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GLOBAL OVERVIEW OF THE PRECISION MANUFACTURING INDUSTRY

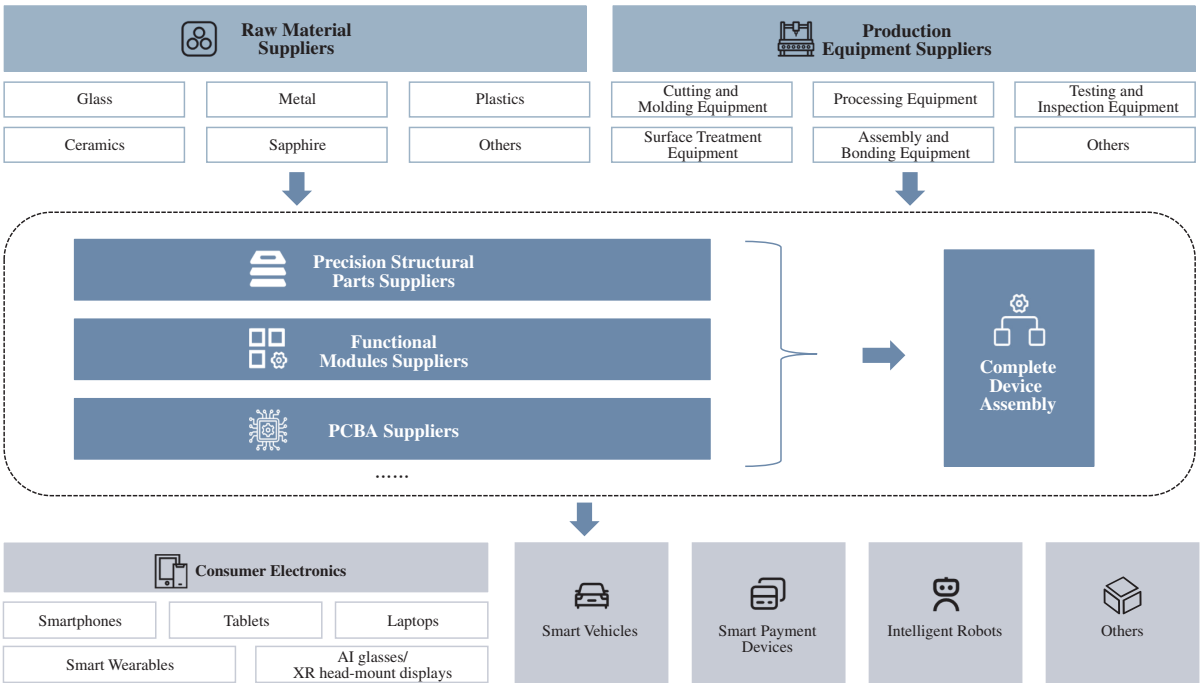
Definition

The precision manufacturing industry refers to an industry that uses precision machining techniques, rapid prototyping technologies, automatic control technologies and other related technologies to design, produce, process, assemble and sell structural parts, functional modules and complete devices that are complex and of high precision.

Precision manufacturing plays a crucial role in promoting product innovation and implementation. As a platform for turning product concepts into reality, precision manufacturing in the industrial chain undertakes the key task of transforming complex designs into high-quality, mass-producible products. For example, cutting-edge products like foldable smartphones rely on the technical support from state-of-the-art manufacturers. Nowadays, leading precision manufacturing companies have transformed from traditional product manufacturers to comprehensive solution providers, capable of providing support for the entire product design and manufacturing process from conceptual design to delivery of the end product. As important players in the industry value chain, precision manufacturers support their customers in maintaining a competitive edge amid rapid technological advancements, facilitating swift product iteration and optimization.

Industry Value Chain Analysis of the Precision Manufacturing Industry

Industry Value Chain of the Precision Manufacturing Industry



Source: Industry expert interviews, Frost & Sullivan

The upstream of the precision manufacturing industry value chain consists of raw material and production equipment suppliers, which provide materials such as glass, metal and ceramics, as well as equipment for cutting, processing and inspection, to mid-stream manufacturers. Leading companies enhance efficiency, reduce costs and shorten delivery cycles by strategically deploying raw materials and smart manufacturing equipment, including independently researching and developing or investing in high-precision industrial robots and smart manufacturing equipment. Mid-stream manufacturers are responsible for processing high-precision structural parts and functional modules, and providing PCBA and complete device assembly. The downstream application fields of the precision manufacturing industry include consumer electronics, smart vehicles, smart retail devices, intelligent robots and others.

Leading precision manufacturing solution providers collaborate closely with customers in product design, research and development, manufacturing and other aspects. They offer tailor-made solutions according to customer needs and gradually achieve vertical coverage of the entire industry value chain, thus forming a one-stop precision manufacturing platform. Additionally, in terms of product design, leading precision manufacturing solution providers proactively propose conceptual designs for customers to evaluate and select from. This way, manufacturing solution providers can continuously deepen long-term strategic partnerships with customers.

Analysis of the Development Trends of the Global Precision Manufacturing Industry

The development trends of the global precision manufacturing industry mainly include the following:

- ***High-precision Development and Application of Multiple Materials***

  The precision manufacturing industry is characterized by high precision, high efficiency, automation and non-standard customization, and involves various materials such as glass, metal and polymers. The demand for high-performance structural parts and functional modules in markets such as consumer electronics, smart vehicles and intelligent robots continues to grow steadily, with increasing demands for higher degrees of stability, reliability and innovation. Leading enterprises enhance product precision and competitiveness through advanced processing techniques, highly reliable processes and innovative materials, driving the industry towards ultra-high precision, high performance and high value-add.

- ***Empowering Production Efficiency through Industrial Smart Manufacturing***

Precision manufacturing optimizes production processes, improves efficiency and reduces costs by leveraging industrial robots, automated equipment and the industrial internet. The automated processing and precise control of intelligent equipment reduce human errors and energy consumption, while technologies such as big data, cloud computing and AI enhance data collection, analysis and reverse control, improving production yield and transforming the production chain. Leading enterprises integrate intelligent manufacturing to build highly standardized and automated production systems, thereby achieving efficient production and assembly and driving the industry towards more efficient and intelligent development.

- ***Global Footprint Development***

Precision manufacturing companies are accelerating their global footprint to meet the global demands of customers in industries such as consumer electronics and smart vehicles. Industry leaders establish production bases at home and abroad, optimizing supply chain coordination, expanding their market share with technological and efficiency advantages and getting closer to customers to reduce delivery cycles and logistics costs, while also leveraging local policies and resources to enhance competitiveness. In addition, precision manufacturing companies jointly build global R&D centers with strategic customers to obtain cutting-edge technologies and to meet diverse market demands. Global footprint not only improves production efficiency but also enhances market adaptability and R&D capabilities, facilitating the continuous development of their global business.

OVERVIEW OF GLOBAL CONSUMER ELECTRONICS PRECISION MANUFACTURING INDUSTRY

Overview of Global Consumer Electronics Products Industry

Consumer electronics refer to smart electronic products used in consumers' daily lives, including smartphones, tablets, laptops, smart wearables and AI glasses/XR head-mount displays. These products typically feature touch interaction with users, multimedia integration and software ecosystem synergy. In 2024, global shipment volume of consumer electronics has reached 1,810.8 million units, with the global shipment volume of smartphones reaching 1,238.8 million units. Driven by high demand for AI glasses, the global shipment volume of AI glasses in 2024 experienced a significant year-on-year increase of over 200%, exceeding 2.0 million units. It is anticipated that the integration of innovative consumer electronics product designs and AI applications will accelerate further iterations of these products.

Shipment Volume of Global Consumer Electronics, 2020, 2024 & 2029E

Product Type	2020 (Million Units)	2024 (Million Units)	2029E (Million Units)	CAGR 2020–2024	CAGR 2024–2029E
Smartphones	1,292.2	1,238.8	1,463.9	–1.0%	3.4%
Tablets	164.0	140.1	180.0	–3.9%	5.1%
Laptops	303.9	262.7	305.1	–3.6%	3.0%
Smart wearables	110.9	159.7	240.4	9.5%	8.5%
AI glasses/XR head-mount displays	6.8	9.6	106.3	8.9%	61.9%
Total	**1,877.8**	**1,810.8**	**2,295.7**	**–0.9%**	**4.9%**

Source: Interviews with industry experts, Frost & Sullivan

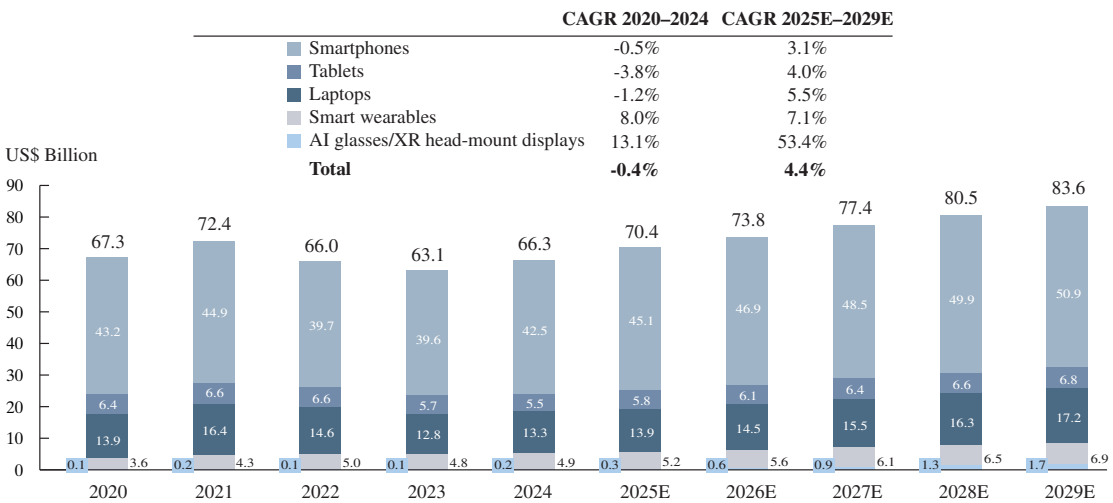
Definition

Consumer electronics precision structural parts and modules integrated solutions refers to the one-stop solution for the design, manufacturing and related services of structural parts (mainly including front, back protective covers and mid-frames) and functional modules for consumer electronics. To better meet the needs of downstream customers, leading providers of consumer electronics precision structural parts and modules integrated solutions typically engage in the product development process years before product releases. Industry participants and downstream customers often have strong ties, resulting in generally saturated orders.

Market Size Analysis of Global Consumer Electronics Precision Structural Parts and Modules Integrated Solutions Industry

Precision structural parts and modules for consumer electronics play a vital role in the functionality, intelligence and usability of consumer electronics. Among them, smartphones represent the largest segment. By 2029, the market size of global consumer electronics precision structural parts and modules integrated solutions industry for smartphones is expected to reach US$50.9 billion. In addition, fueled by ongoing advancements in AI technology and the increasing number of AI glasses introduced by diverse brands, the global market size of consumer electronics precision structural parts and modules integrated solutions for AI glasses/XR head-mount displays is expected to reach US$1.7 billion by 2029, with a significant CAGR of 53.4% from 2025.

Market Size of Global Consumer Electronics Precision Structural Parts and Modules Integrated Solutions Industry by Application, 2020–2029E



Source: Interviews with industry experts, Frost & Sullivan

Market Drivers and Development Trends of Global Consumer Electronics Precision Structural Parts and Modules integrated solutions Industry

The market drivers and development trends for the global consumer electronics precision structural parts and modules integrated solutions industry include the following:

- ***Recovery of the Consumer Electronics Industry and the Application of Foldable Screens and AI Technologies***

  The recovery of the global consumer electronics industry and growth of the AI industry has brought new business opportunities for the global consumer electronics precision structural parts and modules integrated solutions industry. The market size of global AI industry grew from approximately US$0.2 trillion in 2020 to about US$0.6 trillion in 2024, and is expected to exceed US$3.0 trillion by 2029, with a CAGR of 37.8% from 2024 to 2029. The development and application of AI technology will further drive the growth of the global consumer electronics industry, particularly in areas such as smartphones, laptops, and AI glasses/XR head-mount displays.

  As foldable screen technology becomes more widespread and AI functionalities advance, smartphone designs are shifting toward greater personalization and high-end features. The global shipment of foldable smartphones is expected to grow rapidly from 23.8 million units in 2024 to 69.7 million units in 2029, with a CAGR of 24.0%. The rapid advancement of foldable smartphones has driven a substantial growth in screen quantity per device, progressing from single-screen designs to dual-screen and even triple-screen. This evolution has not only enhanced the per-device value contribution from structural parts suppliers, but has also significantly elevated the unit value of individual screen compared to traditional rigid glass displays, owing to the adoption of innovative materials such as ultra-thin flexible glass (UTG). Additionally, the rapid development of AI technology is accelerating smartphone replacement cycles. Global shipment volume of AI smartphones is expected to grow from 235.0 million units in 2024 to 1,069.8 million units in 2029, with a CAGR of 35.4%. At the same time, the market share of high-end smartphones (priced over US$600) is expected to increase from 27.2% in 2024 to 33.0% in 2029, further contributing to the increase in the average unit price in global smartphones, as well as to the increase in the price of related structural parts and modules.

  With the application of AI technology, laptops are becoming increasingly intelligized, which also elevated demands for their exterior protection to combine both protective functionality and a sense of technological sophistication. Compared to other materials, glass, as the material for the screen cover for laptops has higher hardness and scratch resistance, along with better transparency and display effects. Additionally, other laptop components, such as keyboards and touchpads, are expected to integrate glass materials, bringing better user experiences and providing better protection.

AI glasses are smart eyewears that integrate AI technology for enhanced functionality and present a more intelligent, interactive user experience. These glasses support features such as voice interaction, visual AI assistance and wireless connectivity, allowing users to seamlessly access information and perform tasks in real time. As AI glasses become more sophisticated and widely adopted, the demand for high-quality, durable and precisely manufactured structural parts and modules continues to increase.

- ***Breakthroughs in Emerging Technologies and Materials***

With the rapid iteration of consumer electronics, emerging technologies and materials are continuously driving innovations in the consumer electronics precision structural parts and modules integrated solutions industry. For example, leading companies are continuously exploring the development of emerging technologies, including advanced anti-fingerprint coating technology, specialized chemical tempering processes and ultra-thin, high-adhesive ink applications. In the area of emerging materials, UTG, equipped with multiple performance advantages, has gradually replaced colorless polyimide (CPI) materials and become the mainstream choice for foldable smartphone flexible covers. Leading companies are also developing the next generation of foldable ultra-thin glass technology-variable thin glass (VTG). Compared to UTG, VTG provides higher strength, impact resistance and scratch resistance while maintaining the same light transmittance and excellent bending performance. In terms of materials deployed in smartphone's mid-frames, leading solution providers possess mature die-casting or CNC methods for aluminum alloy mid-frames production process, achieving high product yields, relatively low costs, light weight and excellent thermal conductivity. Additionally, sapphire, known for its high strength and scratch resistance, has been used in smartphone camera covers and smartwatches and provides better protection while enhancing the product's aesthetics and user experience.

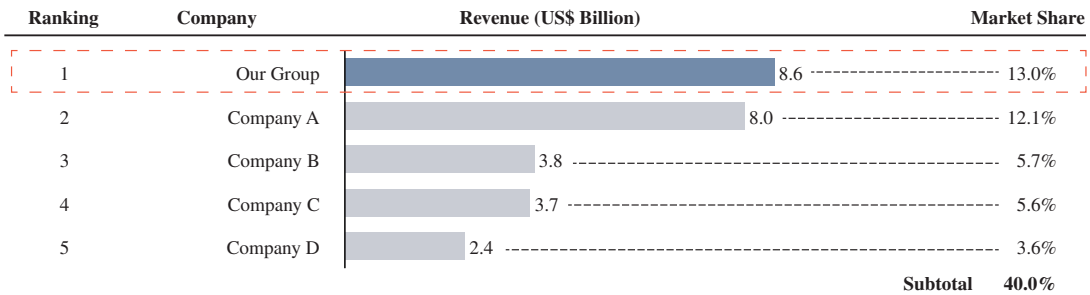
- ***Integration of Smart Manufacturing and Automation***

Smart manufacturing hardware and automation technologies are driving the global consumer electronics precision structural parts and modules integrated solutions industry toward a new stage. Through the integration of industrial robots, smart equipment, smart detection systems, automated production lines and the industrial internet, solution providers have significantly improved production efficiency and product quality while reducing costs and ensuring product consistency. Leading solution providers have developed automation equipment and industrial robots in-house, using artificial intelligence, big data and cloud computing technologies to achieve seamless integration of software and hardware in the production process, ensuring high precision and stability of the products while meeting customers' customized production line needs. Meanwhile, the application of smart detection systems enables data monitoring and quality traceability across all stages of production, effectively reducing the loss within factory systems and facilitating the progress of industry value chain integration.

Competitive Landscape of Global Consumer Electronics Precision Structural Parts and Modules Integrated Solutions Industry

In 2024, the market size of the global consumer electronics precision structural parts and modules integrated solutions industry reached US$66.3 billion. The top five participants in the market accounted for 40.0% of the total market share, indicating a relatively concentrated market. Among them, our revenue in 2024 reached US$8.6 billion, ranking the first among the global consumer electronics precision structural parts and modules integrated solutions providers, with a market share of 13.0%.

Global Top 5 Consumer Electronics Precision Structural Parts and Modules Integrated Solutions Providers by Sales Revenue, 2024



Source: Interviews with industry experts, Frost & Sullivan

Notes:

(1) Company A was founded in 1974 and is listed on the Taiwan Stock Exchange, providing design and manufacturing of structural parts and related functional modules for consumer electronics, among others.

(2) Company B is an unlisted company founded in 1989, focusing on the design and manufacturing of structural parts and modules for consumer electronics.

(3) Company C was founded in 2007 and is listed on the Hong Kong Stock Exchange, mainly engaging in design and manufacturing of structural parts for consumer electronics and smart vehicles interaction systems.

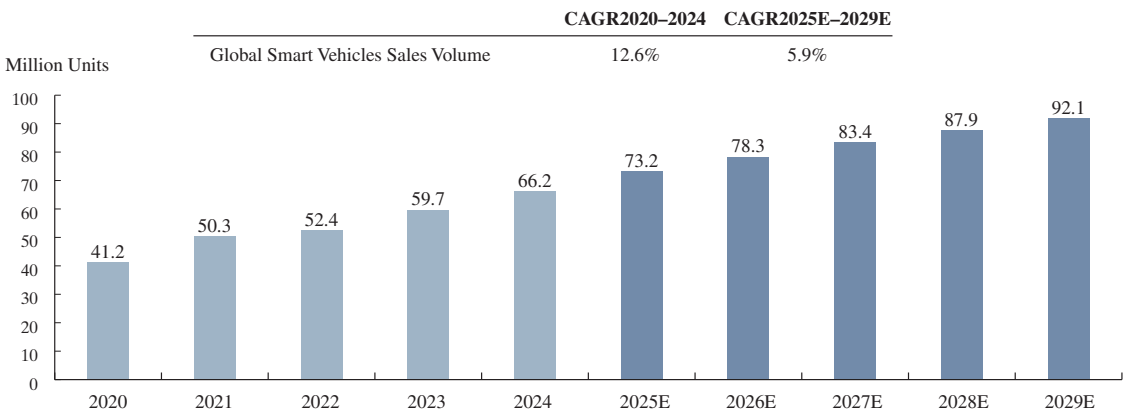
(4) Company D was founded in 2004 and is listed on the Shenzhen Stock Exchange, focusing on design and manufacturing of structural parts, especially laptops.

OVERVIEW OF GLOBAL SMART VEHICLES INTERACTION SYSTEMS INTEGRATED SOLUTIONS INDUSTRY

Overview of Smart Vehicles Industry

In recent years, driven by policy support and technological advancements, the global smart vehicles market has grown rapidly, which in turn accelerated the development of electrification and autonomous driving. The "Intelligent Transformation of Both ICE Vehicles and Electric Vehicles Strategy" has become an industry trend, and vehicle interaction systems are becoming increasingly intelligent to meet consumers' growing demand for an enhanced driving experience. The global sales volume of smart vehicles is expected to increase from 73.2 million units in 2025 to 92.1 million units in 2029, with a CAGR of 5.9% from 2025 to 2029.

Sales Volume of Global Smart Vehicles, 2020–2029E



Source: Association of Automobile Manufacturers, Frost & Sullivan

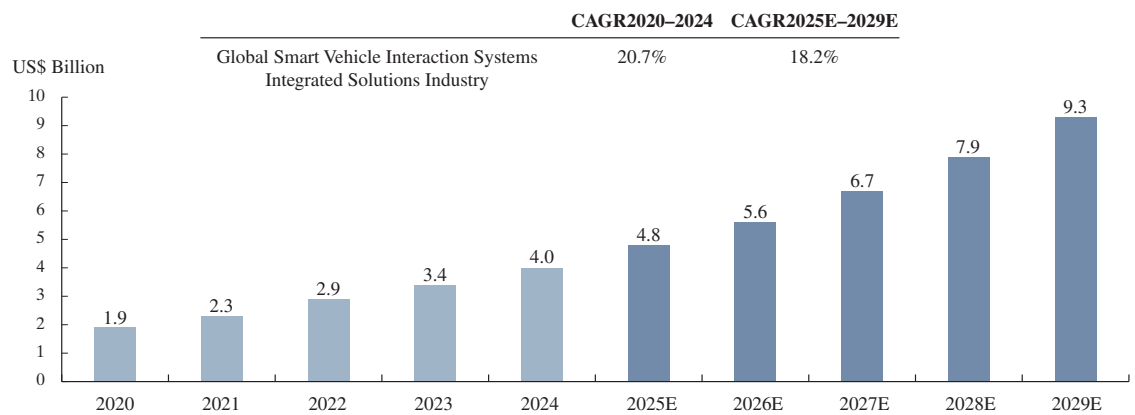
Definition

The smart vehicles interaction systems integrated solutions refers to a one-stop solution encompassing the design, manufacturing and integration of core exterior structural parts and related functional modules for smart vehicles interaction systems. These systems include central control screens, intelligent B-pillar, intelligent instrument panel, HUD and streaming rearview mirror. In addition, with the advancement of technology, multi-functional glass applied in windows and windshields has gradually been used in smart vehicles. This type of glass offers various intelligent and functional services, providing users with a better interactive experience, making it an important structural part of smart vehicles. Providers of smart vehicles interaction systems integrated solutions integrate material innovation, precision manufacturing and other capabilities to deliver high-performance and highly reliable interaction systems integrated solutions for automakers, enhancing smart vehicles in terms of safety, convenience and user experience.

Market Size Analysis of Global Smart Vehicles Interaction Systems Integrated Solutions Industry

Driven by increasing demand for smart cockpits, autonomous driving technology and in-vehicle intelligence technology, the market for smart vehicles interaction systems integrated solutions is expanding rapidly. As display technology, multi-functional glass and sensing systems continue to evolve, the demand for integrated solutions is steadily increasing. Smart vehicles interaction systems integrated solutions suppliers need to offer comprehensive services from one-stop design to manufacturing to gain an edge in the competitive market. In the future, innovative technologies, high-quality services and strong R&D capabilities will become key factors driving the market. The global market size for smart vehicles interaction systems integrated solutions grew from US$1.9 billion in 2020 to US$4.0 billion in 2024 and is expected to reach US$9.3 billion by 2029, with a CAGR of 18.2% from 2025 to 2029.

Market Size of Global Smart Vehicle Interaction Systems Integrated Solutions Industry, 2020–2029E



Source: Interviews with industry experts, Frost & Sullivan

As intelligent technologies become more widely adopted in the automotive industry, vehicle owners are increasingly expecting smart interactive experience. By 2029, the penetration rates for central control screens, intelligent instrument panels, HUD, streaming media rearview mirrors and intelligent B-pillar are expected to reach 98.5%, 65.0%, 50.0%, 25.0% and 29.0%, respectively. The increased penetration of these core interaction systems in vehicles will further drive the development of the global smart vehicles interactive structural integrated solutions industry.

Global Penetration Rate of Key Smart Vehicles Interaction Systems, 2020, 2024 & 2029E

Interaction System	2020	2024	2029E
Central Control Screens	70.0%	90.0%	98.5%
Intelligent Instrument Panels	12.0%	40.0%	65.0%
HUD	4.2%	11.0%	50.0%
Streaming Media Rearview Mirror	0.7%	4.0%	25.0%
Intelligent B-pillar	0.8%	15.0%	29.0%

Source: Interviews with industry experts, Frost & Sullivan

Market Drivers and Development Trends of Global Smart Vehicles Interaction Systems Integrated Solutions Industry

The driving factors and development trends for the global smart vehicles interaction systems integrated solutions industry include the following:

- ***Demand for Automotive Intelligence Driving Growth***

  With continuous breakthroughs in autonomous driving technology, the penetration of smart cockpits has been steadily increasing, and user-vehicle interaction systems are evolving towards higher degrees of personalization, convenience and multimodality. Additionally, the development of smart connectivity technology has accelerated the interconnection of real-time automotive information. Driven by both policy support and technological innovation, automotive intelligence will continue to deepen, further driving the growing market demand for smart vehicles interaction systems integrated solutions.

- ***Advancements in Glass Technology***

  The progress and innovation of structural parts like glass are key factors driving the growth of the smart vehicles interaction systems integrated solutions market. The internal display interfaces of vehicles are continuously evolving towards larger screens, touch interfaces, curved surfaces and transparency. The widespread adoption of in-vehicle touch screens and HUDs is making automotive interfaces increasingly technology-oriented, enhancing the driving experience. At the same time, the application of multi-functional glass in side windows, windshields and sunroofs is rapidly expanding. Glass applied in side windows and sunroofs not only maintain traditional transparency functions but also offer a variety of intelligent and functional services to improve the interactive experience, such as automatic adjustment of light transmittance based on light changes, UV protection, heat insulation, water resistance, anti-fog, conductivity and image projection. These features integrate with in-vehicle display information, offering owners a more comfortable, safe and efficient experience.

- ***Requirements for Safety and Convenience***

As autonomous driving technology develops, the safety and convenience requirements for in-vehicle and vehicle-body interaction systems are continuously increasing. For example, the intelligent B-pillar in vehicles can be integrated with sensing modules to facilitate functions like recognizing owners and unlocking vehicles. With a key card or an electronic device, vehicles can be conveniently unlocked and turned on, which improves vehicle safety and ease of use. Additionally, the camera modules integrated into the intelligent B-pillar can be used for monitoring of the surrounding environment and driving assistance systems, enabling the detection of obstacles or pedestrians around the vehicle and supporting features such as automatic parking, blind spot monitoring and lane-keeping, thereby enhancing driving safety and convenience.

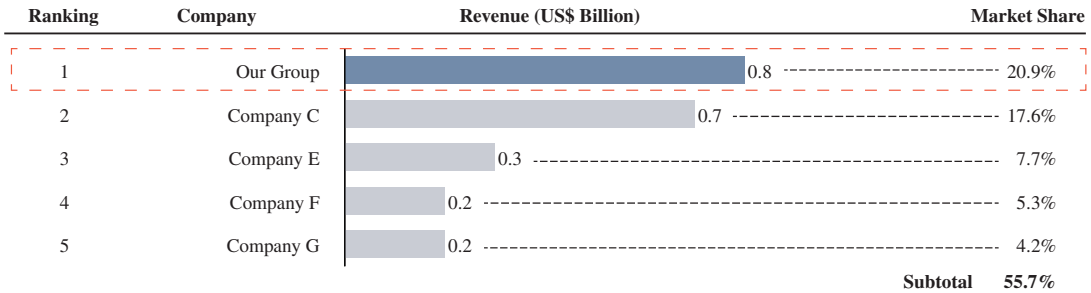
- ***Deeper Collaboration between OEMs and Suppliers***

As the smart vehicles industry value chain deepens, collaboration between original equipment manufacturers (OEMs) and suppliers is transitioning from traditional, single-product supply to deeper collaborative innovation. OEMs' demand for structural parts and modules is gradually emphasizing whether suppliers can provide comprehensive and integrated system solutions. This collaborative model not only creates more market opportunities for smart vehicles interaction systems integrated solutions providers but also drives the integration and innovation of industry technologies, prompting upstream and downstream supply chain companies to break through technological bottlenecks together and improve the overall performance and user experience of intelligent interaction systems.

Competitive Landscape of Global Smart Vehicles Interaction Systems Integrated Solutions Industry

In 2024, the global market size for smart vehicles interaction systems integrated solutions industry is expected to reach approximately US$4.0 billion. The top five participants accounted for 55.7% of the market share, with our Group generating US$0.8 billion in revenue in 2024, ranking the first in the industry, and holding a market share of 20.9%.

Top 5 Rankings in the Global Smart Vehicles Interaction Systems Integrated Solutions Industry, 2024



Source: Interviews with industry experts, Frost & Sullivan

Notes:

(1) Company C was founded in 2007 and is listed on the Hong Kong Stock Exchange, specializing in designing and manufacturing structural parts and associated functional modules for consumer electronics and smart vehicles.

(2) Company E was founded in 2000 and is listed on the Shenzhen Stock Exchange, focusing on the production and manufacturing of structural parts and functional modules for automotive and consumer electronics.

(3) Company F was founded in 1997 and is listed on the Shenzhen Stock Exchange, focusing on design and manufacturing of structural parts and modules, including LCD modules and touch screens.

(4) Company G was founded in 1991 and is listed on the Hong Kong Stock Exchange, providing design and manufacturing of structural parts (mainly including LCD monitors and components, touch screens and touch modules) and related functional modules for automotive and consumer electronics.

OVERVIEW OF GLOBAL SMART RETAIL INDUSTRY

Smart retail devices and electronic price tags are core devices in the smart retail market, driving the integration of online and offline retail activities and the enhancement of consumer experience. Smart retail devices integrate advanced technologies and support multiple payment methods. They can achieve real-time transactions and data transmission through the Internet or mobile networks. The hardware devices feature multi-functional integration, high performance and high security, and are mostly made of tempered glass, metal and plastic. In July 2024, a leading third-party payment platform (with a market share of over 30% in third-party payment industry in China) launched the "Tap-to-Pay" payment mode. The "Tap-to-Pay" payment device adopts an integrated design, with a 3D glass cover plate and metal exterior, ensuring the stability and performance of the device. Electronic price tags replace traditional paper labels through e-paper display technology, updating product information in real time and supporting remote control and batch modification. They are widely used in supermarkets, shopping malls, convenience stores and other places, improving the efficiency of product information updates and the shopping experience of customers.

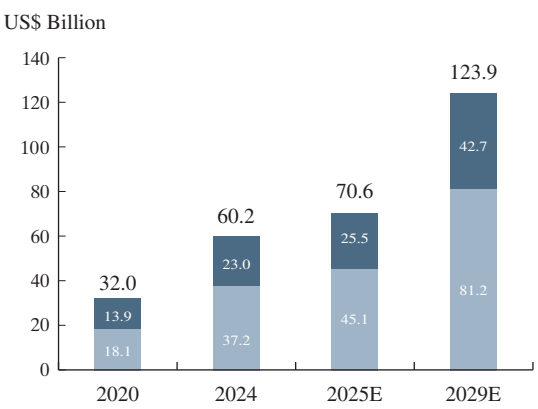
Under the wave of digitalization and the continuous development of technologies for smart retail devices, consumers' dependence on smart retail devices is increasing. Innovative payment devices like "Tap-to-Pay" are becoming widely popular due to their convenience. With the continuous progress of global smart retail devices and NFC technologies, the market for smart retail devices will continue to grow. The global market size of smart retail devices, in terms of the ex-factory price, is expected to increase from US$2.9 billion in 2025 to US$4.4 billion in 2029, with a CAGR of 11.0%. The global market size of electronic price tags, in terms of the ex-factory price, is expected to increase from US$1.6 billion in 2025 to US$2.7 billion in 2029, with a CAGR of 13.4%. Precision manufacturers play a crucial role in the smart retail devices market and the electronic price tags industry value chain. In particular, precision manufacturers with strong technical accumulation and large-scale production capabilities can leverage their strong innovation capabilities to provide high-quality and low-cost customized solutions.

OVERVIEW OF GLOBAL INTELLIGENT ROBOT INDUSTRY

Intelligent robots can be categorized into industrial robots and service robots, with humanoid robots being a new type of service robot. An industrial robot is a multi-purpose mechanical arm that can be automatically controlled and programmed, typically possessing the capability for programming on three or more axes. These robots are mainly used in industrial applications. A humanoid robot is a robot that is designed to resemble the human form in both shape and size and is capable of mimicking human movements, expressions, interactions and locomotion.

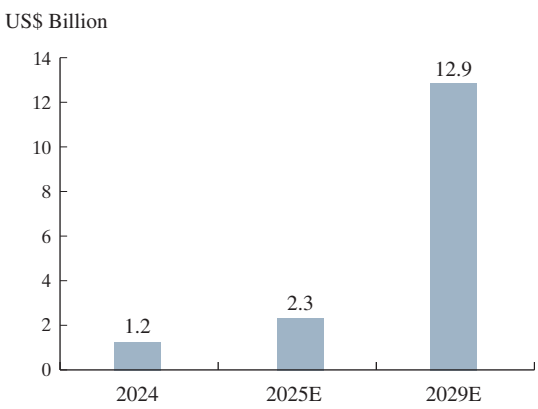
The global intelligent robots market size, 2020–2029E

	CAGR 2020–2024	CAGR 2025–2029E
Industrial robots	13.4%	13.7%
Service robots	19.7%	15.8%
Total	**17.1%**	**15.1%**



The global humanoid robots market size, 2024–2029E

	CAGR 2025–2029E
Humanoid robots market	54.4%



The global market size of intelligent robots increased from US$32.0 billion in 2020 to US$60.2 billion in 2024, with a CAGR of 17.1%, and it is expected to reach US$123.9 billion by 2029. As an important segment of service robots, humanoid robots have become the market focus in recent years. The market size of humanoid robots is expected to grow from US$2.3 billion in 2025 to US$12.9 billion in 2029, with a CAGR of 54.4%.

With the acceleration of the industrialization of humanoid robots, their core components such as structural parts and functional modules, including joint modules, dexterous hands and trunks, tend to be outsourced to highly qualified suppliers due to high technical barriers and complex processing requirements. These suppliers achieve modular production of high-precision structural parts through technological research and development. This can not only reduce the cost of humanoid robots but also improve supply chain efficiency and drive the industry to evolve towards standardization and modularization. Relying on professional production experience and large-scale manufacturing capabilities, leading companies in structural parts and functional modules are expected to enter the complete device assembly market of humanoid robots and provide full-chain solutions from components to end products.

ENTRY BARRIERS ANALYSIS OF GLOBAL PRECISION MANUFACTURING INDUSTRY

The major entry barriers in the global precision manufacturing industry include:

- **Customer and Supplier Relationship Barriers**

The success of precision manufacturers relies heavily on stable customer and supplier relationships. In the precision manufacturing industry, customers have strict certification processes for suppliers, and the verification period is lengthy. As a result, customers tend to maintain stable relationships with long-term partners, and the track record of cooperation with downstream partners in production and R&D is crucial for precision manufacturers to secure orders. Additionally, customers typically prioritize manufacturer reputation and track record. Large, well-established manufacturers with strong technical expertise and quality assurance are often the preferred choice. Existing companies, having accumulated years of experience, have built a reputation of being reliable and earned customers' trust. In contrast, new entrants must invest significant time and resources to achieve a similar level of market recognition. In addition, precision manufacturers without long-term relationships with upstream suppliers may face greater challenges in ensuring the procurement of high-quality raw materials and maintaining stable supply. These factors collectively heighten market entry barriers and sustain the competitive advantages of leading industry players.

- **Solution Customization Barriers**

The precision manufacturing industry often involves highly customized products, with customers having stringent quality and technical requirements. Suppliers must offer highly customized designs, materials and manufacturing solutions for each generation of products. In addition, the ability to provide comprehensive services-from concept design, production to delivery of end products-is an important selection criterion for customers. Leading companies possess vertically-integrated capabilities along the full industry value chain, enabling them to quickly and efficiently respond to customers' diverse needs. New entrants, lacking relevant experience and flexible service capabilities, face difficulty meeting customers' high standards for customized solutions.

- **Technology Innovation Barriers**

Precision manufacturing is a technology-intensive industry. With rapid technological advancements, the demand for advanced manufacturing and intelligent technologies is increasing, requiring companies to have multidisciplinary technical expertise. Some leading companies in the precision manufacturing industry own numerous patents and unique production processes. Furthermore, some leading companies collaborate with strategic clients to establish R&D centers worldwide. This global R&D network allows them to quickly access cutting-edge technological insights and enhance their innovation capabilities. New entrants must overcome these technological research and development barriers, and without breakthroughs in innovation, it is challenging for them to catch up technologically.

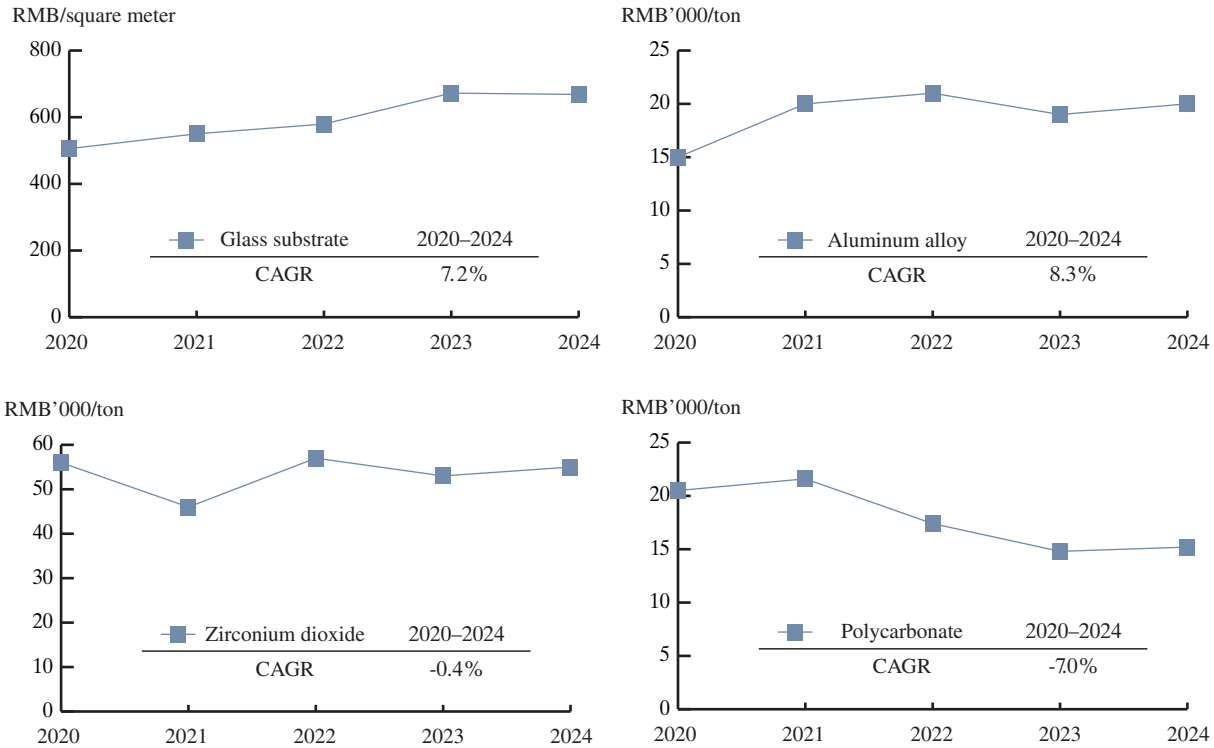
- **Production and Capital Barriers**

Precision manufacturing demands highly stable production capacities. Leading companies achieve this by being the first to develop and widely implement automated intelligent equipment, integrating industrial internet and AI technologies to build efficient, smart production systems. This enables the automation, digitization and intelligent upgrade of the entire production process, significantly enhancing operational efficiency and product quality, while achieving the goals of efficient production and rapid delivery. In contrast, new entrants must invest substantial resources to establish supply chain management and production systems, making it difficult for them to quickly attain sufficient production capacity and stable production lines. Additionally, large companies benefit from economies of scale, effectively reducing the production cost per unit, which is hard for new entrants to match in the short term. Moreover, the capital-intensive investment required in the industry creates a significant entry barrier. This includes expenses for production equipment, factory construction and research and development. Therefore, new entrants face significant financial pressure.

PRICE TREND ANALYSIS OF RAW MATERIAL

The main raw materials for precision structural parts are glass substrates, aluminum alloys, zirconium dioxide and polycarbonate. Glass substrate is a special glass material used in the manufacturing of high-end electronic and optoelectronic devices. It usually features high flatness, a low coefficient of expansion, high light transmittance and excellent chemical stability. Aluminum alloys are widely used in the production of metal outer frames and are commonly used for precision structural parts in consumer electronics. Zirconium dioxide is an important raw material for precision ceramic structural parts. They are non-conductive and will not block signals, making their application in consumer electronics increasingly widespread. In the past three years, due to technological advancements and growing downstream demand, the prices of glass substrate continued to rise. The prices of aluminum alloy and zirconium dioxide remained relatively stable, while polycarbonate prices showed a declining trend.

Precision Structural Parts Raw Material Price Trends, 2020–2024



Source: Interviews with industry experts, Frost & Sullivan

SOURCE OF INFORMATION

We commissioned Frost & Sullivan to conduct market research on global precision manufacturing industry and prepare the Frost & Sullivan Report. Frost & Sullivan is an independent global consulting firm founded in 1961 in New York that offers industry research and market strategies. We have contracted to pay RMB600,000 to Frost & Sullivan for compiling the Frost & Sullivan Report.

In preparing the Frost & Sullivan Report, Frost & Sullivan conducted detailed primary research which involved discussing the status of the industry with certain leading industry participants and conducting interviews with relevant parties. Frost & Sullivan also conducted secondary research which involved reviewing company reports, independent research reports and data based on its own research database. Frost & Sullivan obtained the figures for the estimated total market size from historical data analysis plotted against macroeconomic data and considered the key industry drivers. Its market engineering forecasting methodology integrates several forecasting techniques with the market engineering measurement-based system and relies on the expertise of the analyst team in integrating critical market elements investigated during the research phase of the project. These elements primarily include forecasting methodology based on expert opinions, integration of market drivers and restraints, market challenges, market engineering measurement trends and econometric variables.

The Frost & Sullivan Report is compiled based on the following assumptions: (i) the social, economic and political environment around the globe and within mainland China is likely to remain stable in the forecast period; and (ii) related key industry drivers are likely to drive the market in the forecast period.