

INDUSTRY OVERVIEW

The information presented in this section, unless otherwise indicated, has been derived from various official government publications, market data providers and the CIC Report commissioned by us and prepared by an independent third party, CIC. The information from official government sources has not been independently verified by us, us or any other parties involved in the [REDACTED], or any of our or their respective directors, senior management, representatives, advisers or any other persons involved in the [REDACTED], and no representation is given as to its accuracy, fairness and completeness. For a discussion of the risks relating to our industry, see “Risk Factors.” Our Directors confirm that, after making reasonable enquiries, there is no adverse change in the market information since the date of the CIC Report that would qualify, contradict or have a material impact on the information in this section.

PICKING: THE MOST CRITICAL PROCESS IN WAREHOUSING OPERATIONS

In modern supply chain systems, warehousing performs the core functions of centralized storage, inventory buffering and goods flow management, serving as the operational link between production, transportation and sales. Warehouse operating efficiency and accuracy directly affect inventory turnover, order fulfillment efficiency, overall supply chain responsiveness and operating costs, and are therefore key determinants of supply chain quality.

From the operating-process perspective, the core value of modern warehousing operations is primarily concentrated in five key activities: picking, storage, sorting, packing and inbound/outbound handling.

- *Picking* refers to the retrieval of items from cases in which they are stored on racks, and is the most critical and value-intensive activity in warehousing operations.
- *Storage* is a fundamental function of warehousing, serving as the intermediate stage where goods are held, managed and prepared for onward movement.
- *Sorting* consists of classifying and consolidating picked items based on order or customer requirements and optimizing routing, serving as the key link between picking and dispatch.
- *Packing* involves verifying, cartonizing and sealing goods after sorting, representing the final processing step before outbound shipment.
- *Inbound/Outbound Handling* entails moving goods between different warehouse processes and for inbound and/or outbound flows, ensuring continuity and timeliness across the logistics chain.

In traditional warehouse processes, picking is typically complex: workers must frequently walk, locate storage positions and retrieve items from the cases in which they are stored on racks, and performance is highly sensitive to labor skill and execution quality. Picking also usually consumes the largest share of total warehouse labor time, making warehousing picking automation a key driver for efficiency improvement and cost reduction, and often the highest-value and most urgent component of warehouse automation. According to CIC, the global spending on warehousing picking amounted to RMB991.9 billion in 2024, and is expected to grow to RMB1,537.6 billion by 2030.

GLOBAL WAREHOUSING PICKING AUTOMATION SOLUTION INDUSTRY

Overview

Modern supply chains are increasingly characterized by a high number of SKUs, fast and frequent order cycles, smaller order sizes and higher flexibility requirements, which place even more stringent demands on the efficiency and accuracy of picking. Traditional labor-intensive models often struggle to meet these requirements due to limitations such as slower picking speed, lower accuracy, limited coverage and weak adaptability.

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By converting picking activities into automated processes, picking automation technologies can significantly improve efficiency and accuracy, optimize inventory turnover and transportation scheduling, and enhance overall warehouse throughput. In particular, warehousing picking automation solutions can deliver the following capabilities:

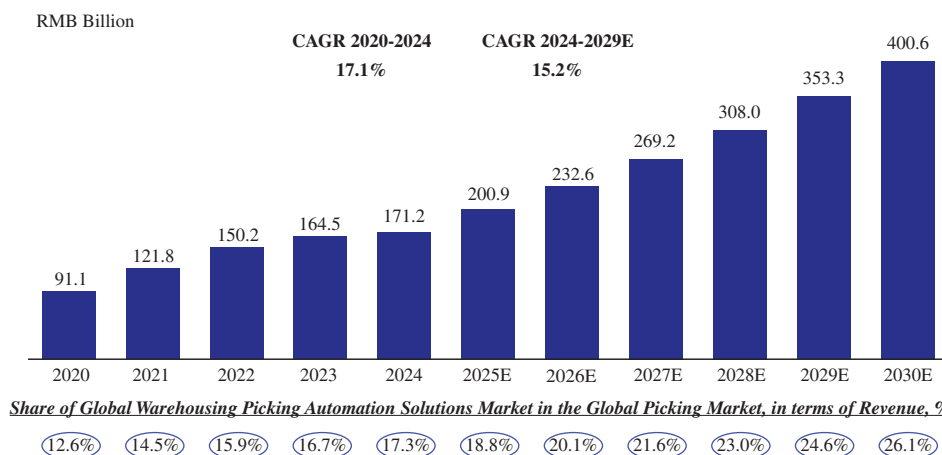
- Standardized and Repeatable Picking Operations. Through the integration of automated picking equipment with control systems and software, picking tasks are executed in a consistent and standardized manner, reducing process variability and significantly improving pick accuracy and execution efficiency.
- Reduced Labor Dependency and Picking Risk Exposure. By replacing manual walking, searching, and item retrieval with automated picking, these solutions lower labor intensity and human error rates, reduce reliance on experienced pickers, and mitigate operational risks associated with peak volumes and workforce instability.
- Real-Time Visibility of Picking Status and Inventory Location. Picking automation systems are tightly coupled with warehouse management and control systems, enabling real-time tracking of pick tasks, inventory positions, and order progress, thereby improving pick planning, reducing mis-picks, and enhancing inventory accuracy at the point of execution.
- Higher Storage Density. Picking automation enables racking systems to be constructed at heights beyond the reach of manual warehouses, significantly increasing storage density, especially in facilities that handle small, standardized items.

Looking forward, with increasingly complex supply chains, continuously rising labor costs and enterprises growing expectations for faster delivery times, warehousing picking automation is expected to evolve beyond its early role as a cost-reduction and efficiency-improvement tool and increasingly become a foundational capability for enterprises to build resilient supply chains and enhance competitiveness in day-to-day operations.

Market Size

The size for the global warehousing picking automation solution market increased from RMB91.1 billion in 2020 to RMB171.2 billion in 2024, and is expected to reach RMB400.6 billion by 2030, largely driven by highly effective emerging solutions such as ACRs. The share of the global warehousing picking automation solution market in the global picking market (measured by global spending on warehouse picking) rose from 12.6% in 2020 to 17.3% in 2024 and is expected to further increase to 26.1% by 2030.

Market Size of Global Warehousing Picking Automation Solution Industry, 2020-2030E



Source: CIC

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Warehousing Picking Automation in Different Domains

Demand for warehousing picking automation is strong in both distribution and manufacturing domains. Within the distribution domain, apparel & fashion, e-commerce & retail, F&B, 3PL, pharmaceutical, 3C electronics and automotive demonstrate strong demand for picking automation driven by complex SKU structures, frequent inbound/outbound order flows and high requirements for space utilization, all of which directly increase picking complexity and execution pressure. Within the manufacturing domain, 3C electronics and automotive sectors drive the demand for picking automation due to large storage scales and complex storage structures, with high requirements for storage density, precise traceability and high-throughput, high-accuracy picking.

Despite the commonalities in demand, the seven sectors differ in operating characteristics and impose distinct requirements on picking workflows, accuracy and system flexibility. Accordingly, the delivery of efficient and user-friendly automation solutions requires solution providers to possess deep industry knowledge and technical know-how.

Distribution Domain

- *Apparel & Fashion.* The apparel & fashion sector is characterized by large SKU counts, short product life cycles and pronounced seasonality, resulting in highly variable picking demand. Automation solutions often focus on zoned storage, wave picking and dynamic slotting to shorten picking paths, balance picking workloads and support high-frequency, small-batch picking throughout seasonal transitions.
- *E-commerce & Retail.* The e-commerce & retail sector features highly fragmented orders and complex SKUs, with pronounced peak demand periods, placing significant pressure on picking speed and accuracy. Warehousing picking automation solutions are widely deployed in scenarios such as order splitting and wave picking to handle high volumes of small-order picking efficiently.
- *F&B.* Due to stringent food safety requirements, complex lot management, short rack life and temperature-control constraints, automation solutions for the F&B sector must ensure time-sensitive and batch-compliant picking, with strict temperature control and time management throughout the picking process.
- *3PL.* 3PL is characterized by a diverse customer base and wide-ranging types of goods, as well as frequent switching between different operating modes, which significantly complicates picking strategies. Picking systems must adapt to multi-customer, multi-category and multi-order picking models and offer high flexibility to accommodate changing customer requirements.
- *Pharmaceutical.* The pharmaceutical sector features high-value and highly regulated items (e.g., pharmaceuticals and medical devices), with stringent requirements on lot traceability, environmental controls (e.g., cleanroom and temperature controls) and near-zero tolerance for picking errors. Automated picking systems must ensure accuracy throughout the “match-locate-pick” workflow to meet compliance and operational efficiency requirements.

Manufacturing Domain

- *3C Electronics.* 3C electronics manufacturing is a highly precision-driven and fast-paced sector, characterized by small-sized yet high-value items, frequent inbound/outbound flows, rapidly changing SKUs and frequent line changeovers. Automation solutions emphasize high-precision, high-speed picking and replenishment to ensure accurate material supply to production lines while supporting frequent line changeovers.
- *Automotive.* Automotive manufacturing involves numerous types of components with high unit value and significant variation in size, coupled with complex material loading/unloading processes. Automotive warehousing therefore places high demands on sequence-based picking, precise access and error-free outbound operations to ensure that components are delivered in the correct order and production-line continuity is maintained. To meet these requirements, automation systems must support high-density storage, accurate picking and end-to-end traceability.

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Major Categories of Warehousing Picking Automation Solutions

There are three major categories of warehousing picking automation solutions, with ACR solutions gaining increasing adoption and market recognition.

- AS/RSs. AS/RSs are designed to automate the storage and retrieval of goods using basic machinery such as conveyors and cranes. As an earlier-generation automation system developed to help improve efficiency and reduce manual labor, AS/RS has achieved a relatively mature level of commercialization and accounted for over 75% of the global warehousing picking automation solutions market. However, they often lack the advanced flexibility and integration seen in newer automation solutions, making them less adaptable to complex or dynamic operational needs.
- AMRs. AMRs are primarily designed for ground-level load transport within a warehouse. They are typically used to carry entire shelves, together with the associated cases, to workstations where workers manually pick items from the cases, rather than to perform autonomous case-level picking.
- ACRs. ACRs are designed to autonomously retrieve only the required cases from the rack and then transport those cases to workstations. By eliminating unnecessary rack movement and manual case selection, ACRs enable higher-granularity automated picking, thereby improving space utilization and delivering end-to-end automation of warehousing picking.

ACR solutions are the most advanced and complex systems in warehousing picking automation. ACR solutions offer high deployment flexibility, lower maintenance costs and higher levels of intelligence, making them ideal for sectors that require frequent inbound and outbound operations, such as apparel & fashion, e-commerce & retail, F&B, 3PL, pharmaceutical, 3C electronics and automotive.

The table below sets forth a detailed comparison of ACR solutions with the other two major categories of warehousing picking automation solutions.

	ACR	AMR
Space Utilization	<ul style="list-style-type: none"> • Vertical reach up to 15 meters • Storage density up to 81.3 cases per square meter 	<ul style="list-style-type: none"> • Vertical reach up to four meters • Storage density less than 25 cases per square meter
Operational Flexibility	<ul style="list-style-type: none"> • Can operate in aisles as narrow as 850 mm • Adapt to changing layouts • Support under-rack operation 	<ul style="list-style-type: none"> • Require wide aisles, rigid layouts • No under-rack operation
Efficiency and Throughput	<ul style="list-style-type: none"> • Automated, high-speed picking and higher throughput, with a six-fold improvement in labor productivity 	<ul style="list-style-type: none"> • Manual rack movement limits speed; slower picking
Scalability	<ul style="list-style-type: none"> • Faster deployment, easily scalable for high-turnover logistics 	<ul style="list-style-type: none"> • Limited adaptability to higher throughput, including as a result of business expansion

Source: CIC

	ACR	AS/RS
Deployment Flexibility	<ul style="list-style-type: none"> • ACR solutions can navigate aisles of varying sizes and layouts • Phased deployment shortens warehouse downtime during initial setup • Rapid deployment speed at approximately 1 month 	<ul style="list-style-type: none"> • Typically requires installation of fixed facilities and complete racking system rebuild upon initial deployment • Strick warehouse layout requirements • Typically requires 9-18 months for deployment

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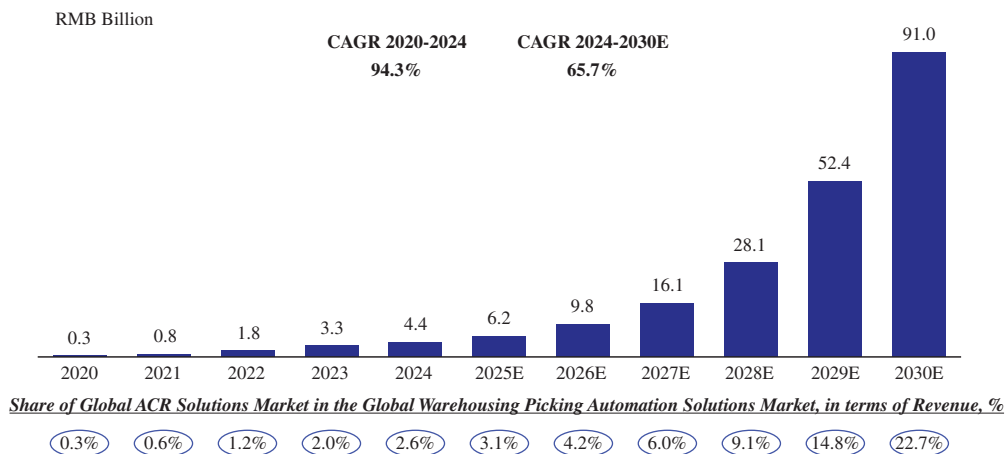
	ACR	AS/RS
ROI Period	<ul style="list-style-type: none"> Relatively lower initial investment and the ability to achieve a shorter payback period of 12 months 	<ul style="list-style-type: none"> Higher initial investment and longer payback period of two to five years
Solution Flexibility/ Scalability	<ul style="list-style-type: none"> Modular design allows flexible scaling by increasing or reducing the number of robots and/or adjusting the racking layout based on business needs 	<ul style="list-style-type: none"> Capacity expansion typically requires re-planning the layout or adding independent warehouse modules
Level of Intelligence	<ul style="list-style-type: none"> Equipped with intelligent scheduling and path-optimization algorithms, enabling dynamic task allocation based on task priority, robot location, target case location and other variables 	<ul style="list-style-type: none"> Often relies on manual instructions or fixed logic control, with relatively limited flexibility and intelligence

Source: CIC

GLOBAL ACR SOLUTIONS INDUSTRY

As the commercialization of ACR solutions only began to scale in 2017, the industry remains at an early stage of market penetration. In 2024, the global ACR solutions market was RMB4.4 billion. Driven by increasing downstream demand for high-throughput, high-density storage scenarios, the market is expected to surge to RMB91.0 billion by 2030, representing a CAGR of 65.7% from 2024 to 2030. Given the stronger automated picking capabilities and technological advantages of ACR technologies, the ACR solutions market represents the fastest-growing segment within the global warehousing picking automation solution market, with ACR penetration within that market expected to increase from 2.6% in 2024 to 22.7% in 2030. ACR solutions are poised to become an integral part of warehouse automation, as the demand for high-throughput, high-density storage solutions continues to rise.

Market Size and Penetration Rate of Global ACR Solutions Industry, 2020-2030E



Source: CIC

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Key Growth Drivers of the Global ACR Solutions Industry

A number of structural and near-term factors are driving the accelerated adoption of ACR solutions globally, including continued increases in automation demand, evolving supply chain requirements and ongoing technology improvements.

- *Rising Demand for Warehousing Picking Automation.* Global labor shortages and rising labor costs have become long-term trends, making automation an increasingly non-discretionary requirement for enterprises. Enterprises have continued to accelerate the deployment of warehousing automation solutions to improve operating efficiency, reduce reliance on labor and enhance operational resilience. By substituting manual picking labor, ACR solutions can improve operating efficiency, support stable capacity during peak periods and alleviate labor pressure.
- *Supply Chain Flexibility Trends.* With the rise of e-commerce channels, more diversified consumer preferences and faster-changing global consumption trends, enterprises need to adjust production and business structures more frequently in response to market volatility. Order structures have correspondingly shifted toward smaller batches and higher-frequency shipments, pushing global supply chains toward greater flexibility and faster response. This trend increases picking complexity and makes picking automation a core enabler of flexible supply chains. Compared with traditional picking automation solutions, ACR solutions can materially shorten picking routes, improve picking efficiency and enhance operating accuracy, thereby providing technical support for building warehouse operations with higher flexibility and faster response.
- *Ongoing Technological Progress.* With continued optimization and broader application of AI scheduling algorithms, path-optimization algorithms and robotic arm technologies, ACR solutions have become increasingly mature. For example, intelligence levels have improved in areas such as multi-robot collaboration, task allocation and each-piece picking/packing, which enhances operating efficiency and stability in complex scenarios. Rapid technology iteration has also gradually reduced solution costs, improved cost structures and shortened payback periods, thereby materially enhancing ROI. As customer experience and economic benefits improve, adoption and penetration across downstream industries are expected to further accelerate.
- *Leading Customers Shaping ACR Standards.* Given the relatively short commercialization history of ACR solutions, their performance advantages and efficiency improvements were first validated by leading customers in downstream industries. As the needs of such leading customers are often representative, benchmark projects co-developed with leading customers not only address specific operational challenges but also form replicable and standardizable practices, laying the foundation for broader rollout to mid-tier and long-tail customers.
- *Increasingly Stringent ESG Requirements.* Heightened focus on workforce safety has led companies to reduce reliance on manual material handling in warehousing environments, thereby accelerating the adoption of ACRs. In parallel, increasing sustainability expectations are also driving demand for ACRs that improve space utilization, optimize routing efficiency, and reduce energy consumption per unit of throughput.

Future Trends of the Global ACR Solutions Industry

The ACR solutions industry is evolving rapidly, with development trends increasingly centered on higher system intelligence, deeper upstream/downstream integration and a shift from single-point automation to end-to-end system optimization.

- *Hardware and Software Upgrading.* Innovations such as hook-type gripping structures, double-deep storage designs and laser SLAM technologies are expected to enhance the flexibility of ACR solutions and broaden their applicability across sub-scenarios. Meanwhile, integration between ACR software and customers’ existing upper-layer management systems continues to deepen, further improving the overall intelligence of ACR solution software.

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- *System-Level Multi-Robot Collaboration.* Efficiency improvements in ACR solutions are increasingly shifting from single-robot performance to coordinated scheduling across heterogeneous robot fleets. Systems are expected to break down “automation islands” and achieve seamless data interfacing and task integration with mobile robots, sorting lines, automated storage systems and other equipment. This requires scheduling systems with a global view that can synchronously optimize end-to-end material and information flows, thereby significantly improving the efficiency and flexibility of the overall automation system.
- *Predictive Operational Optimization.* The large volume of operational data generated by ACR systems provides the basis for efficiency mining. By building digital twin models that map and simulate warehouse states in real time, and by running large-scale simulations and stress tests, systems can work with predictive algorithms to anticipate future orders and potential bottlenecks. This enables a shift from reactive response to predictive scheduling, allowing proactive adjustments to robot deployment and slotting strategies and establishing a data-driven, closed-loop optimization mechanism that improves space utilization and throughput. In addition, customers may use simulation data prior to implementation to assess labor-efficiency gains and reduce acceptance risks arising from underperformance in post-deployment operating data, thereby improving overall delivery success rates.

Competitive Landscape of the Global ACR Solutions Industry

According to CIC, we are the inventor of ACR solutions for warehouse operations and the first company in the world to achieve large-scale commercialization of ACR solutions. In terms of revenue in 2024, we were the world’s largest provider of ACR solutions, with a market share of 31.4%.

Competitive Landscape of Global ACR Solutions Industry in Terms of Revenue, 2024

Ranking	Player	Revenue <i>(RMB in billions)</i>	Market Share <i>(%)</i>
1	Our Group	1.4	31.4%
2	Company A	1.2	26.4%
3	Company B	0.5	12.1%
4	Company C	0.3	7.7%
5	Company D	0.2	4.0%

Source: Annual reports; CIC

Notes:

- (1) Company A is a mobile robotics solutions company founded in France in 2015. It primarily provides compact robotic systems for logistics and warehousing, mainly designed for fulfillment operations. It is a privately owned company.
- (2) Company B is a warehouse robotics and smart logistics company founded in China in 2015. It mainly provides autonomous mobile robots and integrated warehouse automation solutions. It is a listed company on the Exchange.
- (3) Company C is a machine vision and mobile robotics products and solutions company founded in China in 2016. It is a subsidiary of a company listed on the Shenzhen Stock Exchange.
- (4) Company D is a warehouse robotics and smart logistics company founded in China in 2014. It mainly provides autonomous mobile robots and integrated warehouse automation solutions. Company D is a private company.

Entry Barriers of the Global ACR Solutions Industry

The competitive landscape for ACR solutions market is shaped by barriers that are both technology-driven and execution-driven, as solution providers must deliver reliable system performance at scale while building replicable industry capabilities and long-term customer relationships.

- *Scale has Become a Key Source of Advantage.* ACR solutions providers with larger deployment scales are generally able to reduce unit costs by spreading fixed costs over more deployments, improving procurement efficiency and accumulating operational data that can be used to enhance system performance. Lower costs and better system performance, in turn, help attract additional customers, further expanding deployment scale and reinforcing this cycle.

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- *First-Mover Advantage and Access to Leading Customers.* Leading downstream customers typically operate larger warehousing networks with more complex scenarios and higher-frequency warehousing operations. ACR solutions providers that enter leading customers’ supply systems at an early stage can build close cooperative relationships and generate recurring revenues from repeat business. Because ACR solutions form part of the core operational systems of these customers and are closely integrated with their day-to-day workflows, leading customers generally tend not to replace such systems easily, which creates an additional barrier to entry for new providers. In addition, such providers can distill the industry experience gained from serving leading customers into standardized industry solutions, enabling faster reuse and broader scaling across the market.
- *Extensive Industry Experience and Case Accumulation.* Layout design, path scheduling and operating strategies for ACR systems are closely aligned with customers’ business processes. Providers with deep industry experience and extensive case libraries can reuse proven practices to increase solution standardization, reduce upfront design costs, shorten design cycles, identify potential risks and bottlenecks at an earlier stage, and thereby improve customer satisfaction.
- *Brand Reputation and Customer Service Capabilities.* Given the typically significant upfront investment for ACR solutions, providers with higher project delivery success rates and superior after-sales customer engagement can build stronger brand reputation and customer trust. In addition, global service networks and localized support capabilities can support business expansion, enhance customer loyalty and improve lifecycle after-sales service capabilities.
- *Sustained R&D Capabilities Across Hardware, Software and Systems Integration.* As the ACR solutions market remains nascent, competitive advantage depends on sustained R&D investment across three interdependent layers. Providers capable of maintaining this tri-layer R&D depth are better positioned to achieve long-term market acceptance as customer requirements evolve beyond pilot deployments.
 - *Hardware.* Developing ruggedized mobile bases, adaptive grippers for diverse case types, and sensor suites resilient to warehouse conditions such as dust and lighting variations.
 - *Software.* Developing data-driven orchestration engines capable of coordinating large robot fleets (e.g., deployments with over 1,000 concurrent robots), real-time exception handling and seamless WMS integration without custom middleware.
 - *System Integration.* Validating end-to-end reliability at scale while balancing throughput, energy consumption and human-robot safety protocols.

SOURCE OF INFORMATION

We commissioned CIC, an independent market research and consulting company, to conduct detailed research on and analysis of the global warehouse automation solution market and the global ACR market. We have agreed to pay a fee of RMB780,000 to CIC in connection with the preparation of the CIC Report. We have extracted certain information from the CIC Report in this section and elsewhere in this Document to provide our potential [REDACTED] with a more comprehensive presentation of the industries where we operate. Except as otherwise noted, all of the data and forecasts contained in this section and elsewhere in this Document are derived from the CIC Report.

During the preparation of the CIC Report, CIC performed both primary and secondary research using various resources, and obtained knowledge, statistics, information, and industry insights on the industry trends of the target markets. Primary research involved interviewing key industry experts and leading industry participants. Secondary research involved analyzing data from multiple publicly available data sources, including the National Bureau of Statistics of China, Chinese Government releases, annual reports published by relevant industry participants, industry associations, CIC’s own internal database.

The CIC Report was compiled based on the following assumptions: (i) the overall global social, economic, and political environment is expected to maintain a stable trend during the forecast period, (ii) certain key industry drivers are likely to continue to drive market growth during the forecast period, and (iii) there is no extreme force majeure or unforeseen industry regulations in which the market may be affected either dramatically or fundamentally during the forecast period.