year-on-year decline, while the number of patents from the United States, South Korea, and Germany has remained basically stable in recent years, indicating lukewarm progress in their research on floor cleaning machine technology. From a global perspective, the number of patent applications has continued to increase since 2000; although there was a slight decline in 2022, growth resumed in 2023 (the patent data in 2024 has not been fully disclosed, so the data volume declined). This indicates that the floor cleaning machine industry is currently in a period of technological growth, with strong potential for innovative development.

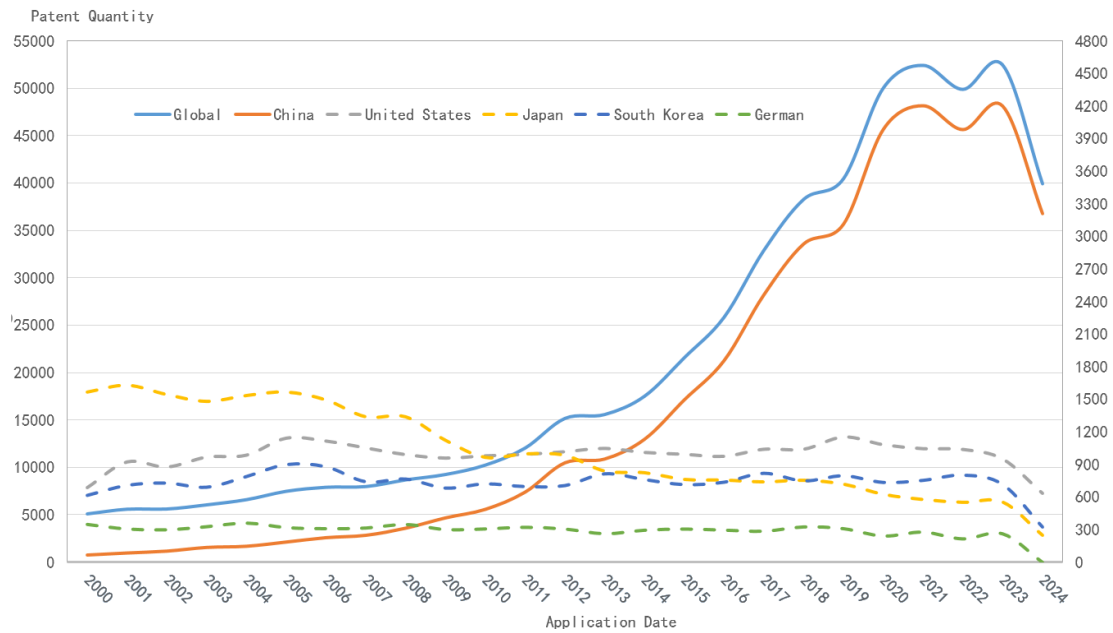


Figure 1: Patent Application Trend in Major Countries/Regions.

2.2. Global Geographical Layout of Patents

Figure 2 shows the countries/regions where applicants in the floor cleaning machine field mainly choose to apply for patents, from which the hot geographical distribution of floor cleaning machine patents can be seen. It can be seen that the top three countries are China, Japan, and the United States. Among them, China is far ahead, and the number of patent applications exceeds the sum of the countries ranked second to fourth, occupying an absolute dominant position.

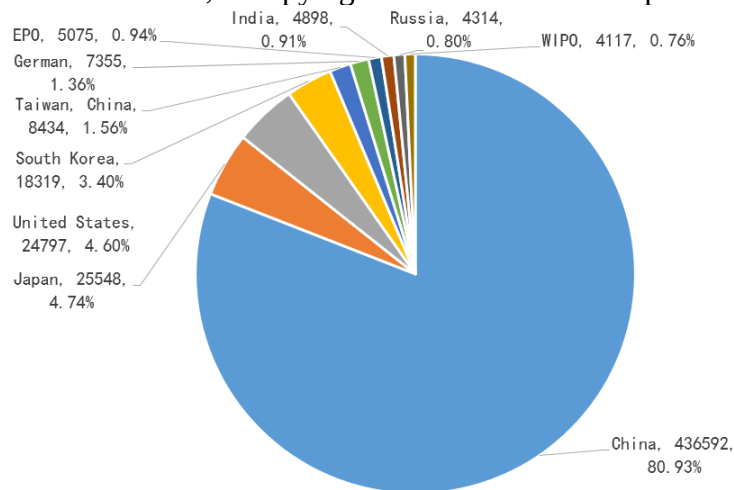


Figure 2: Distribution of Major Patent-Filing Countries/Regions.

Figure 3 shows the main regional origins of applicants in the floor cleaning machine field. Applicants are primarily distributed across five countries: China, Japan, the United States, South Korea, and Germany. The number of patents filed by Chinese applicants is significantly higher than that of the other four countries, confirming China's leading position in global research on floor cleaning machine patent technologies.

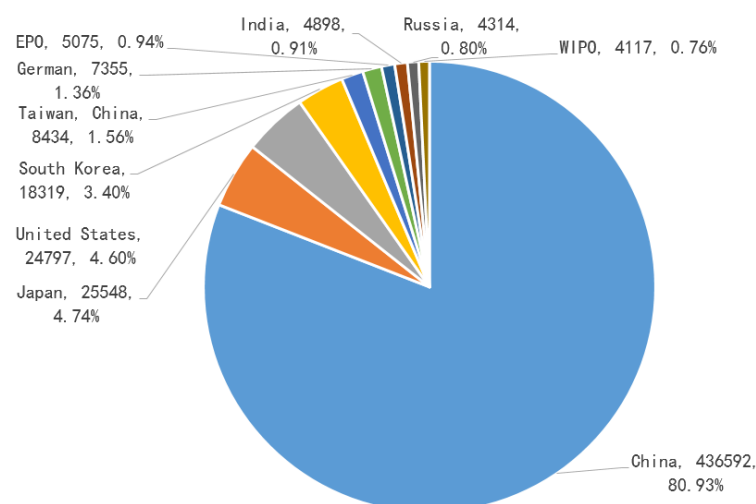


Figure 3: Regional Origin of Global Patent Applicants.

2.3. Types of Global Patents

Since invention patents have a longer protection period than utility model patents, enterprises typically prioritize filing invention patents for technologies they consider strategically important. As shown in Figure 4, the proportion of invention patents is relatively high, indicating that the related technologies in the floor cleaning machine field have high technical content. Additionally, since floor cleaning machines belong to the home appliance sector—where structural and aesthetic design are important—there are also a certain number of utility model and design patent applications.

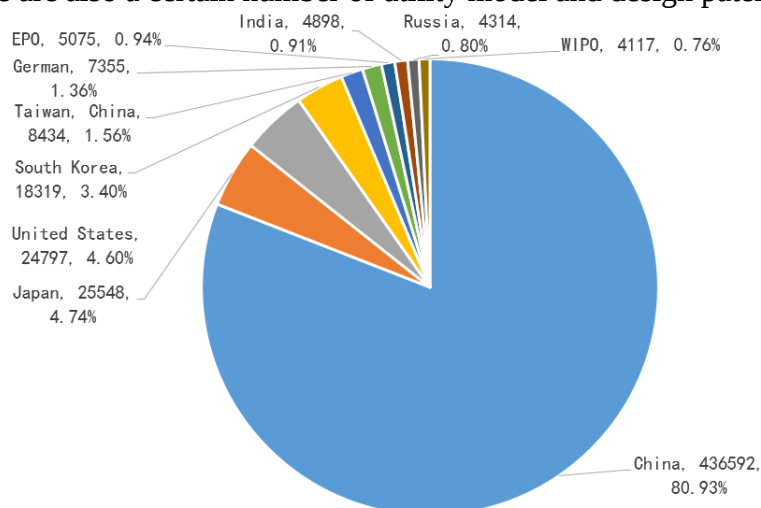


Figure 4: Distribution of Global Patent Types.

3. Patent Technology Themes

3.1. Patent Technology Branches

Using IPC as the basis for differentiation, this study counted the number of patents laid out in different technical fields, resulting in the patent technology composition chart shown in Figure 5. Patented technologies related to floor cleaning machines are mainly concentrated in the IPC of A47L and B08B regarding household cleaning and general cleaning. Besides the classifications in

the technological fields where they are located, the patented technologies of floor cleaning machines are also concentrated in the classification fields related to motors, testing, control, digital and image processing, such as H02K, G01N, B65G, H02P, G06F, etc. Motor and control fields (H02K, H02P) correspond to automatic movement and path planning technologies of floor cleaning machines; Testing and image processing fields (G01N, H04N) correspond to cleaning effect detection technologies; Digital processing fields (G06F) correspond to the integration of floor cleaning machines into smart home ecosystems. These classifications reflect the current hot research directions in the floor cleaning machine field. Table 1 explains the specific meanings of the IPC involved in the top ten technical fields.

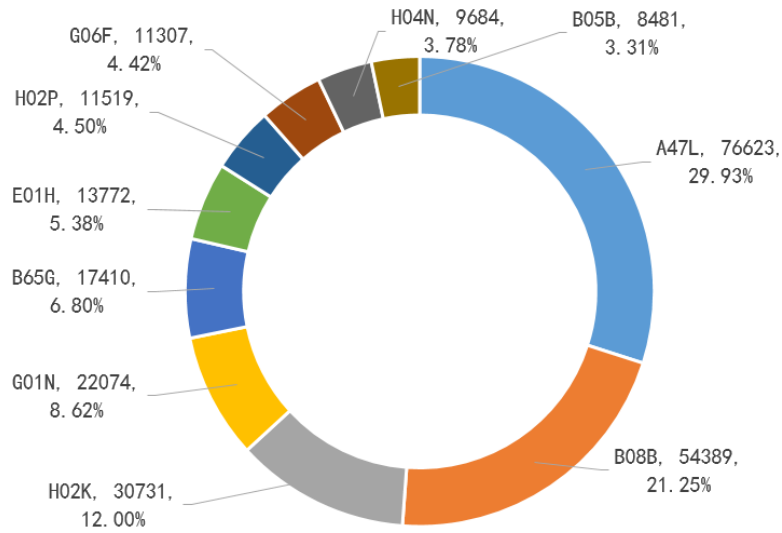


Figure 5: Analysis of Technology Branches.

Table 1: International Patent Classification in the Top Ten Technical Fields.

International Patent Classification	Meaning
A47L	DOMESTIC WASHING OR CLEANING; SUCTION CLEANERS IN GENERAL
B08B	CLEANING IN GENERAL; PREVENTION OF FOULING IN GENERAL
H02K	DYNAMO-ELECTRIC MACHINES
G01N	INVESTIGATING OR ANALYSING MATERIALS BY DETERMINING THEIR CHEMICAL OR PHYSICAL PROPERTIES
B65G	TRANSPORT OR STORAGE DEVICES, e.g. CONVEYORS FOR LOADING OR TIPPING, SHOP CONVEYOR SYSTEMS OR PNEUMATIC TUBE CONVEYORS
E01H	STREET CLEANING; CLEANING OF PERMANENT WAYS; CLEANING BEACHES; CLEANING LAND; DISPERSING FOG IN GENERAL
H02P	CONTROL OR REGULATION OF ELECTRIC MOTORS, ELECTRIC GENERATORS OR DYNAMO-ELECTRIC CONVERTERS; CONTROLLING TRANSFORMERS, REACTORS OR CHOKE COILS
G06F	ELECTRIC DIGITAL DATA PROCESSING
H04N	PICTORIAL COMMUNICATION, e.g. TELEVISION
B05B	SPRAYING APPARATUS; ATOMISING APPARATUS; NOZZLES

3.2. Development Trend of Key Technology Branches

Due to the large gap between the number of patents in the A47L field and other fields, A47L data is plotted on the left vertical axis (solid line), while data from other main technical fields are plotted on the right vertical axis (dashed line).As shown in Figure 6, it can be seen that in the initial stage, the number of patents in the A47L and H02K fields was relatively large. Over time, the number of applications in all fields showed a trend of slight fluctuations but overall growth. After years of development, the fields with the largest number of current applications are A47L, G01N, H02K, and B65G.

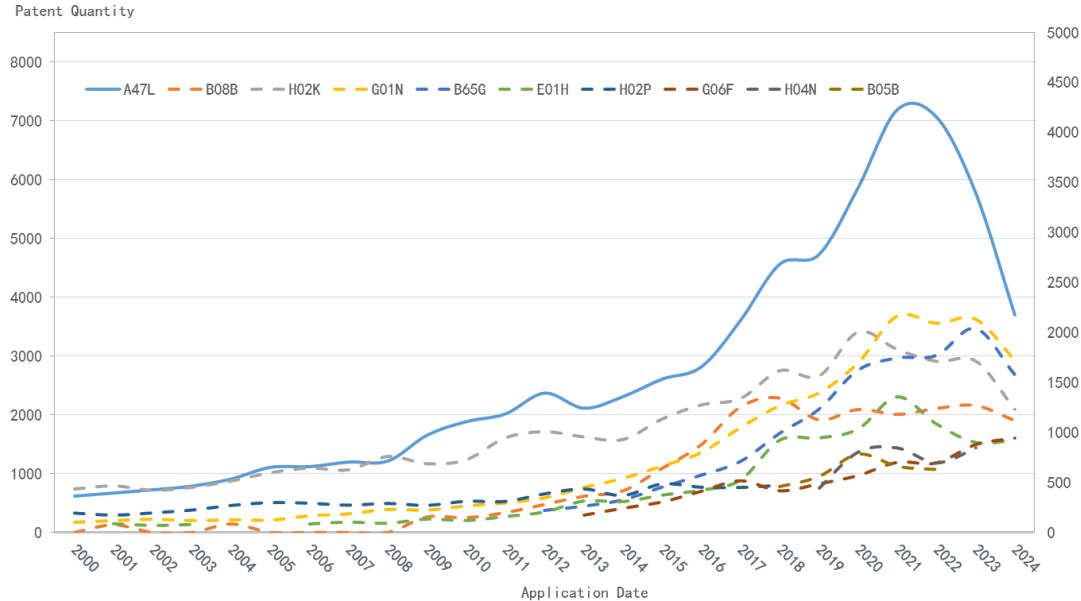


Figure 6: Patent Application Trend of Key Technology Branches.

3.3. Geographical Distribution of Patents in Key Technology Branches

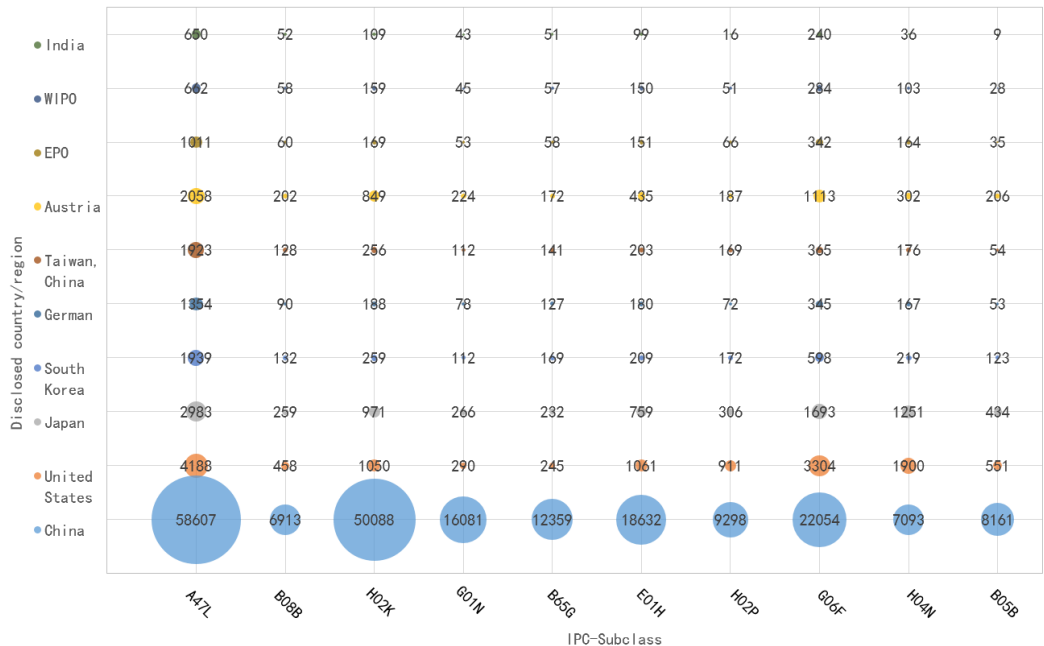


Figure 7: Geographical Distribution of Patents in Key Technology Branches.

Figure 7 shows the patent application status of the top ten countries/regions (by patent quantity) in each technology branch. Patent applications from these countries/regions are mainly concentrated in three fields: A47L, H02K, and G06F. Notably, the ranking of each country/region in terms of patent applications across different technology branches is basically consistent, indicating that global research focuses on floor cleaning machine technology are highly aligned.

4. Major Applicants

4.1. Major Global Patent Applicants

Figure 8 shows the ranking of the top 15 applicants by global patent application volume in the floor cleaning machine field. China's dominant position in this field is evident: over half of the top 15 applicants are Chinese enterprises, and Chinese companies occupy the top three spots. Japanese and South Korean enterprises follow closely.

Notably, all top 15 applicants are well-known home appliance manufacturers, highlighting the emphasis that these industry giants place on technological R&D and patent layout.

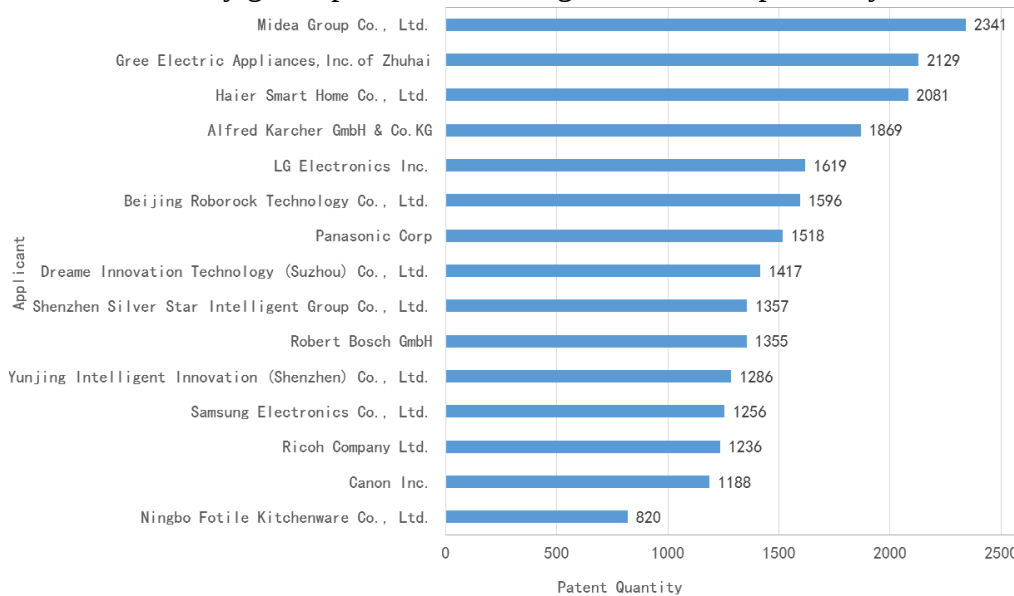


Figure 8: Ranking of Top Global Patent Applicants.

4.2. Technology Distribution of Patents by Major Global Applicants

Figure 9 shows the patent application status of the top 10 global applicants (by patent quantity) across different technology branches. Most enterprises focus their applications on the A47L field. Exceptions include: Robert Bosch GmbH: Almost all its patents are in the H02K field; Panasonic Corporation: Its patents are concentrated in the H02P (motor control) and H02K (motor technology) fields.

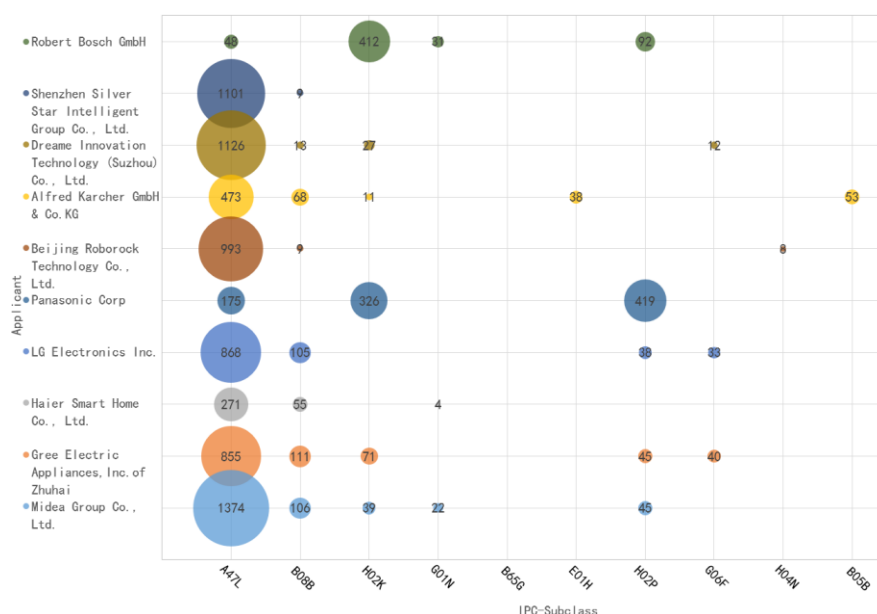


Figure 9: Technology Distribution of Patents by Major Global Applicants.

4.3. Major Chinese Patent Applicants

Figure 10 shows the ranking of the top 15 applicants by national patent application volume in the floor cleaning machine field. These applicants include: Well-known comprehensive home appliance enterprises: Midea, Gree, Haier; Specialized floor cleaning machine enterprises with outstanding performance: Roborock, Dreame, Narwal, Ecovacs, Tineco.

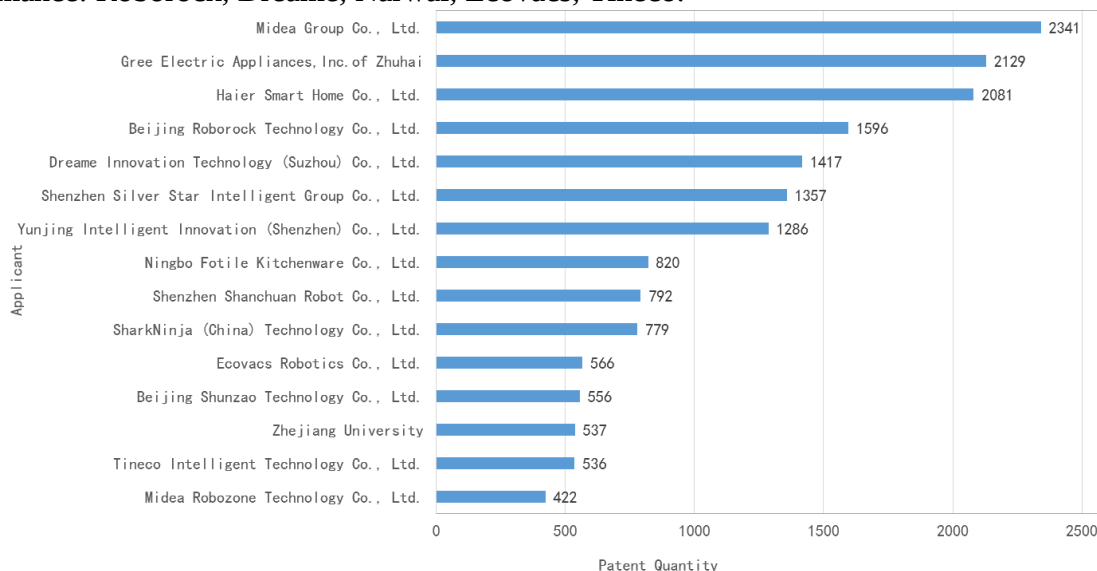


Figure 10: Ranking of Top Chinese Patent Applicants.

4.4. Types of Chinese Applicants

Figure 11 shows the distribution of patent applicant types in China's floor cleaning machine field, reflecting the industrial R&D landscape of the sector. Enterprises account for the majority of applicants; combined with the analysis of key Chinese applicants (Figure 10), it is clear that key patent applicants in China are primarily enterprises, and a group of leading enterprises has been

formed. In future development, these leading enterprises can leverage their leadership to drive the continuous advancement of China’s floor cleaning machine technology and maintain its international competitiveness.

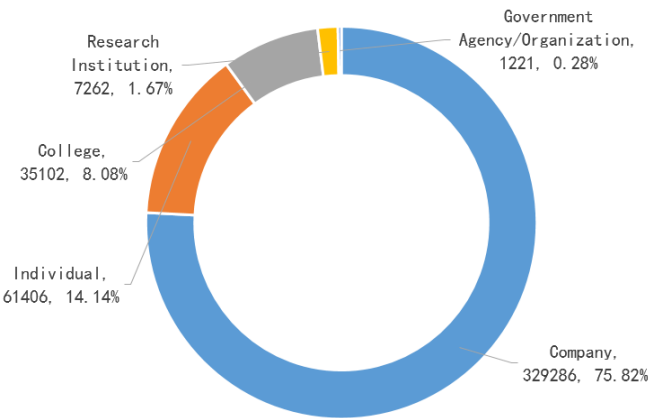


Figure 11: Types of Chinese Applicants.

4.5. Technology Distribution of Patents by Major Chinese Applicants

Figure 12 shows the patent application status of the top 10 Chinese applicants (by patent quantity) across different technology branches. All these enterprises concentrate their applications in the A47L field (core cleaning technology). Additionally: Midea, Gree, and Dreame have relatively broad patent layout across multiple technical fields; Other enterprises focus their applications on 2–3 specific fields.

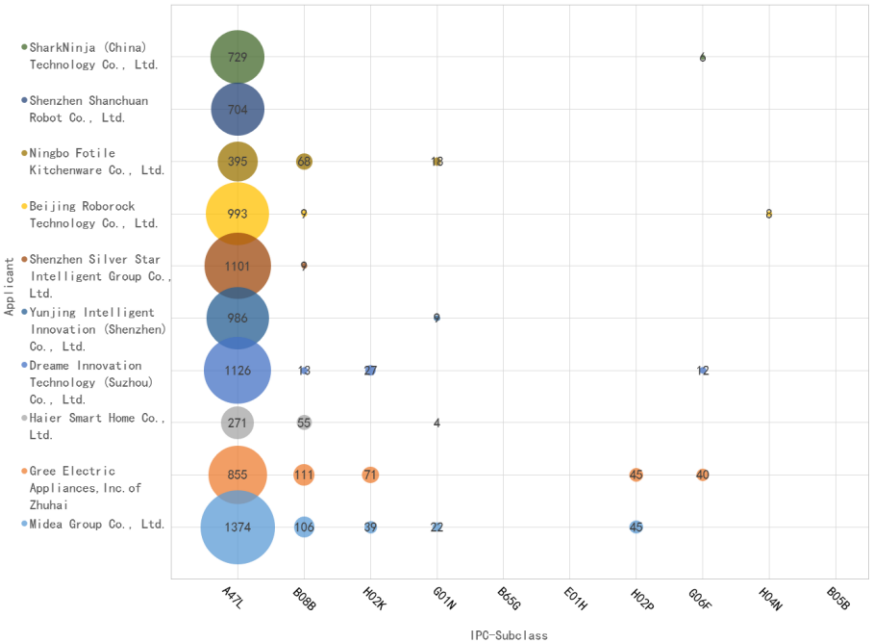


Figure 12: Technology Distribution of Patents by Major Chinese Applicants.

5. Conclusions and Recommendations

5.1. Conclusions

China’s dominant position in patents: In the patent applications in the floor cleaning machine

field, China holds an extremely prominent dominant position in patent applications for floor cleaning machines. Globally, the number of patent applications filed by China in this field is substantial, giving it a significant competitive advantage. Through years of in-depth cultivation and continuous investment, China has not only accumulated rich technological achievements but also nurtured a group of influential leading enterprises.

Deficiencies in specific technical fields: From the perspective of technical field layout in patent applications, Chinese enterprises currently have certain deficiencies. Their patent layout is relatively concentrated in conventional, general technical fields, while layout in specific high-value fields (e.g., R&D of special materials, precision manufacturing of key components) is insufficient.

5.2. Recommendations

Local Governments Should Strengthen Support for Leading Enterprises: Local governments should be aware of the significance that leading floor cleaning machine enterprises hold for regional economies and the entire industry. They need to strengthen policy and service support in the following ways. Firstly, they can introduce targeted tax incentives, which will help reduce enterprises' operating costs and enable enterprises to allocate more funds to technological research and development (R&D) as well as innovation. Secondly, they should build industry-university-research cooperation platforms. These platforms will facilitate the collaboration between enterprises and research institutions and universities, allowing enterprises to gain timely access to cutting-edge research results and accelerate the transformation and application of technologies.

Local Governments Should Promote the Formation of Industrial Clusters: Local governments should guide leading enterprises to drive the coordinated development of surrounding small and medium-sized enterprises (SMEs). By doing so, industrial clusters centered on leading enterprises can be formed. In this model, leading enterprises can take advantage of their strengths in resource integration and technological radiation. Meanwhile, SMEs can make use of their flexibility and professionalism to focus on niche sub-fields. Through such coordinated efforts, the entire industry can achieve progress, and collectively enhance the global competitiveness of China's floor cleaning machine industry.

Enterprises Should Enhance R&D in Specific High-Value Fields: As global technology advances and the floor cleaning machine industry develops in depth, future technological upgrades will concentrate on specific high-value fields. Chinese enterprises should take corresponding actions. They need to conduct in-depth exploration of key fields like innovative material applications and component optimization. Moreover, they should increase R&D investment and attract professional R&D talent to develop new technological paths. In this way, they can drive breakthroughs in core technologies, maintain a strong innovative momentum in global competition, consolidate their dominant position, and lead the high-quality and innovative development of the global floor cleaning machine industry.

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