The information and statistics set out in this section and other sections of this document were extracted from different official government publications, available sources from public market research and other sources from independent suppliers, and from the independent industry report prepared by Frost & Sullivan ("F&S"). We engaged F&S to prepare an independent industry report in connection with the **[REDACTED]** *(the "Frost & Sullivan Report"). The information from official government sources has not been independently verified by us, the Sole Sponsor,* **[REDACTED]***, any of the* **[REDACTED]***, any of their respective directors and advisors, or any other persons or parties involved in the* **[REDACTED]***, and no representation is given as to its accuracy.*

Overview of Global and China's Embodied AI Robotic Solutions Market

Introduction of Embodied AI Robots

Embodied AI robots refer to robotic entities with physical bodies that are integrated with artificial intelligence (AI), allowing them to perceive, learn, and dynamically interact with their physical environment in a manner similar to humans. This integration enables the robots to exhibit intelligent and adaptive behaviors. Embodied AI robots emphasize the interaction between AI and the physical world. The robotic body allows the AI to perceive its surroundings through various senses (such as vision, tactility, sound, and force), understand problems, make decisions, and take actions. The main types of embodied AI robot products include mobile manipulation robots, autonomous mobile robots (AMRs), collaborative robots (cobots), and exoskeleton robots.

The core features of embodied AI robots include: (a) Physical Embodiment, which is the most significant difference between embodied AI and conventional AI applications. Embodied AI possesses a physical form; (b) Environmental Interaction: The robot uses its body to perceive and interact with the real world. It can actively explore, perceive, and manipulate its environment, and learn from these interactions; (c) Perception-Action Loop: Embodied AI emphasizes the importance of the perception-action loop. The robot perceives and transforms outside information into a cognitive understanding, and then makes decisions and takes action based on that understanding. The result of the action then influences subsequent perception, forming a continuous loop that constantly refines its intelligence; and (d) Autonomous Learning and Adaptability: Base on perception-action loop, an embodied AI robot can improve its intelligence and adapt its actions. Advanced embodied AI robots can even make autonomous decisions and execute tasks in complex and ever-changing environments.

Traditional robots are designed to perform precise, repetitive, pre-programed tasks in closed, structured environments. In contrast, an embodied AI robot is an intelligent agent that integrates an AI-based decision-making system with a robotic body, enabling it to autonomously perceive, understand, learn, make decisions, and act in open, dynamic environments. The emergence of embodied AI signifies a shift in the role of robots — from being mere production tools to becoming more versatile and adaptive intelligent productivity assistants. This will allow them to be integrated into a wider range of applications. The core differences between embodied AI robots and traditional robots are as follows:

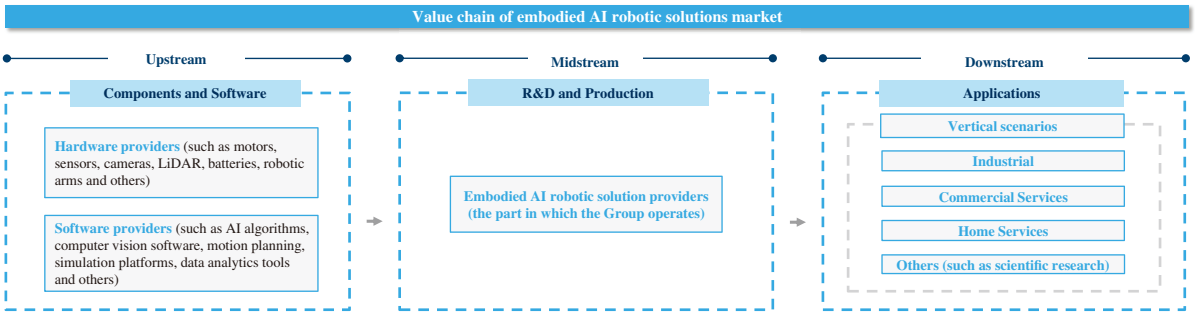
	Embodied AI Robots	Traditional Robots
Interaction with the Physical World	• Actively and dynamically interacts with the environment, using its body as a medium to acquire information and learn	• Perception capabilities are typically limited following predefined paths or relying on external guidance

	Embodied AI Robots	Traditional Robots
Programming and Deployment	• Can learn and be deployed through natural language instructions or a small number of demonstrations	• Deployment and programming require complex programming or coding by robotics engineers, which is time-consuming and complicated
Learning Mechanism	• Adopts a data-driven learning paradigm, integrating various AI technologies to optimize behavioral strategies through large datasets	• Primarily relies on control algorithms and interpreted code, with a relatively simple or limited learning mechanism, and performance is mainly optimized by adjusting parameters
Autonomous Decision-Making and Adaptability	• Possesses autonomous learning, inference, and decision-making capabilities	• Executes precise, predefined instructions; lacks the flexibility and adaptability to handle unforeseen changes
Generalization and Task Versatility	• Aims for general intelligence, capable of learning and performing various tasks, and can transfer knowledge between different tasks and environments	• Usually specialized tools designed for specific tasks and scenarios, lacking the ability to generalize across different tasks or scenarios
Examples of Product Types	• Mobile manipulation robots (including bipedal humanoid robots), autonomous mobile robots (AMRs), collaborative robots (cobots)	• Cartesian industrial robots, SCARA industrial robots

Sources：Frost & Sullivan

Value Chain of Embodied AI Robots

The upstream segment includes hardware providers and software providers. Hardware providers supply the physical components that form the foundation of robotic systems. This includes motors, sensors, cameras, LiDAR, batteries, robotic arms and others. Software providers focus on the intelligence and control systems that drive embodied AI robots. This includes AI algorithms, motion planning, simulation platforms, data analytics tools and others that allow robots to perceive their surroundings, make decisions, and execute tasks autonomously or collaboratively. The midstream segment centers on research, development and production to transform core technologies into complete embodied AI robotic solutions. The downstream segment involves the deployment and application of solutions across various industries, where robots are used to improve operational efficiency, automation, or productivity.



Market Size of Embodied AI Robotic Solutions

The global robotic solution market increased from RMB273.9 billion in 2020 to RMB472.6 billion in 2024 with a CAGR of 14.6%, and is expected to reach RMB1,080.4 billion in 2030. China's robotic solution market increased from RMB87.0 billion in 2020 to RMB170.8 billion in 2024 with a CAGR of 18.4%, and is expected to reach RMB462.3 billion in 2030.

The global market size for embodied AI robotic solutions reached RMB82.0 billion in 2024 and is projected to grow further to RMB367.4 billion by 2030, with a CAGR of 30.7% from 2025 to 2030. The market size for embodied AI robotic solutions in China reached RMB28.7 billion in 2024 and is expected to further grow to RMB142.6 billion by 2030, with a CAGR of 32.7% from 2025 to 2030. In the global robotic solution market, the proportion of embodied AI robotic solution market in terms of revenue was 17.4% in 2024, and is expected to reach 34.0% in 2030. And that proportion in China's robotic solution market was 16.8% in 2024, and is expected to reach 30.8% in 2030.

Market Size of Embodied AI Robotic Solutions Globally and in China, in terms of revenue (RMB Billion)

Market Size of Embodied AI Robotic Solutions Globally, in terms of revenue

RMB billion, 2020-2030E

CAGR	2020-2024	2025E-2030E
Total	21.3%	30.7%
Mobile manipulation robotics solutions	43.4%	59.5%
Cobots solutions	31.6%	37.0%
AMR solutions	34.9%	29.0%
Others	6.6%	-34.8%

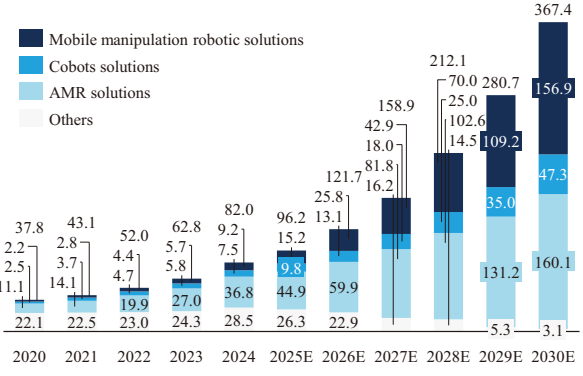
Note: Others include home services/commerce service, and etc.

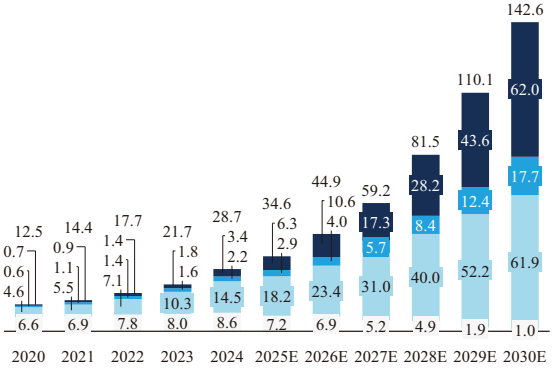
Market Size of Embodied AI Robotic Solutions in China, in terms of revenue

RMB billion, 2020-2030E

CAGR	2020-2024	2025E-2030E
Total	23.1%	32.7%
Mobile manipulation robotics solutions	48.5%	58.0%
Cobots solutions	38.4%	43.6%
AMR solutions	33.2%	27.7%
Others	6.8%	-32.5%

Note: Others include home services/commerce service, and etc.





Sources: International Federal Robotics, Expert interviews, Frost & Sullivan

Overview of Global and China's Mobile Manipulation Robotic Solutions Market

Introduction of Mobile Manipulation Robots

Mobile manipulation robots are a type of embodied AI robot that combines both manipulation and mobility capabilities. They can perceive environmental changes in real-time and use efficient learning algorithms to optimize their behavior, enabling dynamic interaction with the physical environment. This allows them to exhibit a high degree of intelligence and adaptability, efficiently completing complex and varied tasks.

The core differences between mobile manipulation robots and single-function robots, such as Cobots and AMRs, are as follows:

Comparison between major types of embodied AI robots

	Mobile Manipulation Robot	Collaborative Robot (Cobot)	Autonomous Mobile Robot (AMR)
Definition	A robot system that combine both manipulation and mobility capabilities for an intelligent mobile solution that can solve complex tasks in a variety of environments, and major types include wheeled mobile manipulation robots and bipedal mobile manipulation robots (as known as bipedal humanoids)	An industrial robot designed to safely operate alongside humans in a shared workspace, enabling direct human-robot collaboration	A self-navigating robot capable of moving and performing tasks in an environment without direct human intervention, using sensors and software to understand and navigate its surroundings
Core function	Multi-functioned: Performs complex tasks requiring both movement and object handling	Single-functioned: assists humans with specific manipulation or production tasks	Single-functioned: performs autonomous navigation and material transport across facilities
Mobility	Yes	No	Yes
Manipulation Capability	Yes	Yes	No
Typical role	Handling, picking, transporting, and interacting with objects across locations	Assembly, machine tending, packaging, and precision handling	Logistics, warehouse transport, and internal material movement

Sources: Frost & Sullivan

Market Size of Mobile Manipulation Robotic Solutions

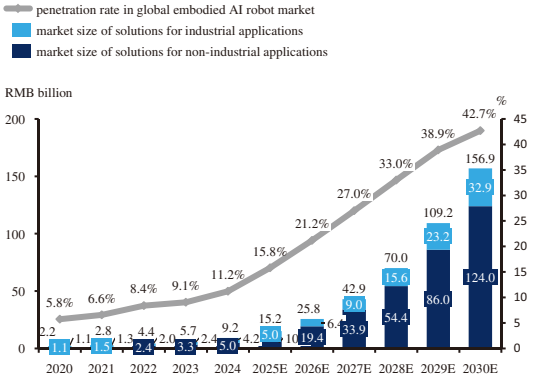
The global market size for mobile manipulation robotic solutions increased from RMB2.2 billion in 2020 to RMB9.2 billion in 2024, with a CAGR of 43.4% from 2020 to 2024, and is projected to further grow to RMB156.9 billion by 2030, with a CAGR of 59.5% from 2025 to 2030. The market size for mobile manipulation robotic solutions in China reached RMB3.4 billion in 2024 and is projected to further grow to RMB62.0 billion by 2030, with a CAGR of 58.0% from 2025 to 2030.

Market Size of Mobile Manipulation Robotic Solutions in China, in terms of revenue (RMB Billion)

Market Size of Mobile Manipulation Robotic Solutions Globally, in terms of revenue

RMB billion, 2020-2030E

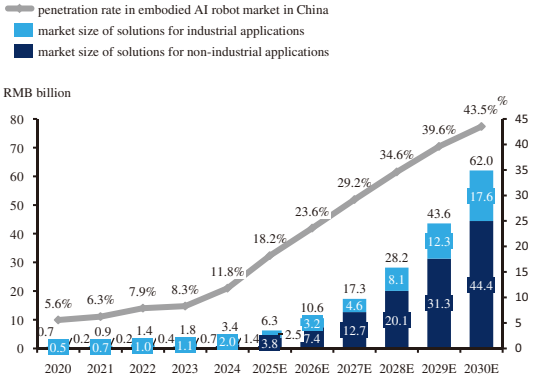
CAGR	2020-2024	2025E-2030E
Total	43.4%	59.5%
Industrial applications	39.8%	45.8%
Non-industrial applications	46.8%	64.8%



Market Size of Mobile Manipulation Robotic Solutions in China, in terms of revenue

RMB billion, 2020-2030E

CAGR	2020-2024	2025E-2030E
Total	48.5%	58.0%
Industrial applications	41.1%	47.8%
Non-industrial applications	63.5%	63.5%



Sources: International Federal Robotics, Expert interviews, Frost & Sullivan

Application Scenarios of Mobile Manipulation Robots

Mobile manipulation robots are primarily applied in industrial, commercial service, and domestic service sectors. These robots effectively address the pain points faced in these scenarios or meet the core needs for intelligent services.

Application Scenarios	Core Needs & Pain Points	Core Value of Mobile Manipulation Robots
Industrial	• The industrial sector faces labor shortages, and labor costs continue to rise • Traditional, highly repetitive and high-intensity tasks are prone to human fatigue, leading to decreased efficiency and increased error rates • Specific industrial environments (e.g., high pressure, radiation, high temperature, toxicity) pose significant safety threats • Traditional fixed automation equipment struggles to quickly adapt to the flexible production demands of high-mix, small-batch manufacturing • The industrial sector seeks greater automation and intelligence in production processes.	• Continuously replaces human labor for repetitive tasks • Achieves precise operations 24/7 through high-precision positioning and multiple-axis coordinated motion control, significantly improving production efficiency and product quality • With environmental perception and autonomous navigation, they handle inspections, material transport, and maintenance in hazardous conditions, reducing human risk. • Multi-modal navigation and route planning enable fast layout changes and flexible small-batch, multi-product production.

Application Scenarios	Core Needs & Pain Points	Core Value of Mobile Manipulation Robots
		• Mobile manipulation robots integrate with industrial equipment and software, providing real-time data feedback to optimize factory operations, enhance production efficiency, and ensure consistent product quality.
Commercial Services (such as warehousing and logistics, accommodation and catering, healthcare, public services)	• Labor costs are continuously increasing, and personnel turnover is high • Human services are affected by factors like experience, making it difficult to guarantee standardized and highly efficient service	• By leveraging autonomous navigation, obstacle avoidance, and item grasping and delivery functions, they can complete repetitive, labor-intensive tasks • Through precise task execution, data recording and analysis, and autonomous learning and optimization, they ensure that every service is highly efficient, accurate, and standardized
Home Services	• Household chores are repetitive and time-consuming • It is difficult for caregivers to constantly monitor and accompany the elderly and other individuals who need care	• Mobile manipulation robots possess multi-functional modules, interactive capabilities, and intelligent planning skills, allowing them to autonomously complete daily household tasks • With mobile manipulation and interactive features, they provide safety monitoring, companionship, and life assistance functions for the elderly and other individuals in need of care
Others (such as scientific research)	• A large number of repetitive experimental operations in scientific research are labor-intensive and time-consuming • There are potential risks in handling biological experiments, radioactive materials, and other hazardous substances, and manual operation poses high risks	• Using high-precision robotic arms, vision recognition, and automated liquid handling, they automate repetitive lab tasks, shortening cycles and improving data quality. • Equipped with enclosed operation, remote control, and spill prevention designs, they can handle toxic, harmful, radioactive, or biohazardous substances in an isolated environment

Sources : Frost & Sullivan

Competitive Landscape of Mobile Manipulation Robotic Solutions Market

The competitive landscape of the global and China's mobile manipulation robotic solutions markets is relatively fragmented. Most companies are still in the early stages of technology research and development and commercialization, and their revenue scale remains low. In 2024, only a few leading players achieved large-scale product sales and revenues exceeding RMB100 million. These leading companies have established a strong competitive edge in terms of technological capabilities, product portfolio, and commercialization.

In terms of the revenue in 2024, The Company is the fourth-largest player in the global mobile manipulation robotic solutions market, holding a 2.8% market share. Additionally, The Company is the largest player in China's mobile manipulation robotic solutions market, with a 7.1% market share.

Top Five Mobile Manipulation Robotic Solution Providers Globally, in terms of revenue (2024)

Ranking	Player	Revenue (RMB Million)	Market Share
1	Company A	501	5.4%
2	Company B	337	3.7%
3	Company C	286	3.1%
4	The Company	255	2.8%
5	Company D	180	2.0%

Sources：Desk Research, Expert Interview Frost & Sullivan

- Company A is a private company founded in 1992 and headquartered in the United States. It mainly provides mobile and mobile manipulation robotic solutions for applications such as inspection and automation in industries including manufacturing, commercial services and public services.
- Company B is a private company founded in 2015 and headquartered in the United States. It focused on providing humanoid robots for logistics and warehousing scenarios.
- Company C is a private company founded in 2022 and headquartered in the United States. It is an artificial intelligence robotics company, focused on developing autonomous humanoid robots.
- Company D is a private company founded in 2016 and headquartered in the Chinese mainland. It is a robotics company specializing in the independent research, development, production, and sales of robotic-related products for consumer and industrial markets.

Top Five Mobile Manipulation Robotic Solution Providers in China, in terms of revenue (2024)

Ranking	Player	Revenue (RMB Million)	Market Share
1	The Company	240	7.1%
2	Company D	130	3.8%
3	Company E	120	3.5%
4	Company F	100	2.9%
5	Company G	50	1.5%

Sources：Desk Research, Expert Interview, Frost & Sullivan

- Company E is a public company listed on the Shanghai Stock Exchange and it is founded in 2012 and headquartered in the Chinese mainland. It mainly provides intelligent robotic solutions for industrial, transportation, commercial and medical sectors.
- Company F is a private company founded in 2023 and headquartered in the Chinese mainland. It specializes in providing intelligent robotic solutions to industries such as manufacturing, logistics, and healthcare to enhance operational efficiency and productivity.
- Company G is a public company listed on the Hong Kong Stock Exchange and it is founded in 2015 and headquartered in the Chinese mainland. It dedicates to the research, development, and innovative application of intelligent robots.

Overview of Global and China's Industrial Mobile Manipulation Robotic Solutions Market

Introduction of Industrial Mobile Manipulation Robots

Industrial mobile manipulation robots are a type of mobile manipulation robot specifically designed and deployed for industrial production environments. They are intended to increase the level of automation, efficiency, and safety in factory production settings, and are a critical component for the future of smart factories and the intelligent upgrade of industrial scenes. The applications of industrial mobile manipulation robots are extensive, including but not limited to material handling, assembly, loading and unloading, quality inspection, and inspection and maintenance.

Compared to mobile manipulation robots for other applications, industrial mobile manipulation robots typically have the following characteristics: (a) High reliability: The reliability directly impacts the continuity, efficiency, and safety of industrial production and operations. Compared to other scenarios, the industrial sector has a higher demand for the reliability of mobile manipulation robots under long-term, high-intensity work; (b) High precision: Industrial mobile manipulation robots can perform repetitive tasks with extremely high precision to ensure product quality and production consistency; (c) High efficiency: Through high-speed motion control, parallel multi-tasking, intelligent task management, and path optimization, they can achieve 24/7 uninterrupted, high-efficiency

operations, thereby boosting factory production efficiency; (d) Integration and interoperability: Industrial mobile manipulation robots need to seamlessly integrate into existing industrial automation systems and production lines, enabling data exchange and collaborative work with other equipment and various industrial software systems; and (e) Programmability and flexibility: Industrial mobile manipulation robots typically feature programming interfaces and software platforms that allow for rapid programming and redeployment based on changes in production demands, adapting to different tasks and production processes.

Market Size of Industrial Mobile Manipulation Robotic Solutions

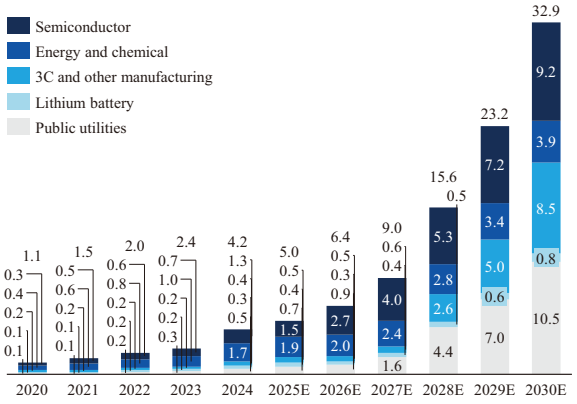
The global market size of industrial mobile manipulation robotic solution market increased from RMB1.1 billion in 2020 to RMB4.2 billion in 2024, with a CAGR of 39.8%, and is expected to continue to increase to RMB32.9 billion in 2030, with a CAGR of 45.8% from 2025 to 2030, which indicates an acceleration in commercialization as adoption broadens across downstream industries. Meanwhile, the market size of industrial mobile manipulation robotic solution market in China increased from RMB0.5 billion in 2020 to RMB2.0 billion in 2024, with a CAGR of 41.1%, and is expected to continue to increase to RMB17.6 billion in 2030, with a CAGR of 47.8% from 2025 to 2030. The growth of the global and China's industrial mobile manipulation robotic solutions markets is driven by a combination of increasing labor shortages, strong demands for digital and AI transformation across various industrial sectors, and continuous advancements in AI technologies, especially embodied AI technologies, which collectively accelerate the adoption of mobile manipulation robotic solutions.

Among end-user industries, the semiconductor, energy and chemical, 3C and other manufacturing, and public utility sectors are expected to be the major contributors to market growth, primarily driven by their continued industry expansion, increasingly stringent requirements for automation and intelligent operations, and stronger demand for mobile manipulation robotic solutions capable of performing tasks in complex, labor-intensive and safety-critical industrial environments. For example, for the semiconductor sector, the global semiconductor market is expected to increase from USD630.5 billion in 2024 to USD1,174.6 billion in 2030, while China's semiconductor market is expected to increase from USD211.8 billion in 2024 to USD415.9 billion in 2030. The high growth of mobile manipulation robotic solutions in the semiconductor industry is driven by the following factors: (i) the increasing capital expenditure and the expanded production capacity of wafer manufacturing, fabrication or assembly and testing plant in the semiconductor industry; (ii) the rising automation demands due to the increasing complexity of material workflows, increasing loss of labor and initiatives promoting intelligent manufacturing and automation; (iii) the transition of industrial mobile manipulation robot solution projects from pilot deployments to large-scale replication; and (iv) the continued enhancements in performance and reliability of industrial mobile manipulation robots.

Market Size of Industrial Mobile Manipulation Robots Globally, in terms of revenue, by end-users

RMB billion, 2020-2030E

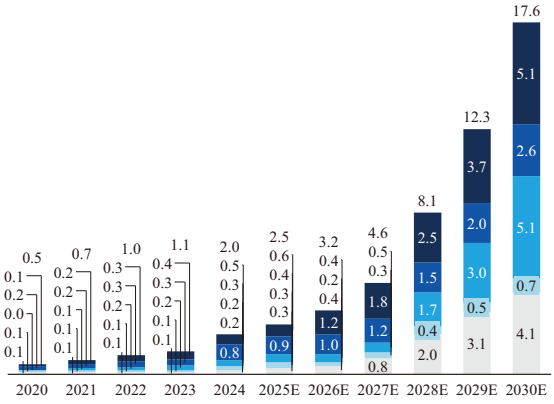
CAGR	2020-2024	2025E-2030E
Total	39.8%	45.8%
Semiconductor	44.3%	43.7%
Energy and chemical	43.6%	15.5%
3C and other manufacturing	18.9%	76.2%
Lithium battery	31.6%	14.9%
Public utilities	49.5%	71.9%



Market Size of Industrial Mobile Manipulation Robots in China, in terms of revenue, by end-users

RMB billion, 2020-2030E

CAGR	2020-2024	2025E-2030E
Total	41.1%	47.8%
Semiconductor	49.5%	53.4%
Energy and chemical	41.4%	23.6%
3C and other manufacturing	196.1%	66.6%
Lithium battery	18.9%	18.5%
Public utilities	18.9%	68.7%

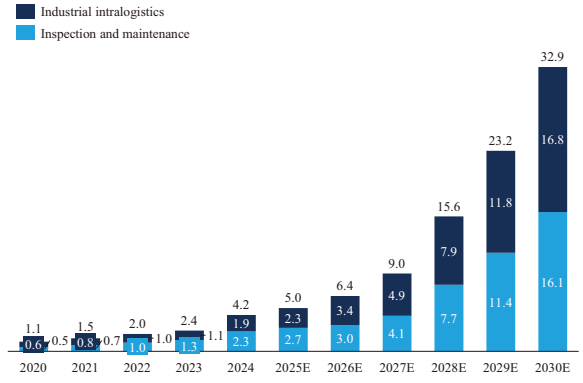


The global market revenue for industrial mobile manipulation robots is projected to grow with industrial intralogistic robots and inspection and maintenance robots reaching RMB16.8 billion and RMB16.1 billion, respectively. A similar trend is expected to happen in China with industrial intralogistic robots maintain a stronger growth rate, reaching RMB9.9 billion in 2030 with a CAGR of 52.5% from 2025 to 2030.

Market Size of Industrial Mobile Manipulation Robots Globally, in terms of revenue, by applications

RMB billion, 2020-2030E

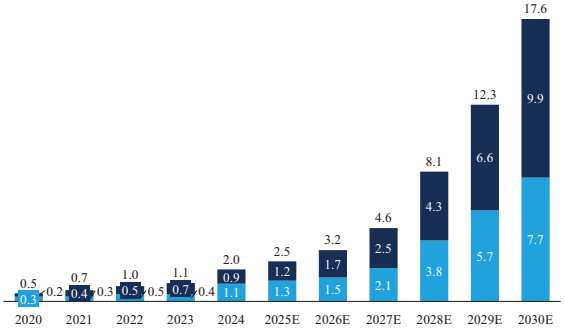
CAGR	2020-2024	2025E-2030E
Total	39.8%	45.8%
Industrial intralogistics	33.4%	48.8%
Inspection and maintenance	46.5%	42.9%



Market Size of Industrial Mobile Manipulation Robots in China, in terms of revenue, by applications

RMB billion, 2020-2030E

CAGR	2020-2024	2025E-2030E
Total	41.1%	47.8%
Industrial intralogistics	45.6%	52.5%
Inspection and maintenance	37.9%	42.8%



Industry Verticals of Industrial Mobile Manipulation Robots

Industry verticals	Core needs	Core value of industrial mobile manipulation robots
Semiconductor	• **Precision Material Handling:** High-value, fragile materials require handling with very low vibration; vibration must be less than 0.3g during the transport process • **High Cleanliness Requirements:** Semiconductor manufacturing typically takes place in cleanrooms, with cleanliness standards often reaching ISO Class 3 • **24/7 Uninterrupted Operation:** Production line automation is highly advanced, and downtime costs are extremely high	• **High-Precision Operation:** Integrates multi-modal data from LiDAR, vision, and force control to achieve millimeter-level positioning and millimeter-level operation, ensuring accuracy. The robot's vibration control at less than 0.3g can reduce potential losses from wafer breakage • **Ultra-High Cleanliness:** Robot operations can guarantee ultra-high cleanliness, reducing potential contamination • **Stable and Reliable Automated Transport:** Enables automated loading, unloading, and transfer of carriers, ensuring production continuity
3C Manufacturing	• **Short Product Cycles:** Production cycles are short, and products are updated rapidly, requiring quick shifts in production lines • **Complex Material Flow:** There is a large variety of components and a high frequency of material handling, requiring accurate delivery to specific locations	• **Flexibility & Easy Programming:** The modules are highly flexible and easy to program, enabling rapid adaptation to new product lines and supporting flexible, high-mix, small-batch production • **Intelligent Material Handling:** Integrated with MES/WMS systems, it achieves precise and timely material delivery to designated workstations
Energy, Chemical and Public Utilities	• **Hazardous Environments:** production environments may contain flammable, explosive, or toxic chemical substances, posing a high risk to human safety • **Frequent & Inefficient Inspection:** Manual inspection is time-consuming and labor-intensive, making it difficult to achieve 24/7 coverage and high frequency	• **Improved Safety:** Robots can perform tasks in dangerous and hazardous environments, ensuring personnel safety • **Efficient & Safe Inspection:** Performs 24/7 continuous, visual, and traceable inspections, improving fault detection and timeliness. It also monitors on-site hazardous conditions to prevent major accidents
Lithium Battery	• **Large-Scale Production:** The large-scale production of power batteries requires high levels of automation • **Complex Processes:** The production processes are complex with many interconnected steps, requiring high efficiency in material flow • **Multi-Station Operation:** Manual operations at multiple stations and complex logistics require highly efficient management	• **Full-Process Automation:** Automates the entire process from raw material loading to final product warehousing and material flow • **Improved Efficiency & Quality:** Reduces manual intervention and fatigue, increases production line efficiency and output

Industry verticals	Core needs	Core value of industrial mobile manipulation robots
Automotive	• **Standardized Production:** Large-scale production requires high levels of automation • **Complex Assembly & Coordination:** The production line is long, with complex processes and a high degree of collaborative work required	• **High-Efficiency Logistics & JIT:** Enables autonomous navigation and JIT (Just-In-Time) material delivery within the factory, supporting highly automated production and reducing waiting and inventory • **Flexible Assembly & Human-Robot Collaboration:** Assists with complex and fine operations on the final assembly line, enabling flexible assembly and human-robot collaboration
Other Scenarios (e.g., Smart Mining, Smart Oilfields, Biomedicine)	• **Large-scale Manufacturing & Complex Needs:** There is a need for both standardized batch operations and flexible production that can handle frequent changes • **High Demand for Continuity:** Production processes are continuous over long periods, and the cost of downtime is extremely high • **Strict Reliability Requirements:** Product quality and operational safety directly impact economic benefits • **Instability from Human Factors:** Differences in operator skill, fatigue, and high turnover rates affect production continuity and consistency	• **Improved Production Continuity:** Enables all-weather, continuous operation, reducing downtime and quality fluctuations • **Accelerated Flexible Production:** Enables rapid line changeovers and process adjustments • **Improved Overall Benefits:** Increases production line utilization and product consistency, and accelerates the response to market demand

Sources : Frost & Sullivan

Key Drivers for Industrial Mobile Manipulation Robot Market

- **Labor Structure Transformation:** With an aging population and declining birth rates, the industrial sector is experiencing a downward trend in average annual employment. Concurrently, the new generation of workers is shifting its preferences away from traditional industrial jobs, which collectively exacerbates the structural shortage in the labor market. Meanwhile, continuously rising labor costs are prompting labor-intensive industrial enterprises to seek ways to optimize production efficiency and control operational expenses, accelerating their transition to automation. Consequently, industrial mobile manipulation robots have become one of the core solutions to fill this labor gap.
- **Growing Demand for Enhanced Intelligence and Efficiency in Advanced Manufacturing:** The industrial sector typically have a stronger willingness and ability to invest in and purchase automation and intelligent equipment. Therefore, they are at the forefront of adopting mobile manipulation robots to enhance intelligent manufacturing and operational efficiency. Mobile manipulation robots can flexibly adapt to the complex scenarios of advanced manufacturing, collaborate efficiently with humans, and complete repetitive or precise tasks, thereby driving the intelligent upgrade of industrial productivity.
- **Increasing Demand for Flexible Production:** The core of flexible production lies in its agility and adaptability, requiring production lines, equipment, personnel, and management systems to quickly adapt and reconfigure in response to market fluctuations and changing customer needs.

Adopting mobile manipulation robots, supports "cellular" manufacturing, and allows for more flexible production line layouts. This significantly lowers the infrastructure modification costs and production losses caused by production line adjustments.

- **Advancements in Hardware and Software Technology:** Hardware technology advancements, represented by mobile platforms and robotic arms, have significantly enhanced the mobility and manipulation capabilities of mobile manipulation robots. Concurrently, the deep integration of large models and multi-modal perception technologies is enabling robots in industrial settings to gradually evolve into "generalized intelligent agents" with autonomous decision-making and cross-scenario adaptability. This not only provides a solid technological foundation for the implementation of embodied AI in industry but also, at a fundamental level, broadens the application boundaries in complex scenarios.
- **Establishment of Industry Best Practices Driving Broader Adoption:** Leading manufacturers, by serving key clients in specific industrial segments, have accumulated a wealth of successful cases and experiences. This has given them a deep understanding of the unique pain points, process flows, and technical challenges in these fields, leading to the creation of proven, mature solutions and industry best practices. These best practices provide clear guidance for other companies, thereby driving their penetration into existing and new industrial scenarios.
- **Maturity of Core Component Technology and Mass Production Driving Down Robot Manufacturing Costs:** With the maturity of technologies related to the core components of industrial mobile manipulation robots, these components have achieved large-scale commercial production, which in turn has pushed their manufacturing costs down. Simultaneously, for increased localization rate in the core component sector has also contributed to a decline in average component prices. The decrease in the average manufacturing cost of robots allows for a broader range of applications.

Key Trends for Industrial Mobile Manipulation Robot Market

- **AI Evolution Propelling Robots to More Intelligent, Adaptive, and Versatile Embodied AI Agents:** The advancement of multi-modal perception technology enables industrial mobile manipulation robots to achieve a more precise understanding of the environment, improved recognition and grasping of complex targets, high robustness, and support for sophisticated human-robot collaboration. VLA （Vision Language Action) technology empowers directly map perceived visual information and received language instructions to specific actions. VLA models focus on learning the general connections between vision, language, and action, endowing robots with enhanced task generalization and transferability, transforming them from single, repetitive task execution devices into intelligent agents capable of understanding and performing a variety of complex and varied tasks.
- **Continuous Increase in Penetration of Industrial Mobile Manipulation Robots in More Application Scenarios:** With the continuous decline in the selling price of industrial mobile manipulation robots and an improvement in their cost-effectiveness wider range of small and medium-sized enterprises will also be able to purchase them, leading to a diversification of application scenarios. Furthermore, as the intelligence capabilities of industrial mobile manipulation robots improve and manufacturers accumulate experience in serving specific vertical industries, the difficulty of deploying and applying these robots in more industrial scenarios is reduced, allowing an increasing number of industrial settings to begin deploying and using mobile manipulation robots.
- **Robots with Wheeled Mobile Platforms will First Dominate Market Growth:** When deciding whether to implement robotic products. In this context, industrial customers typically first select and introduce the product type that best suits their current production and operational needs, budget requirements, and ROI/payback period expectations. On one hand, industrial settings

demand higher efficiency, stability, and battery life from robots, and current industrial mobile manipulation robots based on wheeled platforms perform better in these metrics. On the other hand, the ground in the main application scenarios is relatively flat, and a wheeled mobile platform can meet the robot's mobility needs within the environment.

- **Manufacturers with Deep Industry Know-How Hold a Greater Competitive Advantage:** Industrial scenarios are characterized by high complexity and diversity and emphasize the practical business value of automation solutions. Industrial embodied AI robot manufacturers with deep industry know-how can typically better understand the actual needs of a given scenario and continuously optimize their solutions based on feedback from scene data, thus providing a more advantageous business value.
- **Explore the Specific Application Scenarios and Feasibility of Humanoid Robots in the Industrial Sector:** Humanoid robots are generally considered to have higher adaptability, flexibility, and scalability. The industrial sector is also seen as one of the important downstream application scenarios once humanoid robot technology and products mature. Therefore, industrial mobile manipulation robot manufacturers are also making the R&D of humanoid robot technology and products, as well as their commercial application in industrial settings. Simultaneously, downstream customers in the industrial sector are continuously and dynamically evaluating the advantages of humanoid robots in key metrics such as functionality, affordability, ROI, safety, usability and durability. In the future, once humanoid robot technology and products mature and their performance and cost can meet the requirements of industrial settings, the implementation of humanoid robots in industrial scenarios will become a key factor in driving the continuous growth of the industrial mobile manipulation robot market.

Competitive Landscape of Industrial Mobile Manipulation Robotic Solutions Market

The competitive landscape of the global and China's industrial mobile manipulation robot markets is relatively fragmented. In terms of the revenue in 2024, The Company is the largest market player in the global industrial mobile manipulation robot market, with a market share of 6.1%. Meanwhile, The Company is also the largest market player in China's industrial mobile manipulation robot market, with a market share of 12.0% in the same year.

Top Five Industrial Mobile Manipulation Robot Players Globally, in terms of revenue (2024)

Ranking	Player	Revenue (RMB Million)	Market Share
1	The Company	255	6.1%
2	Company H	130	3.1%
3	Company E	120	2.9%
4	Company B	86	2.0%
5	Company G	50	1.2%

Sources : Desk Research, Expert Interview, Frost & Sullivan

— Company H is a private company founded in 2015 and headquartered in the Taiwan, China. It specializes in autonomous robotics, IoT, and Industry 4.0 solutions for intelligent automation in industrial environments.

Top Five Industrial Mobile Manipulation Robot Players in China, in terms of revenue (2024)

Ranking	Player	Revenue (RMB Million)	Market Share
1	The Company	240	12.0%
2	Company E	120	6.0%
3	Company I	50	2.5%
4	Company G	40	2.0%
5	Company H	30	1.5%

Sources : Desk Research, Expert Interview, Frost & Sullivan

— Company I is a private company founded in 2016 and headquartered in the Chinese mainland. It focuses on providing robotic solutions for human-robot collaboration and interaction scenarios.

Comparative Analysis between Comparable Products of Leading Players

Robots for industrial intralogistics

	OW series of the Company	Most comparable products	
		Comparable product A	Comparable product B
Key performance parameters			
— Accuracy of SLAM	±5mm	>±50mm	±10mm
— Maximum travel speeds	1.5m/s	<1.5m/s	1.5m/s
— Drive modes	Omnidirectional/ differential	Omnidirectional	Omnidirectional/ differential
— Visual positioning	2.5D/3D	2.5D	2.5D/3D
Major end industries	Semiconductor	Semiconductor	3C manufacturing
Year of first application in foundry	2021	After 2021	Not available
Year of first application in OSAT	2020	2018	Not available
Self-developed software	✓	✓	✓
Product features	Covering the whole process of semiconductor production, including raw material manufacturing, wafer fabrication, and assembly and testing processes	Mainly covering assembly and testing processes of semiconductor production	Mainly covering material loading and unloading in 3C manufacturing
Cost control capability	Strong cost control capability due to the increasing adoption of domestic and self-developed components	—	—

Robots for inspection and maintenance

		Most comparable products
	ARIS-MS series of the Company	**Comparable product C**
Key performance parameters		
— Accuracy of SLAM	±10mm	±50mm
— Maximum travel speeds	1.5m/s	<1.5m/s
— Drive modes	Four-wheel drive	Tracked drive
Year of first deployment	Mid 2024	After 2024
Self-developed software	✓	✓
Product features	Strong magnetic field-resistant; autonomously navigate through narrow passages; and industry-leading temperature monitoring coverage	Capable of running in typical strong magnetic environments; comparatively limited maneuverability due to tracked drive system, larger size and greater weight
Cost control capability	Strong cost control capability due to the increasing adoption of domestic and self-developed components	—

Note: The product comparison herein is based on publicly available information, company disclosures, expert interviews and other third-party sources available as of the date hereof. Owing to differences in disclosure practices, technical definitions, testing conditions, configurations and application scenarios, certain information and actual product performance may vary in different projects.

Entry Barriers of Industrial Mobile Manipulation Robot Market

- **Leading R&D and Innovation Capabilities:** Leading players have continuous investment in cutting-edge R&D, including breakthroughs in perception, cognitive decision-making, and motion control algorithms, ensuring that products demonstrate intelligence that surpasses current market levels. Manufacturers lacking leading R&D and innovation capabilities will struggle to offer competitive products, gain pricing power, and achieve sustainable growth. Furthermore, market players who were early investors in R&D for mobile manipulation robots often have a first-mover advantage, building significant technological barriers through long-term, sustained R&D and innovation. New entrants are often followers in the technology field and require substantial capital and time to achieve comparable technological milestones.
- **Product Standardization and Modularity:** Standardized components and modular design allow manufacturers to flexibly combine functions or quickly upgrade specific parts according to customer needs, enhancing the adaptability and scalability of the robot products. For manufacturers, this also enables a faster response to market changes and technological

developments, accelerating product iteration. Manufacturers lacking product standardization and modularity often need to develop highly customized products and solutions for each new client, which limits their commercial expansion speed and profit margin growth potential.

- **Capability to Implement Products and Solutions:** The commercial success of the mobile manipulation robot market is fundamentally about transforming products into actual productivity. Leading manufacturers must possess the ability to efficiently deliver and widely apply complex technical solutions, ensuring stable operation and continuous service optimization. Manufacturers that lack this capability will struggle to prove the practical value of their products in real industrial production scenarios.
- **Deep Know-How in Vertical Industries:** A deep understanding of a specific industry's operating model and customer pain points is crucial. Market participants need to deeply integrate mobile manipulation robot products into vertical application scenarios, providing customized functions and process optimization solutions to truly meet end-user needs and create significant business value.
- **Customer Resources and Brand Reputation:** Leading suppliers earn strong customer loyalty through reliable products and support services, securing long-term partnerships. With more than 12-month validation cycles and high switching costs, customers generally do not easily switch suppliers to ensure their production stability, which constitutes a significant entry barrier for new entrants.

Cost Analysis of Major Raw Materials

The industrial mobile manipulation robots are composed of hundreds of raw materials or components, each differing significantly in attributes, functions and prices. The major components of industrial mobile manipulation robots mainly include motion and transfer control components such as motor, gear reducer, and drive wheel module, robotic arms and sensors. Such major components collectively determine the robot's motion accuracy, load capacity, operational efficiency, and environmental perception capabilities, thereby directly shaping overall system performance and competitiveness. Among these, motion and transfer control components and robotic arms typically account for a substantial portion of the overall cost due to their critical role in enabling precise manipulation and stable mobility, while sensors such as LiDAR remain essential for navigation and obstacle detection in dynamic environments. The historical trend of these components has been characterized by gradual cost declines alongside continuous performance improvements. Ongoing domestic substitution, improved manufacturing processes, and increased standardization have contributed to a steady decline in average prices. Looking ahead, the unit prices of these major components are expected to continue trending downward, supported by economies of scale, supply chain localization, and further standardization across robotics platforms. The table set forth below demonstrate the historical price trends of the major components and the major factors which affect the prices of such components.

Category	Major types of raw materials or components	Price range (RMB per unit)			Key factor affecting the prices
		2023	2024	2025	
Motion and transfer control	Motor	300-8,000	280-7,600	250-7,000	Differences in power rating, torque density, motion control precision, and component integration level
	Gear reducer	400-15,000	350-14,000	300-13,000	Performance requirements such as torque capacity, transmission accuracy, backlash tolerance, and service life
	Drive wheel module	500-20,000	450-18,000	400-17,000	Differences in load capacity, motor integration level, and steering functionality
Robotic arms	Robotic arms	50,000-150,000	40,000-120,000	30,000-100,00	Differences in payload capacity, precision, types of core components, and degree of integration
Sensors	Single-line LiDAR	400-680	300-600	250-500	Differences in measurement range, accuracy, angular resolution, scanning mechanism, and integration level

SOURCES OF INFORMATION

In connection with the **[REDACTED]**, we have engaged Frost & Sullivan to conduct a detailed analysis and prepare an industry report on the markets in which we operate. Services provided by Frost & Sullivan, which is an independent global consulting firm founded in 1961, include market assessments, competitive benchmarking, and strategic and market planning for a variety of industries. We have agreed to a total of RMB450,000 in fees and expenses for the preparation and use of the Frost & Sullivan Report. The payment of such an amount was not contingent upon our successful Listing or on the results of the Frost & Sullivan Report. Apart from the Frost & Sullivan Report, we have not commissioned any other industry report in connection with the **[REDACTED]**.

Frost & Sullivan prepared its report based on its in-house database, independent third-party reports and publicly available data from reputable industry organizations. Where necessary, Frost & Sullivan contacts companies operating in the industry to gather and synthesize information in relation to the market, prices and other relevant information. The market projections in the Frost & Sullivan Report are mainly based on the assumption that the social, economic, and political environments in the PRC and globally will remain stable throughout the forecast period. Frost & Sullivan believes that the basic assumptions used in preparing the Frost & Sullivan Report, including those used to make future projections, are factual, correct and not misleading. Frost & Sullivan has independently analyzed the information, but the accuracy of the conclusions of its review largely relies on the accuracy of the information collected. Frost & Sullivan's research may be affected by the accuracy of these assumptions and the choice of these primary and secondary sources.

Our Directors have confirmed that Frost & Sullivan has exercised reasonable care in selecting and identifying the sources of information used in this section (which are extracted from the Frost & Sullivan Report), compiling, extracting and reproducing the information, and ensuring no material omission of the information. Our Directors confirm that, after making reasonable enquiries, there is no material adverse change in the market information since the date of the Frost & Sullivan Report which may qualify, contradict or have an impact on the information in this section.