CMRA
China Mobile Robot Alliance

Global Mobile Robot (AGV/AMR) Market Report (2022-2023 Edition)

China Moblie Robot(AGV/AMR) Alliance

New Strategy Research Institute - Mobile Robot(AGV/AMR) Division

Description

- **Data source:** This analysis is based on the 2022 data of over 200 mobile robot enterprises from both domestic and overseas markets, along with data from around 120 supply chain enterprises. In addition, it also includes an in-depth analysis of mobile robot applications in different sectors, as reported by top-end users both domestically and abroad.

- **Scope:** The mobile robots analyzed and studied in this report are mainly mobile robots (AGV/AMR) used in industrial and logistics fields, including AGVs (Automated Guided Vehicles), industrial AMRs (Autonomous Mobile Robots), AGCs (Automated Guided Carts), etc. AGV, AMR, and AGC are the types of mobile robots included in this report.

Executive Summary

- **Market share**: The AGV/AMR industry saw significant growth in 2022, with sales reaching around USD 4.75 billion--a 35.71% increase from the previous year--and a sales volume of 153,000 units, a year-on-year increase of 27.5%. With the gradual recovery of the economy and the emergence of new markets, the demand for AGV/AMR will continue growing in the coming years. It is predicted that by 2030, the global mobile robot market will be worth USD 20 billion.

- **Distribution**: The Asian-Pacific market holds more than 50% of the market share and is the biggest market for AGV/AMR applications. The American market comes in the second, while Europe is the third. AGV/AMR enterprises in China, Europe, and the US are the key players in the market, and the competition is getting more and more fierce.

- **Technology**: Natural navigation (Laser SLAM + Visual SLAM) applications are gaining popularity and outpaced QR code products in 2022. For now, enterprises will focus on adapting to the demand for AGV/AMR technology and iterating on existing products. There weren't many cutting-edge innovations or products.

- **Market segment**: The automotive & auto parts, new energy, and supply chain/3PL/retail sectors all experienced tremendous growth in 2022, making them the primary markets for AGV/AMR applications.

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PART ONE

Introduction

1.1.1 Definition & Classification of Mobile Robot (AGV/AMR)

- Mobile robots are designed with mobility, composed of sensors, remote controllers, automatic controllers, and other mechanisms. They come in various types, including ground, aerial, water surface, and underwater mobile robots, each with its own unique mobility mechanism such as wheeled, tracked, legged, hybrid, and special types.
- The report covers mobile robots (AGV/AMR) used in the industrial and logistics fields which are equipped with navigation devices and in-vehicle control systems for wheeled mobility and self-powering. They consist of the vehicle chassis, drive, actuator, safety and protection devices, control system, charging device, navigation device, communication device, human-machine interaction system, etc.

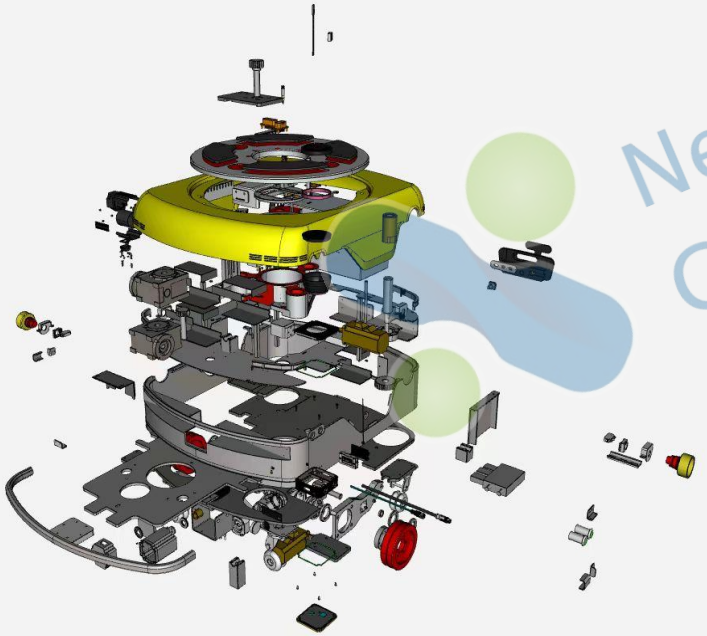
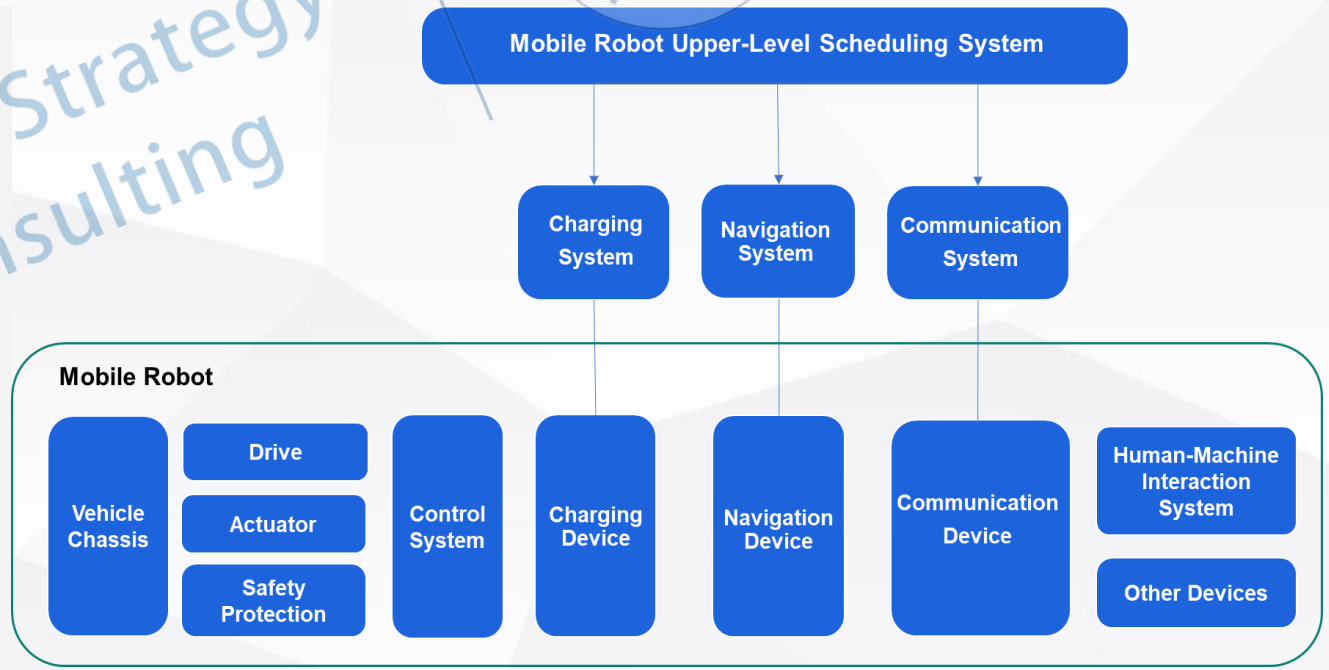


Image Credits: Wellwit Robotics



1.1.2 Definition & Classification of Mobile Robot (AGV/AMR)

Mobile robots (AGV/AMR) are classified into various types, with the two most common classifications today being:

1) Mobile robots categorized based on their navigation types, including electromagnetic navigation, magnetic tape navigation, magnetic nail navigation, optical navigation, QR code navigation, laser navigation, visual navigation, inertial navigation, base station navigation, RFID navigation, fusion navigation, and so on;
2) Mobile Robots classified based on their function, such as handling, assembly, tugger/ towing tractor, inspection, sorting, and compound robot.

By Navigation Type

- Electromagnetic Navigation
- Laser Navigation
- Magnetic Tape Navigation
- Visual Navigation
- Magnetic Nail Navigation
- Inertial Navigation
- Optical Navigation
- Base Station Navigation
- QR Code Navigation
- RFID Navigation
- Fusion Navigation

By Function

- Handling Robot
- Compound Robot
- Sorting Robot
- Tugger/towing Tractor
- Assembly Robot
- Inspection Robot

1.1.3 Definition & Classification of Mobile Robot (AGV/AMR)

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Mobile Robot(AGV/AMR) Major Product Types

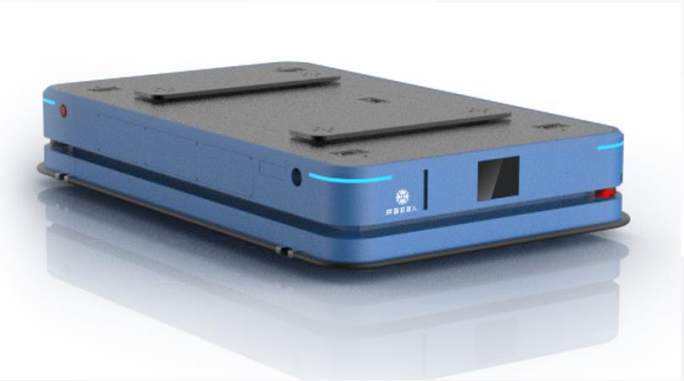
Unmanned Forklift

Compound Robot

Latent Jacking AGV/AMR

Assembly Robot

Tote/Case/Bin Handling Robot



Heavy-Duty Robot

1.2 History of Mobile Robots (AGV/AMR)

Mobile robots(AGV/AMR), were first developed in Europe and the US, but China has now become the largest market for mobile robots.

AGVs/AMRs have been used for material transportation for over 70 years. Developed in the US, the technology spread worldwide. China has become a leader in AGV/AMR development and application in recent years due to a surge of startups.

Origins

The first AGV was made in 1953 by modifying an AGC tractor to transport goods along wires in a grocery warehouse. Research on AGV continued and by 1960, over 1,300 AGVs were being used across Europe.

Division

AGVs were introduced in Japan in 1963, while they were expanding in Europe and the US. However, Japan took a different approach than Europe and the US. While they focused on AGV automation, Japan developed simple and efficient AGC skills to help users recoup their costs quickly.

Developing

The AGV market has expanded globally beyond Europe, America, and Japan. China launched its first AGV in 1992 and established a production line. The industry experienced steady growth in the 1990s and the first decade of the 21st century, with AGVs being used in various fields and penetrating different sectors.

Thriving

Amazon's acquisition of Kiva Systems in 2012 for $775 million brought warehouse robots into the spotlight, leading to the widespread implementation of AGVs in various industries. This also led to the development of Autonomous Mobile Robots (AMRs) that build on existing AGV technology.

PART TWO

2

Overview of The Global AGV/AMR Market

2.1 Background of the AGV/AMR Industry

The global manufacturing and logistics industries are being compelled to move towards automation and artificial intelligence due to downward demographic trends in main advanced economies. As a result, "machines for humans" is becoming the prevailing theme.

The rapid advancements in science and technology have led to a significant increase in the field of robotics. Many countries are currently promoting the development of the robotics industry by implementing enhanced national policies.

Industrial Upgrading

Technological Advancement

Policies

The advancement of AI, cloud computing, and other technologies has significantly broadened the scope of robot capabilities. This has led to AGV/AMR being equipped with a strong foundation for meeting the demands of diverse scenarios in different industries.

2.2 2022 AGV/AMR Market Share

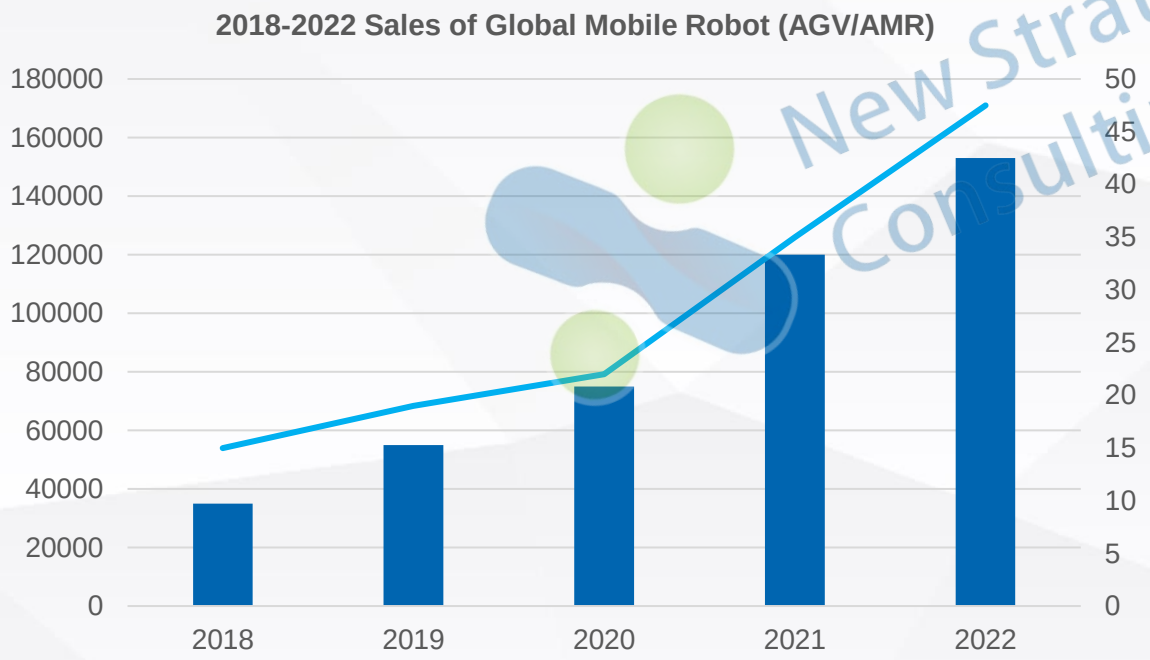
In 2022, global sales of AGV/AMR reached around USD $4.75 billion

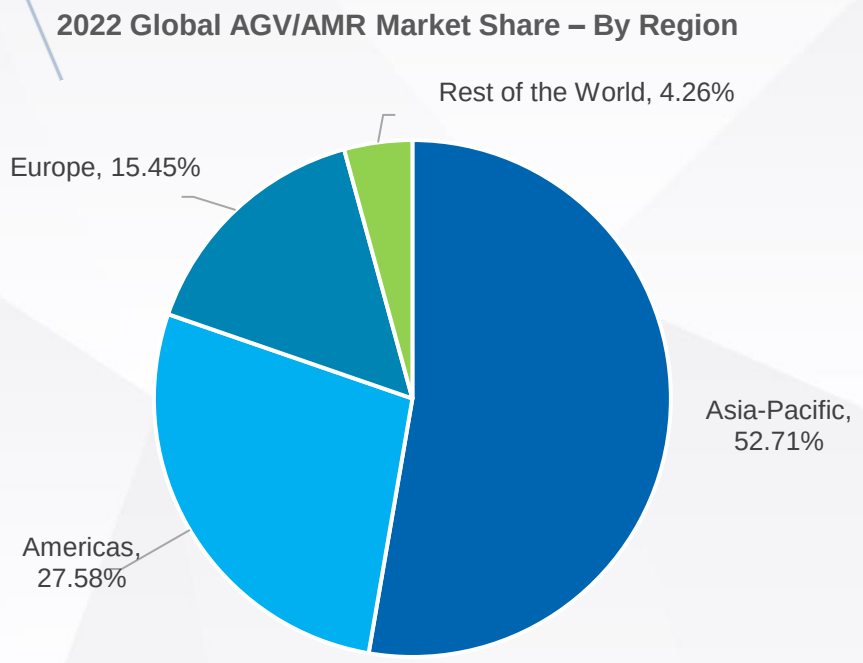
The mobile robot (AGV/AMR) market experienced significant growth in 2022 due to several factors, such as the rise of e-commerce, the labor shortage, and the ongoing shift towards flexible manufacturing.

In 2022, global sales of AGV/AMR reached around USD $4.75 billion, a 35.71% increase compared to the previous year, with 153,000 units sold--up 27.5% YoY.

Asia-Pacific held the largest share of the global market in 2022, representing 52.71%.

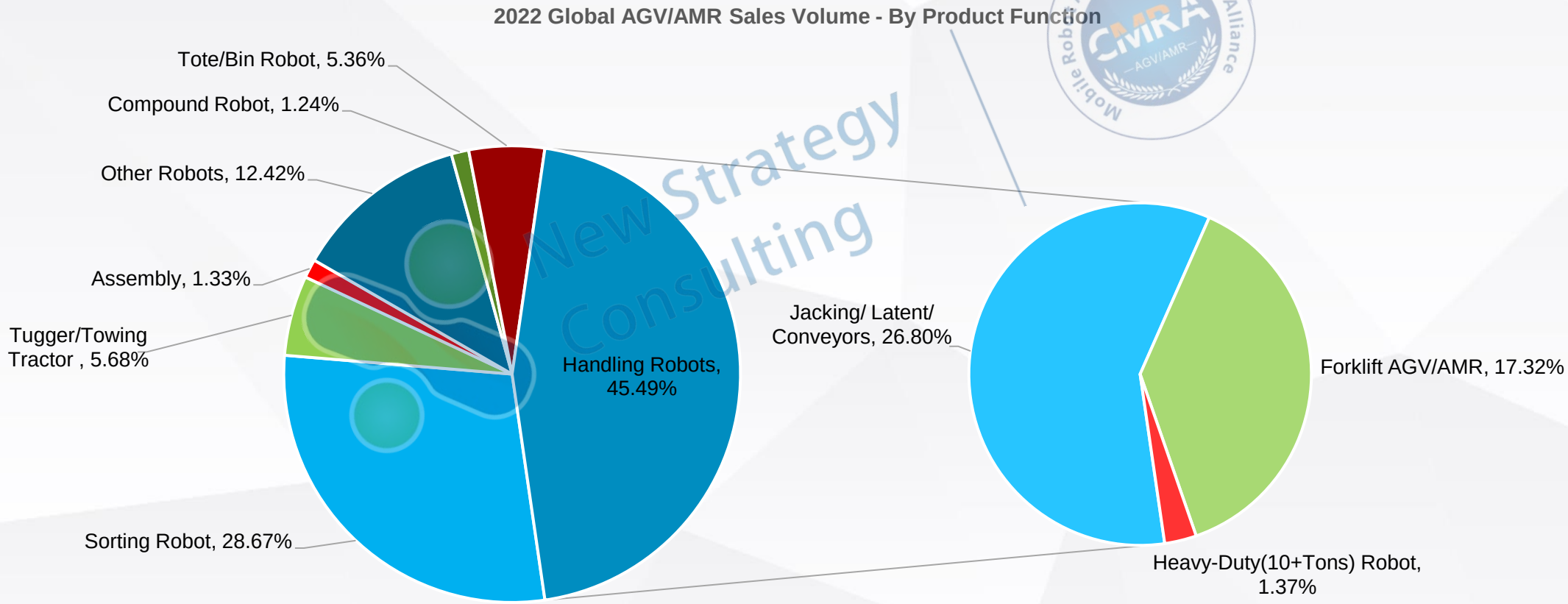
China was the single largest market in this region, followed by Japan, South Korea, and Southeast Asia. North America was the main contributor to the Americas' 27.58% share of the market. Europe's market share was 15.45%, with Germany, France, the UK, Italy being the major markets. The rest of the world accounted for 4.26% of the market.





2.3 2022 Global AGV/AMR Sales Volume - By Product Function

- The global sales volume of AGV/AMR exceeded 150,000 units in 2022. Among them, handling robots (including forklift AGV/AMR, conveyor/latent/jacking, heavy-duty robots) accounted for 45%, sorting robots accounted for 28.76%, tote/bin robots accounted for 5.36%, tugger/towing tractors accounted for 5.68%, inspection robots accounted for 1.44%, assembling robots accounted for 1.05%, compound robots accounted for 1.24%, and other types of robots accounted for 10.98%.



2.4 2022 Global AGV/AMR Sales Volume – By Navigation Type

33.72%

Natural Navigation (Laser SLAM + Visual SLAM)

The increasing maturity of technology and growing market awareness have further accelerated the growth of AMR. In 2022, the sales volume of AMR surpassed that of 2D products.

27.45%

QR Code Navigation

QR code products have been increasingly imported into the manufacturing scene in the last two years, in addition to their primary use in warehouses.

13.23%

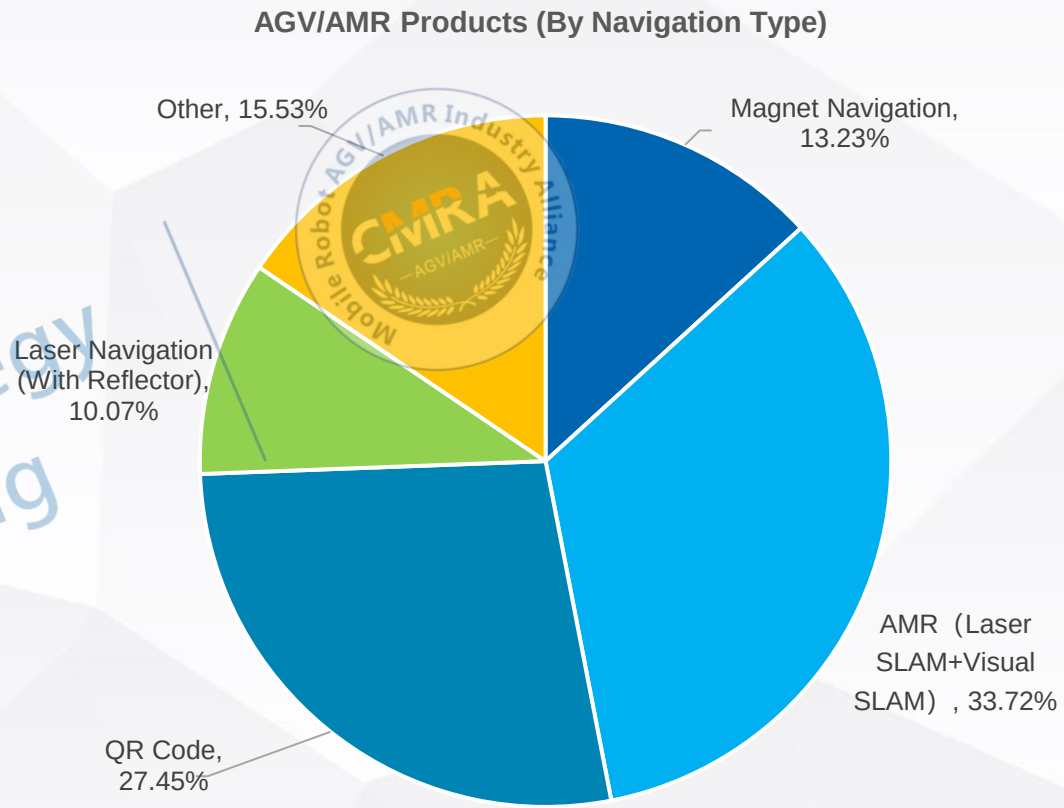
Magnetic Navigation

In certain situations, magnetic navigation can still offer practical advantages, despite its decreasing proportion.

10.07%

Laser Navigation (With Reflector)

The introduction of forklifts with natural navigation has resulted in a decrease in their usage in recent years.



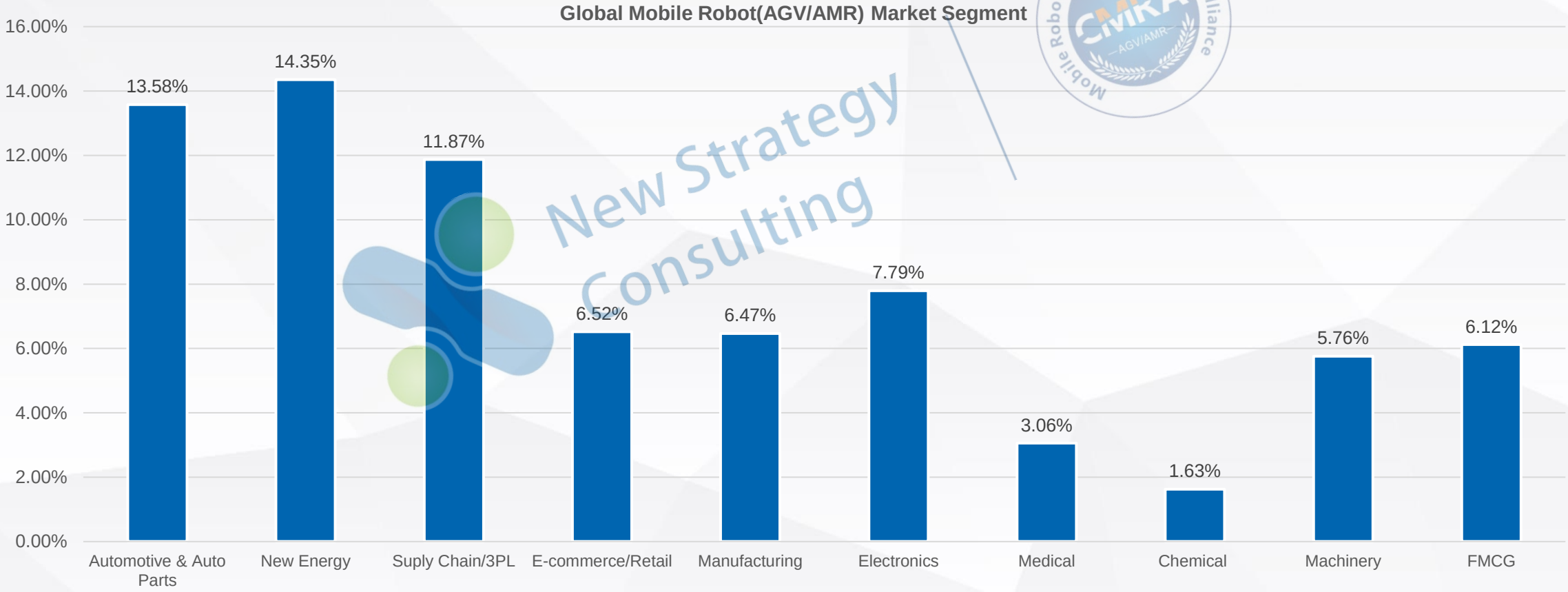
Note: Natural navigation products refer AGVs/AMRs that can realize navigation without need of hardware installation such wires, tapes, reflectors. These robots utilize SLAM technology, which can be categorized into Laser SLAM and Visual SLAM based on the sensors used.

2.5 AGV/AMR Products - By Navigation Type

Navigation Type	 Magnetic Navigation	 QR Code Navigation	 Natural Navigation (Laser SLAM + Visual SLAM)
Work Principle	A magnetic induction device measures the signal of magnetic tape on a path using RFID tags, enabling control and navigation of the vehicle.	The AGV-mounted camera scans and decodes discretely placed QR codes to obtain real-time coordinates.	A map is created by utilizing LIDAR/camera to capture the natural environment contours in the workspace. The coordinate position is established by matching it with the map. Finally, mobile robot positioning and navigation is achieved by using the SLAM algorithm.
Pros	Accurate positioning, high-reliability navigation, and low cost.	The path is easily laid and modified due to its flexibility.	No other positioning facilities are required, and the path can be set flexibly and freely.
Cons	The magnetic tapes are prone to breakage and require regular maintenance. Furthermore, if the path changes, the magnetic strips must be re-laid.	QR codes are prone to being worn out and require regular maintenance.	The price is higher compared to magnetic tape and QR code navigation.

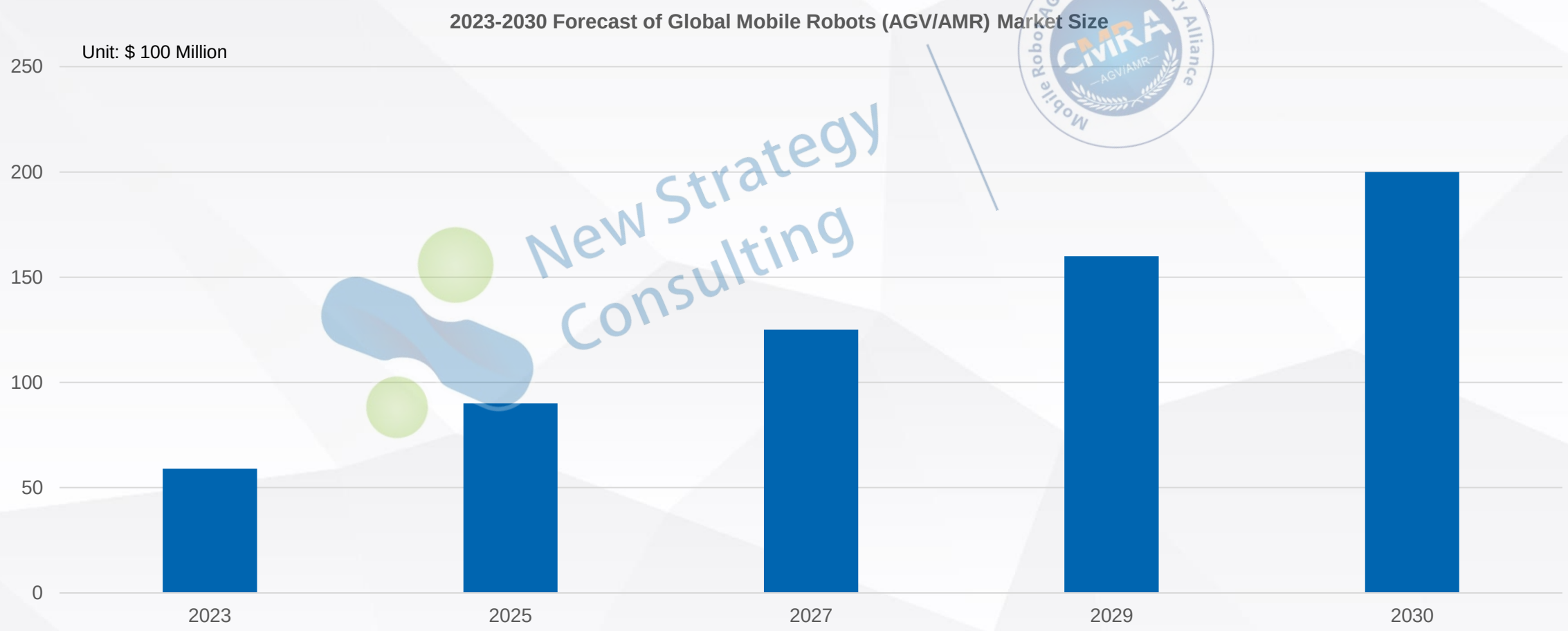
2.6 2022 Global AGV/AMR Market Segment (By End-user Industry)

- In 2022, the mobile robot (AGV/AMR) market witnessed growth in three major sectors: Automotive and Auto parts, New Energy, and Supply Chain/3PL.
- The demand for AGV/AMR applications in e-commerce/retail, manufacturing, and the electronics industry has not shown significant growth due to the global economic downturn. In fact, some industries have even experienced a decline compared to 2021.



2.7 Global AGV/AMR Market Forecast

The global economic downturn in 2023 will result in a decrease in the demand for AGVs/AMRs in various sectors, which will also affect the global mobile robots market. However, we anticipate that the market demand for AGV/AMR is far from saturated, and as the economy gradually recovers, it is predicted that the global mobile robot market size will reach USD $20 billion by 2030.



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PART THREE

Competition In The Global AGV/AMR Market

3.1 Number of AGV/AMR Enterprises in Major Countries/Regions

China

The number of AGV/AMR enterprises exceeds 220, the highest total in the world.

Europe

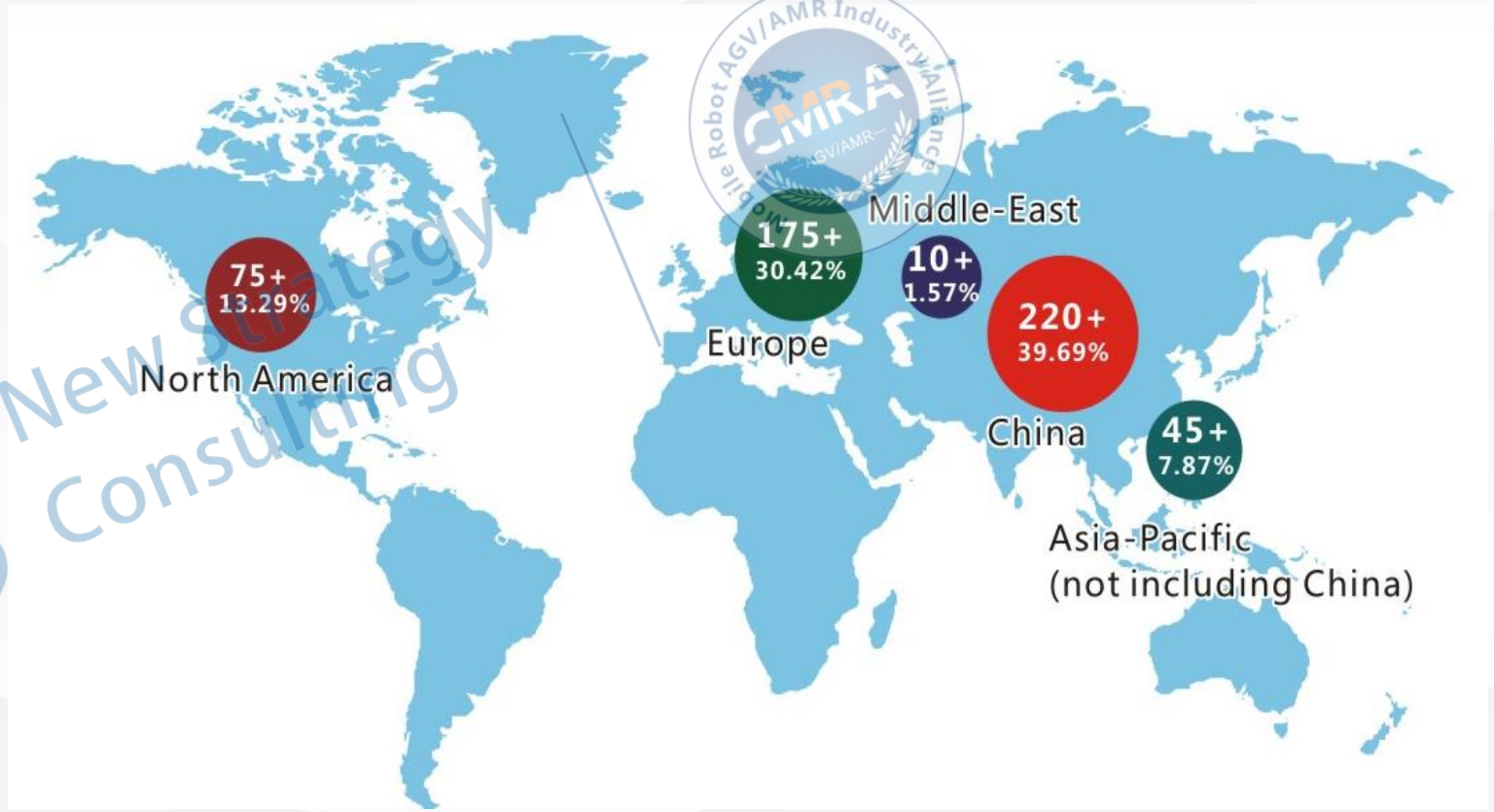
Europe has over 175 AGV/AMR enterprises, ranking as the second largest market after China.

North-America

There are over 75 AGV/AMR enterprises, mainly in the US.

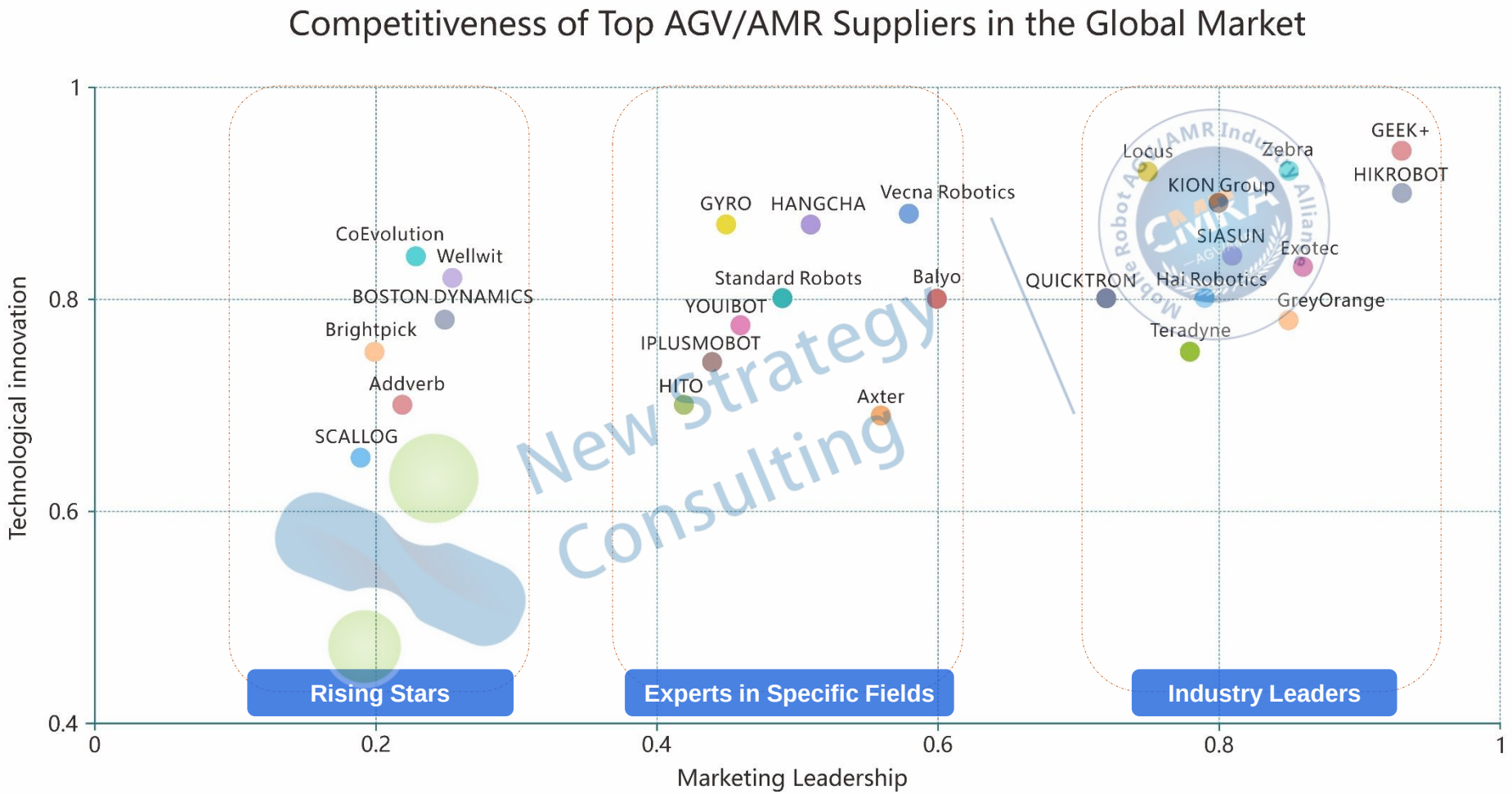
Asia-Pacific (Excluding China)

There are more than 45 AGV/AMR enterprises in the Asia Pacific (Excluding China).



3.2 Representative AGV/AMR Enterprises in Major Countries/Regions

3.3 Competitiveness of Top AGV/AMR Suppliers in the Global Market



Note: *Rising stars are newly established but have the potential for growth. Experts in Specific Fields focus on specific products or scenarios and have competitive barriers. Industry leaders, on the other hand, have established leadership in both product technology and market share.*

3.4.1 Key Movers in the Global AGV/AMR Market - Warehousing Robots

Geek+

- No. 1 in global AMR market share for 4 consecutive years.
- Holds the absolute leading position in the global warehouse logistics robot market.
- Global sales, service outlets in 40+ countries, enabling 700+ customers.
- The only company in the industry that offers a full range of logistics robot production lines and solutions.

HAI ROBOTICS

- The pioneer and leader in ACR-based goods-to-person solutions.
- Integrated service and local operations capability in more than 30 countries and regions worldwide, operating 1100+ projects.
- 1800+ patents worldwide.

Quicktron

- 1,000+ successful cases and over 25,000 machines deployed in various industries worldwide.
- The first manufacturer in Asia to deploy more than 1,000 robots in a single warehouse.
- Overseas sales have grown at a CAGR of over 300% in the last three years.

LOCUS ROBOTICS

- No. 1 global market share for "Good-to-Person" robots.
- Over 10,000 AMRs operate in more than 250 locations in the U.S., Europe, and Asia.
- Valued at over USD $2 billion.

3.4.2 Key Movers in the Global AGV/AMR Market - Warehousing Robots

TERADYNE

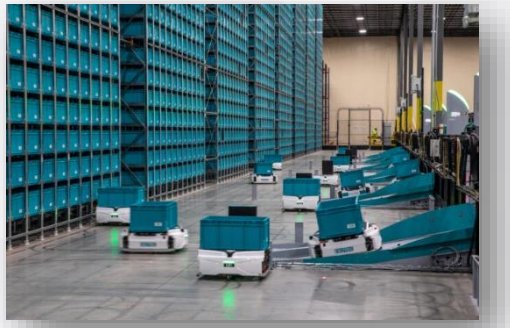
- Focusing on industrial automation, acquired MiR and AutoGuide in 2018 and 2019.
- In 2022, Teradyne planned to merge MiR and AutoGuide to offer a wider range of autonomous mobile robots capable of handling heavier loads and supporting more diverse application scenarios.

GreyOrange

- Leading market share in India.
- Partnered with a number of leading global retailers.
- Offices in India, Japan, Germany, and the US, and major R&D centers in India, the US, and Singapore.

EXOTEC

- The major product is Skypod, a three-dimensional warehouse robot.
- Over 4,000 Skypod robots have been put to practical use.
- Valued at USD $2 billion as of the latest round of funding in 2022.



CoEvolution

- Specializes in AI-powered multi-vendor robot fleet orchestration system for automated logistics.
- Core products are Smart Robot Control System (RCS), Smart Logistics Control System (WCS), and Smart Logistics Simulator (Simulator).
- 50+ successful projects for worldwide clients.

3.5.1 Key Movers in the Global AGV/AMR Market – Production Line

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SIASUN

- One of the pioneers in China engaged in the R&D of mobile robots, as well as commercial applications.
- Holds a prominent position in the high-end market globally and was the first to export Chinese robots internationally.
- Advanced technology meets global standards and has attracted clients worldwide.

HIKROBOT

- Two product lines - "AMR" and "Machine Vision", generated a revenue of RMB 3.916 billion in 2022.
- As of the end of 2022, our company has surpassed 1,500 customers and shipped over 35,000 units of AMR products globally.

HITO ROBOTIC SYSTEM

- AI technology of Industry-pioneered distributed algorithm and Multi-robot collaboration system combined with Industrial scenario to provide one-stop services for Intelligent factories.
- Heavy-load mobile robots (Maximum 120T) aim to Industry cases with high accuracy. The interface with standardized system enable to and fit vary flexible production mode.

GYRO SYSTEMS, INC.

- Provides intelligent manufacturing solutions for unmanned semiconductor factories.
- The compound robots hold the dominant market share in the semiconductor industry and have successfully deployed in 30+ semiconductor factories worldwide.

3.5.2 Key Movers in the Global AGV/AMR Market - Production Line

KION GROUP

- With brands such as STILL, Linde Material Handling and Dematic, the KION Group is the largest manufacturer of forklift trucks in Europe.
- Created a "Mobile Automation Center of Excellence (COE)“ in 2017 which combined the Dematic, Egemin Automation, and NDC’s AGV products.

STANDARD ROBOTS

- Specializing in intelligent manufacturing and production line logistics automation, with its AMRs running for over 20 million hours in manufacturing.
- With global sales of over 6,000 AMRs, worth over CNY 300 Million in 2022, and a five-year CAGR of over 100% from 2018-2022.

HANGCHA

- Specializes in total logistics solutions, with forklift AGV and stereo warehouse stacker as major products.
- With 8 branches, over 220 dealers, and service outlets in 180+ countries/regions.
- A leading manufacturer of forklift AGVs in China with the largest R&D and manufacturing base.

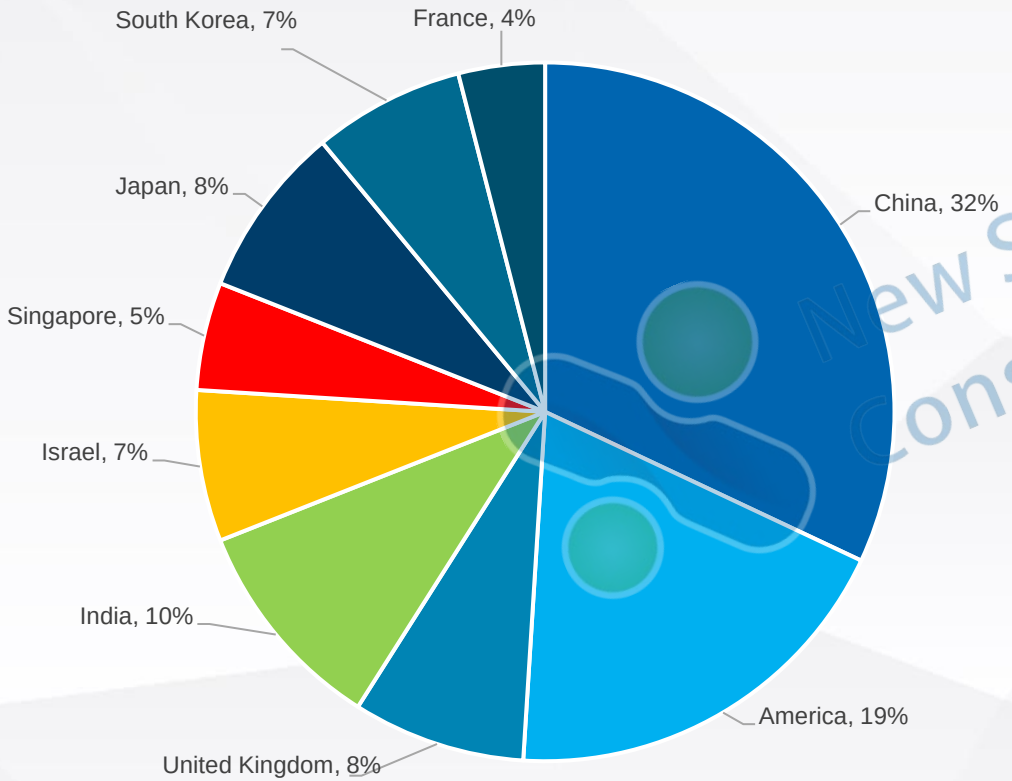
井智机器人 Wellwit Robotics

- Specialize in ODM/OEM services and has strong ability to customize non-standard AGVs.
- Allows global system integrator customers to benefit from the same hardware costs as Chinese AGV enterprises by utilizing the supply chain advantage in China.

3.6 Investments in AGV/AMR in Major Countries

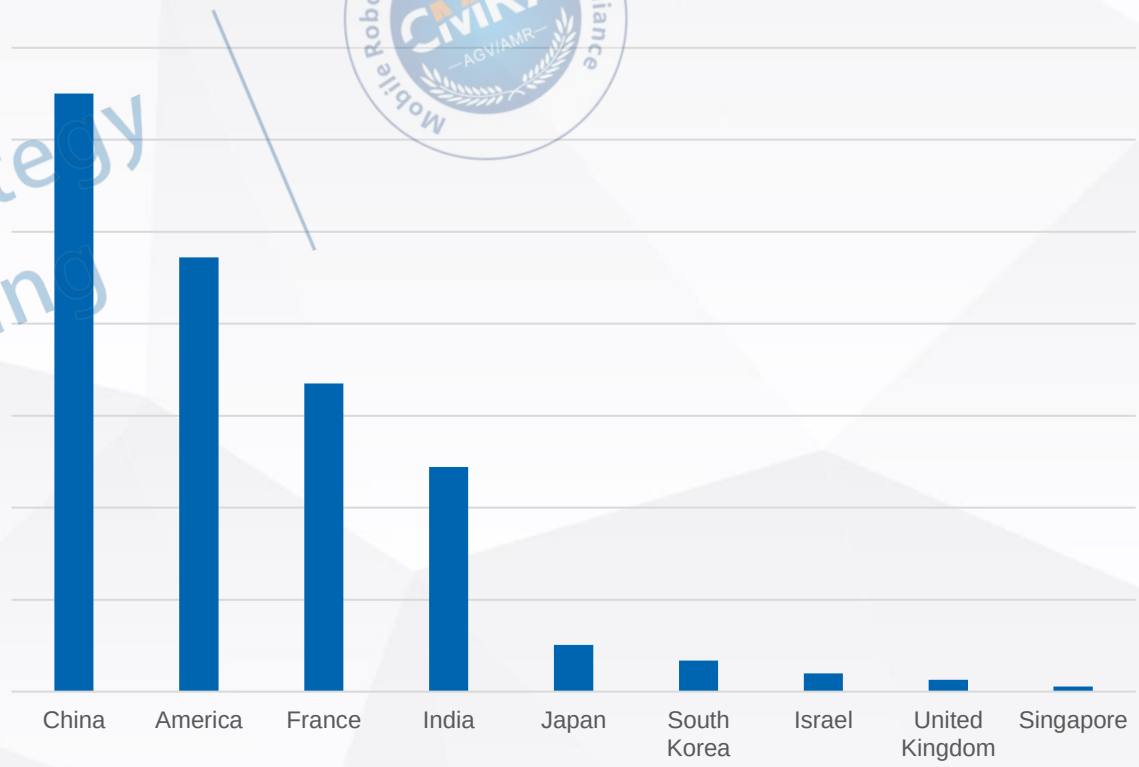
In 2022, Chinese AGV/AMR companies have secured the highest amount of financing, with U.S. companies coming in a close second. However, companies in Europe and other regions have received relatively less funding.

By Total Number of Investments



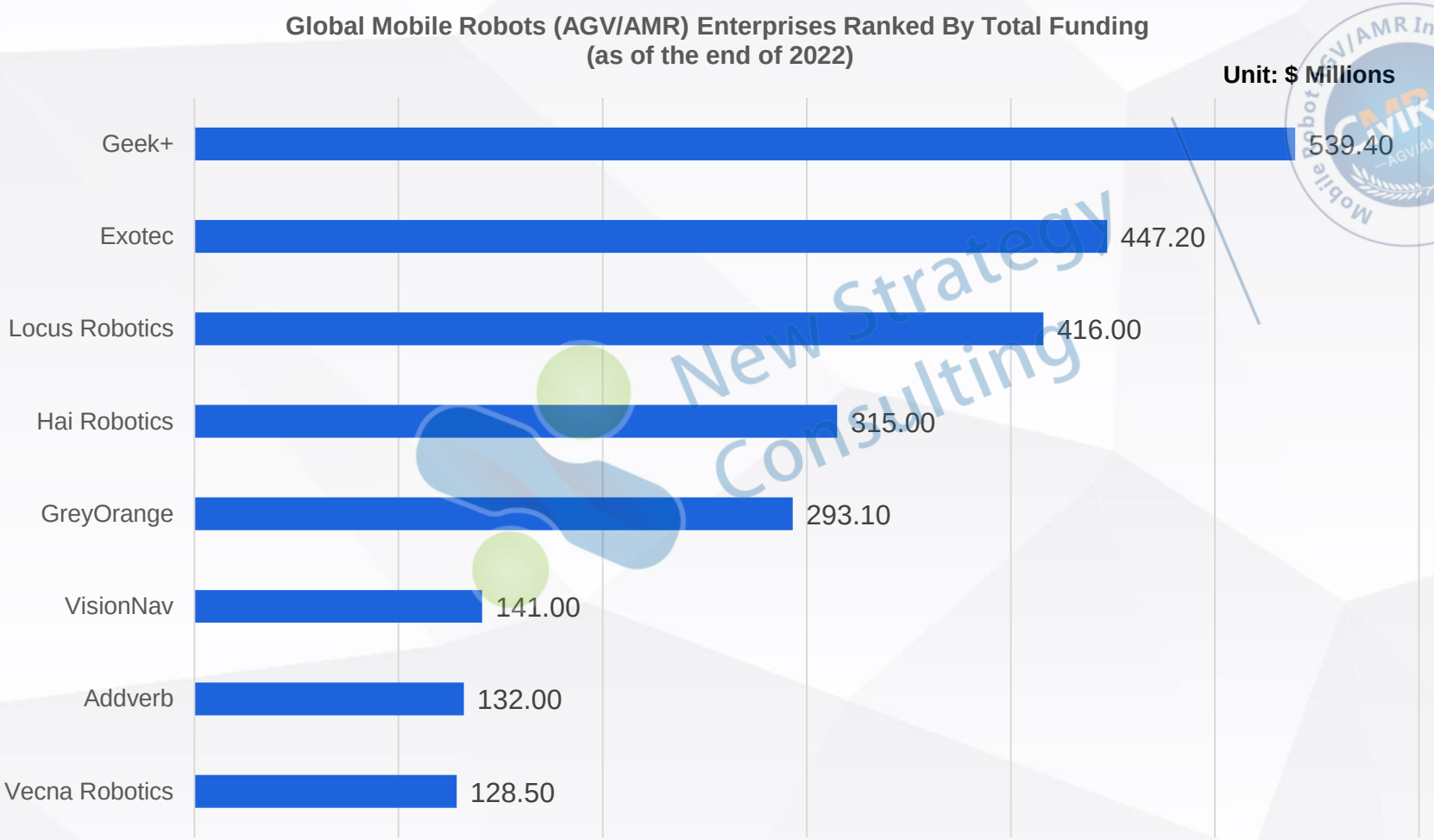
By Total Investments Amount

Unit: Million $



3.7 Global AGV/AMR Enterprises Ranked By Total Funding

Capital plays an important role in driving the development of industries. Enterprises can be far ahead of others in terms of product iteration and market expansion with the support of strong capital.



Geek+

Geek+ attracted the greatest investment amount by end of 2022.

In August 2022, it completed a round of E1 financing of $100 million, with a valuation of over $2 billion.

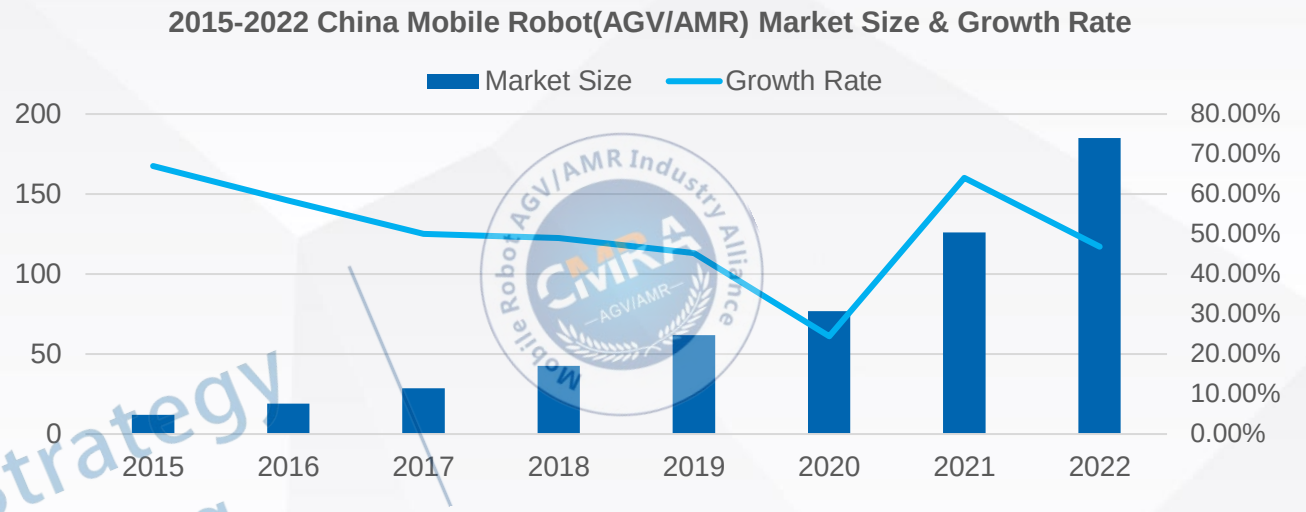
4

PART FOUR

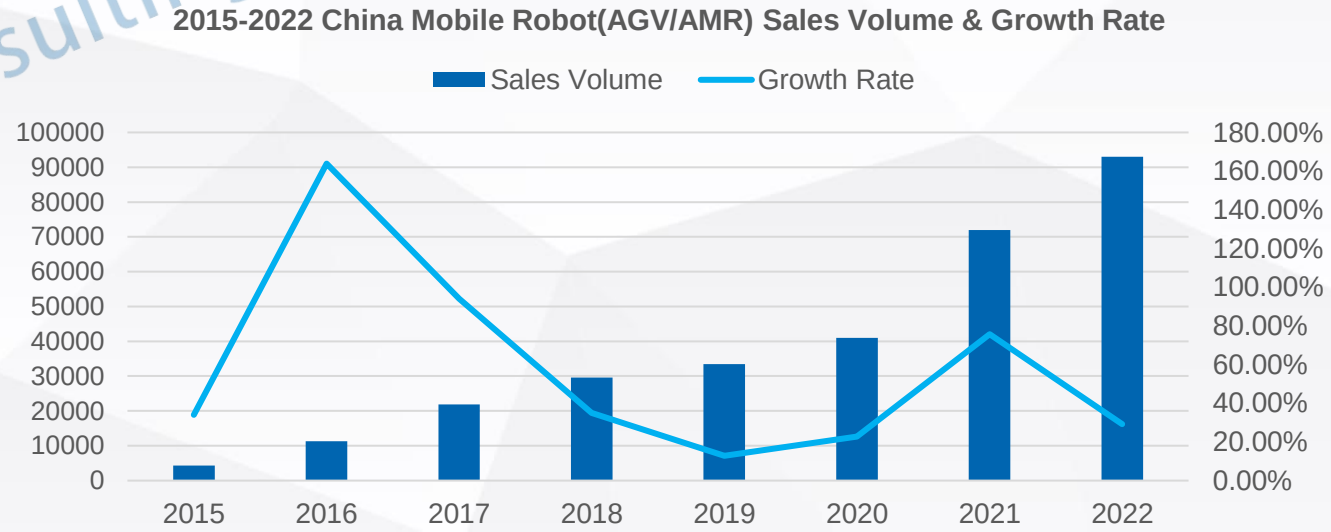
Competitiveness of Chinese AGV/AMR Enterprises in the Global Market

4.1 Overview of the Chinese AGV/AMR Market

- In 2022, Chinese market saw a significant increase in the overall sales of mobile robots (AGV/AMR). The number of AGVs/AMRs sold reached 93,000, which is a 29.17% increase from the previous year. Market sales also reached RMB 18.5 billion, indicating a YoY increase of 46.83%.

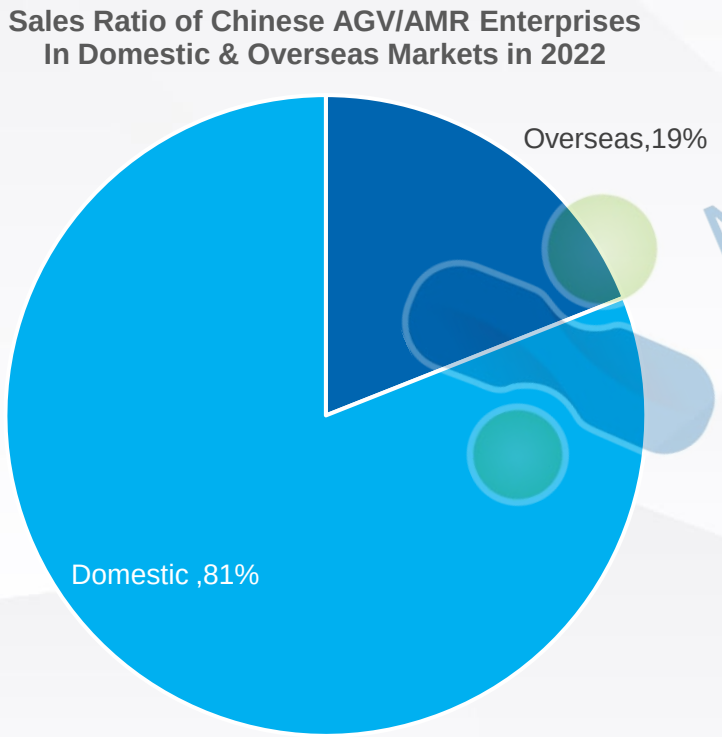


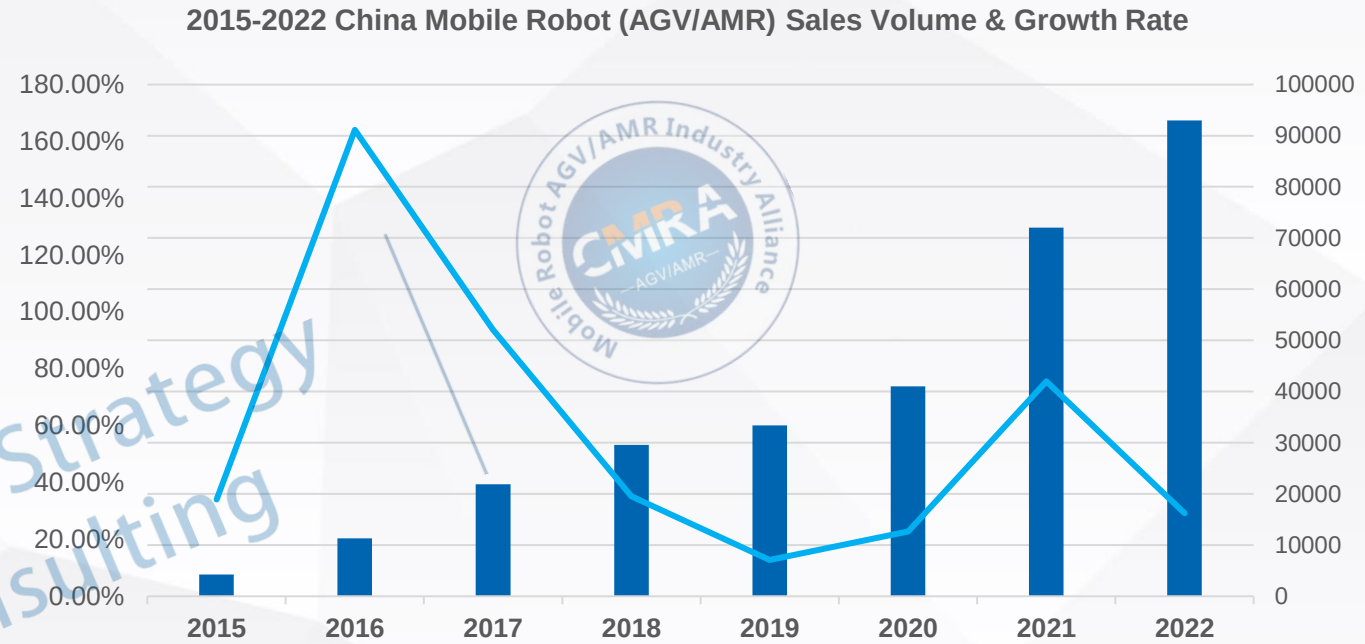
- Mobile robots (AGV/AMR) in the Chinese market have shown significant growth from 2015 to 2022, with a CAGR of 47.81%. Despite the challenges posed by epidemics and the turbulent international situation, the AGV/AMR market growth rate remained high at 46.82% in 2022.



4.2 Analysis of Exports of Chinese AGV/AMR

In 2022, Chinese AGV/AMR enterprises are projected to experience a year-on-year increase of 44% in overseas sales, reaching a total of RMB 3.6 billion.





Since 2019, Chinese AGV/AMR enterprises' sales in the overseas market have increased significantly, from RMB 1 billion to RMB 3.6 billion in 2022. Chinese enterprises are expanding their presence in the global market, as indicated by their increasing sales ratio. The impact of Chinese products on the worldwide market is steadily growing.

4.3 Ranking of Chinese AGV/AMR Enterprises' Global Sales

In 2022, Chinese AGV/AMR enterprises accelerated their plans to go overseas. In 2022, due to the epidemic in China, it was challenging to implement certain projects, so some enterprises have shifted their focus to overseas markets. Additionally, the rapid growth of e-commerce worldwide has led to a surge in demand for warehousing robots, creating many opportunities that have attracted more players to enter the market.

Enterprises such as **GEEK+**, **Hai Robotics**, **SIASUN**, **QUICKTRON**, **HITO**, **Multiway**, **VisionNav, Syrius,** and **GUOZI** have been expanding their business overseas and have made significant strides in improving their market presence globally.

2022 Overseas Sales Ranking of Chinese AGV/AMR Enterprises

Rank	Enterprise	Rank	Enterprise
1	GEEK+	9	GUOZI
2	Hai Robotics	10	YOUIBOT
3	SIASUN	11	GYRO
4	QUICKTRON	12	Standard Robots
5	HITO	13	Multiway
6	HIKROBOT	14	Wellwit Robotics
7	VisionNav	15	HANGCHA
8	Syrius		

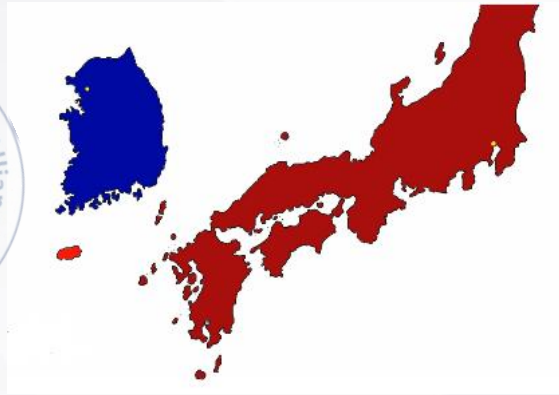
4.4 Target Markets for Chinese AGV/AMR Enterprises

Europe

Europe, where AGV originated, has a rich history in traditional industrial applications like automotive. With the advent of e-commerce and automation technology, there has been a surge in the development of warehousing automation, which led to a high demand for warehousing AGVs.

Southeast Asia

Southeast Asia's manufacturing industry relies heavily on manpower as it's still in the early stages of industrial upgrading. The market potential for AGV/AMR products is huge due to flexible certification requirements and high acceptance, resulting in a great demand for AGVs/AMRs.



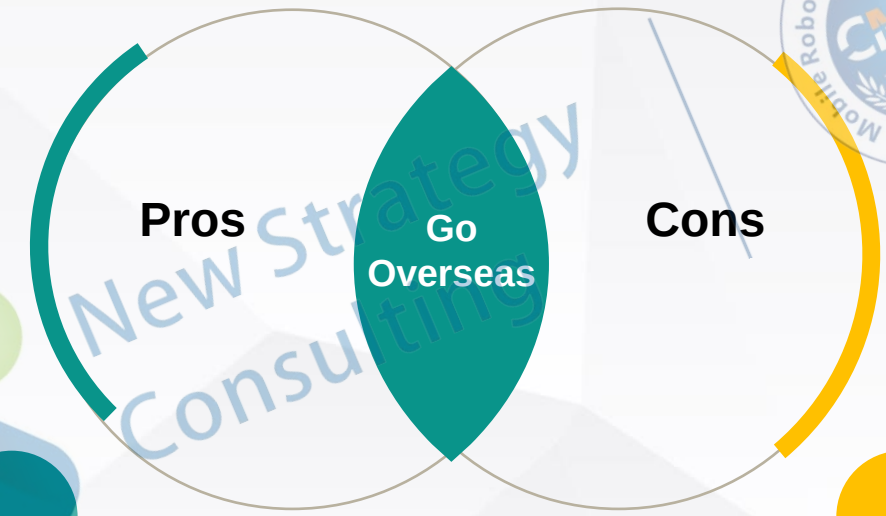
North-America

The growth of e-commerce is fueling the demand for warehouse robots. The market for warehouse automation in North America is expected to grow at a CAGR of 9.6% from 2022-2027.

Japan & South Korea

The industry is well-developed and local robotics enterprises lack competitiveness. Japanese companies focus on traditional AGV, leading to decreased competitiveness in the high-end AGV market. The Korean AGV market is largely dominated by Chinese companies with a 70% market share.

4.5 The Pros and Cons of Going Overseas



Costs

Chinese mobile robots are competitively priced due to the cost-effective labor and manufacturing benefits available in the Chinese market.

Technological Innovation

Diversified application needs are driving Chinese AGV/AMR enterprises to further accelerate technological innovation and product iteration.

Rich Experience

As the "World's Factory" and the biggest consumer, together with the experience of e-commerce shopping festivals such as 11.11 and 6.18, Chinese AGV/AMR enterprises have accumulated rich experience in various settings in different industries.

Distribution Channels

Setting up effective overseas distribution channels can be a long and challenging process and it will be hard at the initial stage.

Brand Image

Establishing brand recognition among global customers may take time due to the limited exposure of Chinese brands.

Localization

Small businesses may have difficulty creating a localization team due to the resources needed, so they may have to rely on agents and integrators who may not offer sufficient localization services.

PART FIVE

Global AGV/AMR Supply Chain

5

5.1 AGV/AMR Supply Chain Demographics

New Strategy Consulting

Supply Chain	Key Players
Sensors	ifm, SICK Sensor Intelligence., PEPPERL+FUCHS, HOKUYO, Leuze, INUCHIP, MINSON, OUSTER, VANJEE TECHNOLOGY, KELI, Velodyne Lidar, Parker, IST Innovative Sensor Technology, onsemi
Navigation & Controllers	KOLLMORGEN A REGAL REXNORD BRAND, BLUEBOTICS Mobile Robots at Your Service, SIEMENS, BECKHOFF, KC, Schneider Electric, SEER, Panasonic
Servo Drives	Kinco, Elmo Motion Control, metalrota, YASKAWA, ADVANCED MOTION CONTROLS, ZAPI GROUP, ZD, MITSUBISHI ELECTRIC, SIEMENS, rexroth A Bosch Company, Schneider Electric, Nabtesco, Sumitomo Drive Technologies, HCD, SEW EURODRIVE
Charging Devices & Batteries	HAWKER POWER GROUP LTD, LG, Panasonic, STÄUBLI, AVAHLE, CATL, BYD, KINGOR
Scheduling Software & Systems	KOLLMORGEN A REGAL REXNORD BRAND, rexroth A Bosch Company, CoEvolution, SEER

5.2 The Status of the AGV/AMR Supply Chain - Sensors

For mobile robots to achieve navigation and obstacle avoidance, they must rely on acquiring sensing the external environment and acquiring information. Currently, the main navigation and obstacle avoidance sensors applied to mobile robots are laser, visual, infrared, inertial guidance, etc.

Sensors

LIDAR

LIDAR technology is primarily utilized for AGV/AMR navigation and obstacle avoidance, with a focus on mechanical and single-line applications. German brands dominate the high-end LIDAR navigation market.

Infrared Sensors:

Infrared sensors are used for high-sensitivity data processing, mainly for obstacle avoidance in AGV/AMR.

Inertial Sensors:

Including accelerometers (or accelerometer sensors) and angular velocity sensors (gyroscopes), as well as their single, double, and triple-axis combinations of IMUs (inertial measurement units). Mainly used for aiding navigation.

Visual Sensors:

Image Credits: ifm 3D TOF camera

Visual sensors are widely used for navigation, obstacle avoidance, and pallet identification. The main application is Time-of-Flight (TOF), with the German manufacturer **ifm** being one of the main suppliers.

5.3 The Status of the AGV/AMR Supply Chain - Controllers

The mobile robot in-vehicle control system refers to the software and related devices used to control the movement and operation functions of mobile robots. The controller is the core of the entire control system.

A cost-effective option for developing peripheral circuits, utilizing ARM, X86, and other chips or motherboards. However, the development process can be challenging.

Integrated advanced navigation and motion control algorithms, such as laser positioning and Mecanum wheel control, to enhance stability and safety for optimal performance.

PLC | **Single-chip Microcontroller** | **IPC** | **Specialized Controllers**

High stability and reliability, easy to develop, but its limited openness makes it challenging to expand software functions and hardware modules.

Compact structure, good stability, small size. It can run general operating systems, such as Windows and Linux.

5.4 The Status of the AGV/AMR Supply Chain - Servo Drives

The hardware components of an AGV/AMR motion control system include a motion controller, servo drive, reducer, and DC motor. The motion controller is responsible for receiving task instructions, converting them into the required speed for each motor, and then sending the instructions to the driver for motor control, ultimately controlling the movement of the AGV/AMR body.

- **Drives:**

AGV/AMR vehicles are typically powered by a battery with a voltage range of 12V to 72V. Therefore, low-voltage DC-type servo drives are commonly used.

- **Reducers:**

AGVs require reducers that can handle large radial loads and have a short length, while also maintaining high precision. Currently, the market offers two main types of reducers for AGVs: AGV-specific cycloid gear reducers and AGV-specific precision planetary reducers.

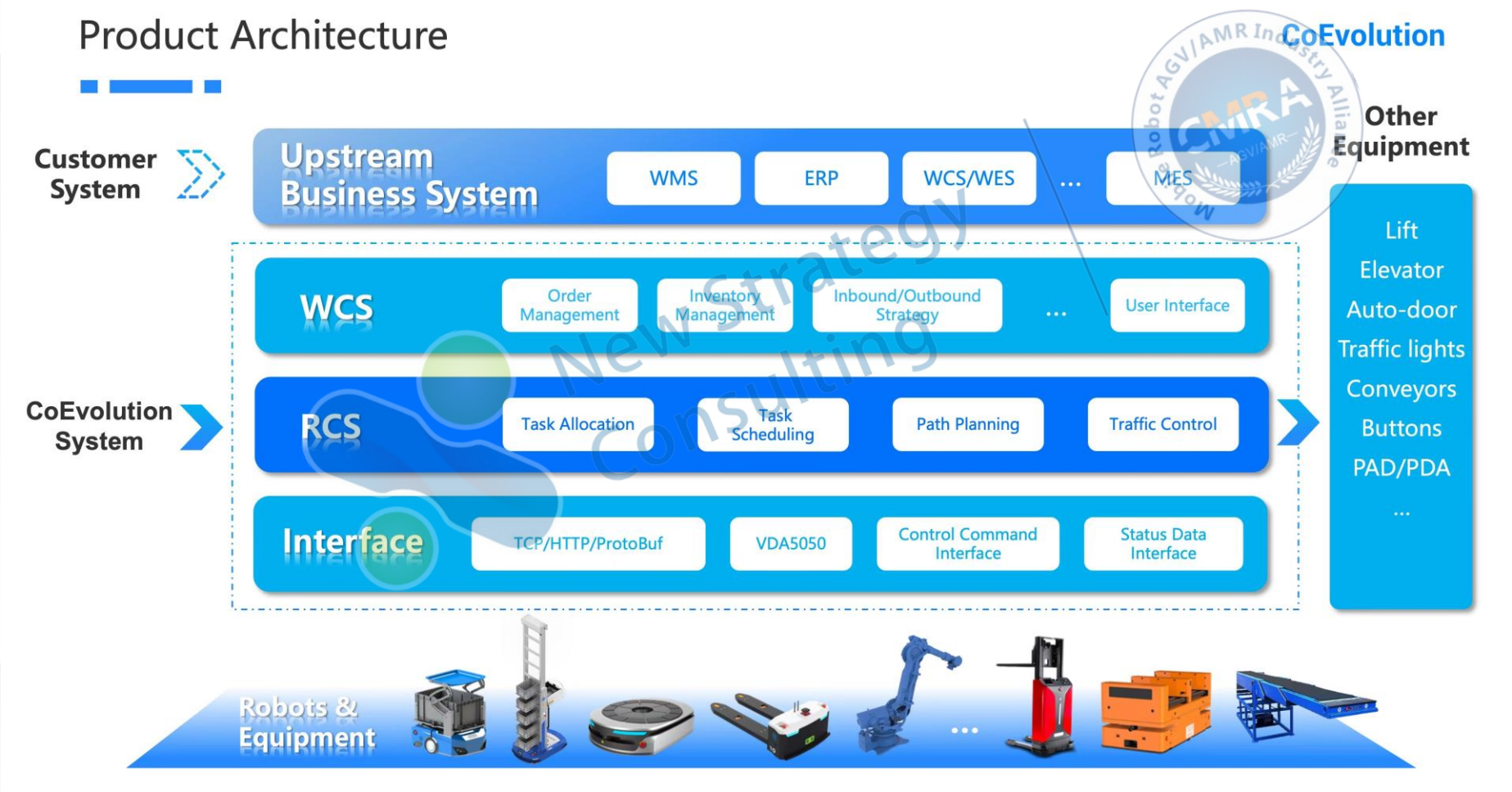
- **Motors:**

The motors most commonly used in AGV/AMR are brushless DC motors with stable torque output and large starting torque. These motors are suitable for applications with high torque requirements.

iWMC Integrated Servo Motor
Image Credits: Kinco

5.5 The Status of the AGV/AMR Supply Chain - Scheduling Software

Automated Guided Vehicle (AGV) scheduling software is a tool that enables the efficient management and control of AGVs. This system is designed to optimize AGV path planning, task allocation, resource scheduling, and other related functions.



Product Architecture
Image Credits: CoEvolution

PART SIX

6

Global AGV/AMR Market Segments

6.1 Global AGV/AMR Market Segments (By End-User Industry)

The market segmentation characteristics of AGV/AMR are clear: new modalities and demand are driving market expansion. Many enterprises are focused on deep segmentation in order to achieve their future development goals.

AGV/AMR Market Segments

- **Manufacturing**
  - Automotive & Auto Parts
  - New Energy
  - Electronics(3C,Semiconductor…)
  - Machinery/Construction
  - ……
- **Warehousing & Logistics**
  - 3PL/Supply Chain
  - E-commerce/Retail
  - Shoes & Apparel
  - ……
- **Special Sectors**
  - Military
  - ……

AGV/AMR technical requirements may vary in order to meet the diverse needs of various applications. It is important to have adaptable solutions for different scenarios. Below are some classic cases of AGV/AMR in major warehousing, logistics, and industrial manufacturing scenarios.

Warehousing & Logistics – 3PL

AGV/AMR Applications in Different Sessions of 3PL Warehouse

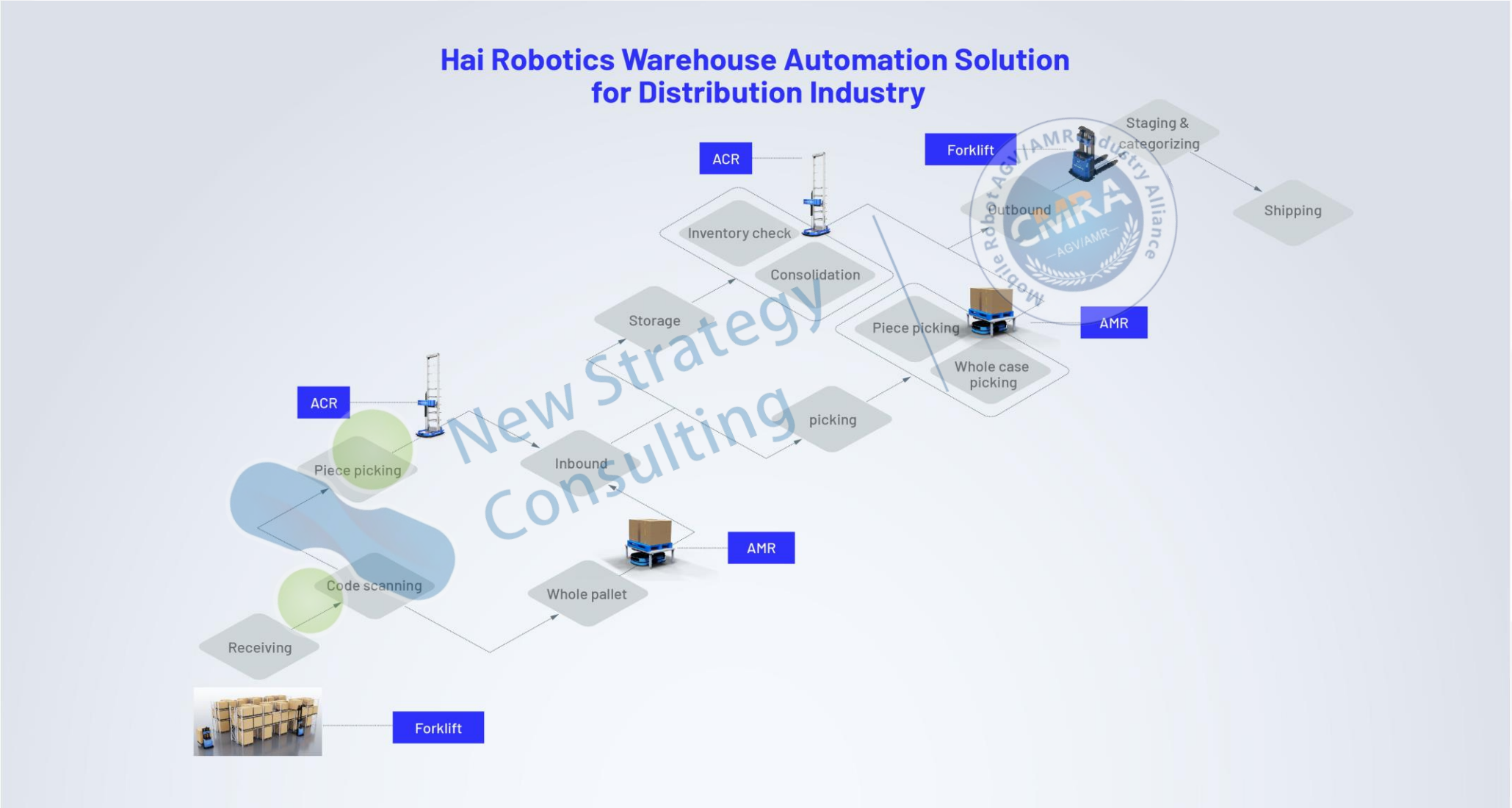


Image Credits : HAIROBOTICS

Warehousing & Logistics - Shoes & Apparel

New Strategy Consulting

AGV/AMR Applications in Shoes & Apparel

Image Credits：GEEK+

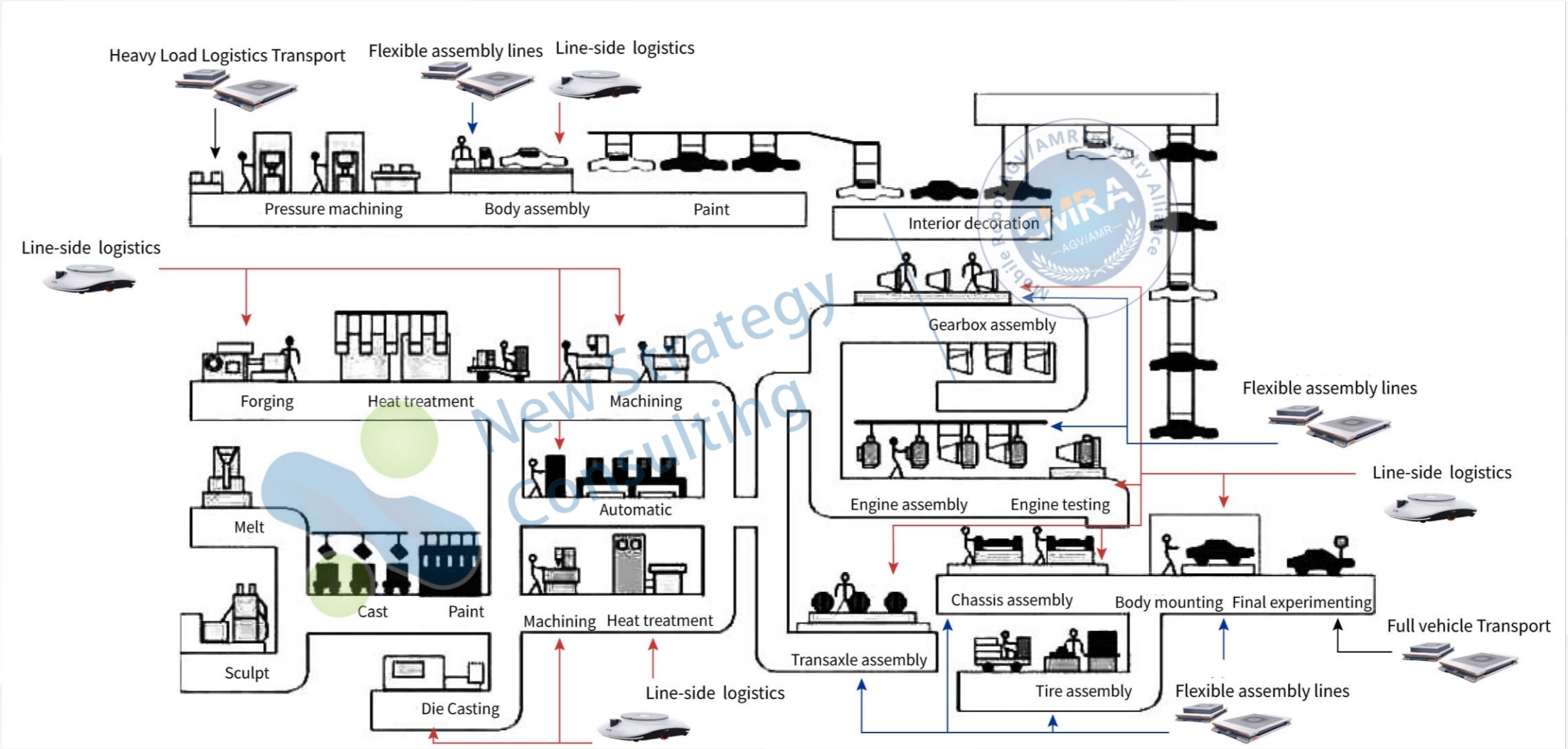
Warehousing & Logistics – E-Commerce

AGV/AMR Applications in E-Commerce

Image Credits：GEEK+

Industrial Manufacturing - Automotive

AGV/AMR Applications in the Automotive Industry



The product is from HITO

Industrial Manufacturing - New Energy (Lithium Battery)

AGV/AMR Application in Li-ion Module PACK Production Line

Image Credits: SIASUN

Industrial Manufacturing - Electronics

AGV/AMR Applications in the Electronics Industry

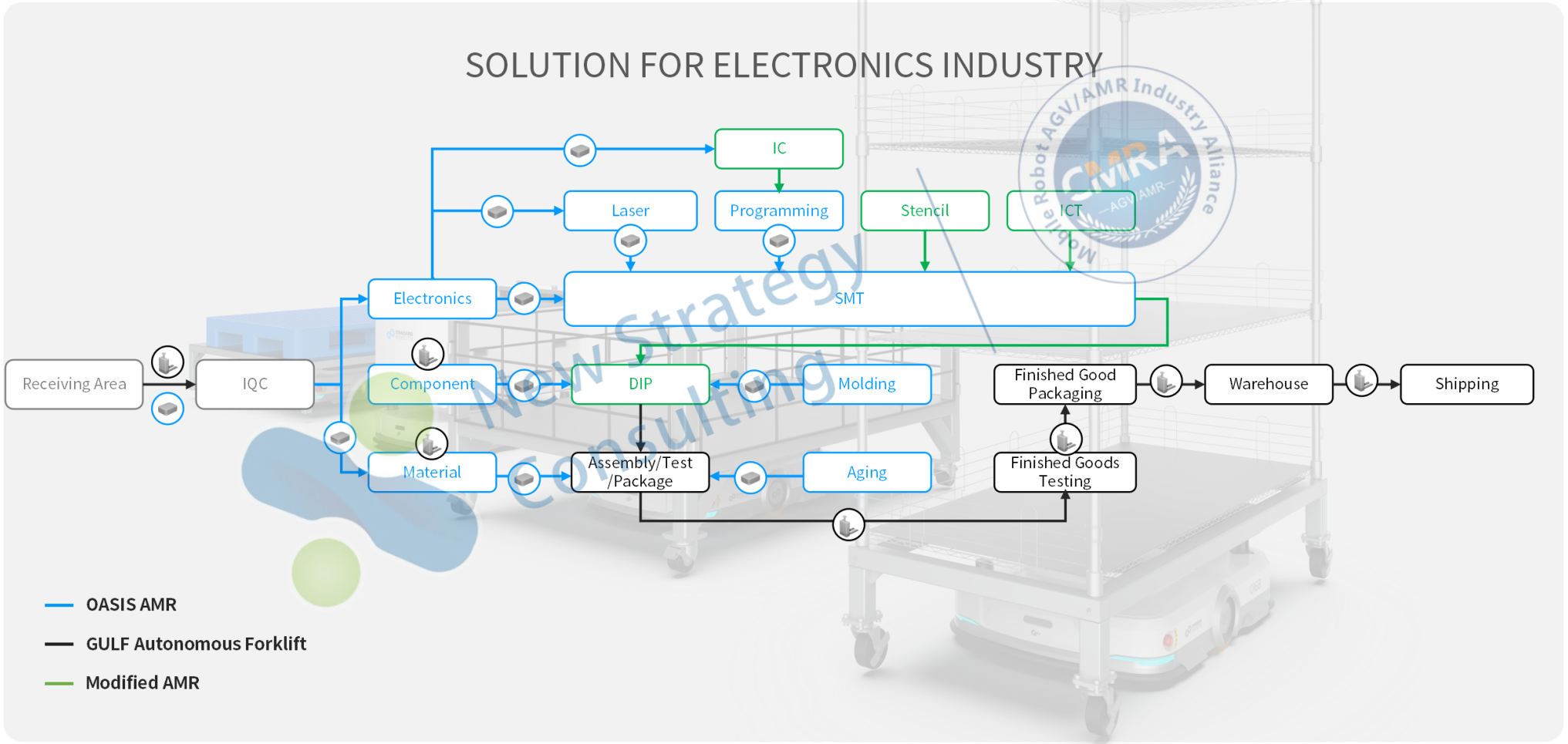


Image Credits: Standard Robots

Case Study - AGV/AMR Applications in Different Scenarios

Anta's ACR Smart Warehouse

Hai Robotics built ACR smart warehouse for Anta. It caters to both B2B and B2C businesses, ensuring efficient storage, retrieval, replenishment, and order fulfillment.

UK Retail Giant NEXT

Geek+ hybrid "Pick-and-Sort" solution streamlines order processing for UK retail giant NEXT. Over 250 of two types of Geek+ robots have been integrated together.

3PL Cubyn

Cubyn's French warehouse introduced Quicktron's QuickBin solution, creating the first unmanned and automated e-commerce storage site in France.

CEVA

CEVA Logistics, Geek+ implement goods-to-person solutions at Grobbendonk distribution site in Belgium

Case Study - AGV/AMR Applications in Different Scenarios

Lotte

Lotte introduces the CoEvolution CO-PICK solution to accelerate its logistics operations in the warehouse, to provide highly efficient goods delivery for its 417 stores.

Power Battery Plant

SIASUN developed an AGV loading structure suitable for palletizing based on the shape of the pole coil and the form of docking equipment, ensuring stable operation and meets the demands of fast-paced production.

Drinking Water Plant

HANGCHA uses AGV's 24-hour operation capabilities to reduce manual work and enable less manned and unmanned operations in densely stacked warehouses.

Lens Manufacturing Factory

CoEvolution made a tailored AGV/AMR handling solution for a lens manufacturing plant, which has improved the efficiency of the factory's production flow by up to 50%.

Case Study - AGV/AMR Applications in Different Scenarios

Philips's Plant in Zhuhai

Hai Robotics automated Philip's factory with 36 sets of ACR and 30 sets of AMR equipment, covering warehousing, logistics, batching, supply line, and finished product transportation.

Rubber Tire Factory

China's largest rubber tire company has replaced manual forklifts with automated ones from HANGCHA, minimizing manpower requirements and increasing efficiency.

Semiconductor Factory

The semiconductor manufacturer employs 20 GYRO's AMR handling robots to efficiently serve a large number of production machines.

TOYOTA Factory

A hybrid solution containing Standard Robot's autonomous tugger and AMRs was introduced into TOYOTA for diversified materials and goods transport, handling, and delivery.

Case Study - AGV/AMR Applications in Different Scenarios

Electronics Factory

Standard Robots assisted in OPPO 5G factory construction, where around 50 AMRs were applied for both warehouse and manufacturing logistics automation.

Semiconductor Packaging & Test Fabs

The introduction of the Gyrobot series AGVs led to a significant increase in activation by 25% and a monthly production capacity increase from 45K to 75K.

BMW Factory

HITO Robotics has successfully built a flexible engine transfer line equipped with 18 AGVs for BMW's Shenyang plant.

SAIC Hongyan Factory

HITO Robotics has developed a new engine production line that utilizes 28 AGVs to enable flexible and efficient engine manufacturing.

PART SEVEN

Global AGV/AMR Market Trends

7

7.1 Technology Status

From AGV to AMR

AMR can be both a "vehicle" and a "robot": Currently, there is a greater focus on research related to "robots" compared to "vehicles".

Gets involved in the entire process

Navigation has evolved from simple traffic management to sophisticated intelligent group control. A variety of specific applications have been developed, integrated with processes and technologies, and involved in the entire process.

Navigation Technology

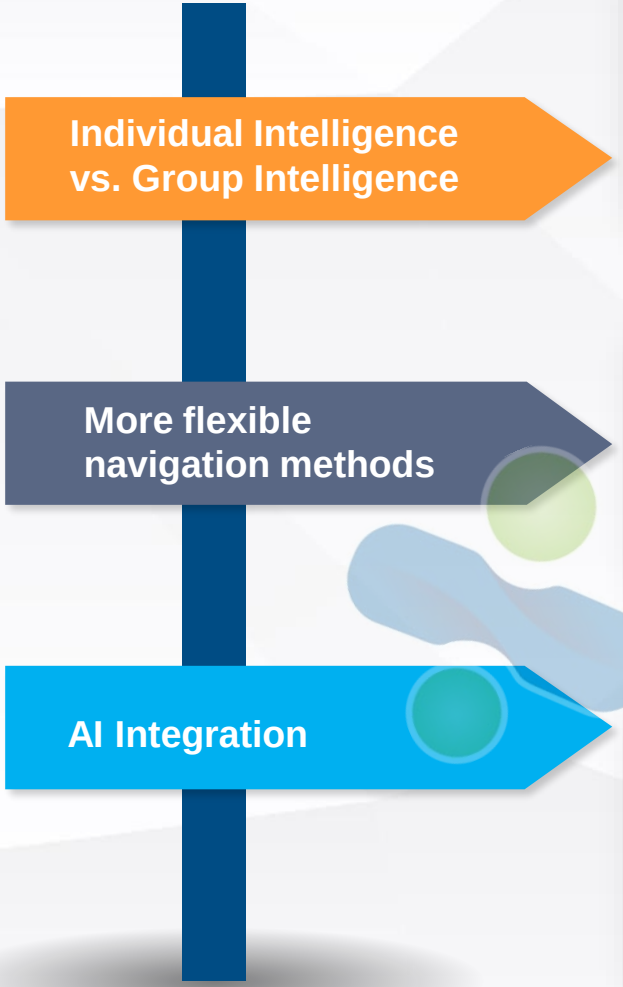
The widespread use of natural navigation technology has significantly broadened the scope of mobile robots. Navigation technology advancements have led to various solutions, including sensor data fusion as a promising approach to addressing navigation challenges.

Lightweight unmanned forklifts
Image Credits：HANGCHA

Some products have become standardized

While most mobile robots are still custom-made and non-standard, there are now some standardized products available. Latent jacking robots like those from KIVA, and lightweight unmanned forklifts are becoming increasingly standardized.

7.2 Technological Trends



Individual Intelligence vs. Group Intelligence

The intelligence of individual robots is known as individual intelligence, whereas group intelligence refers to the overall system's intelligence, which is its ability to efficiently schedule cluster operations to achieve optimal results.

More flexible navigation methods

In order to enhance navigation capabilities, mobile robots will focus on full life-cycle SLAM, dynamic target filtering, multi-sensor fusion, and semantic segmentation and recognition. Additionally, 3D navigation applications will continue to grow in the future.

AI Integration

The usage of AI in mobile robotics applications will experience a swift expansion, and the integration of AI technology will create numerous opportunities. AI technology will continue to empower mobile robotics in areas such as navigation, positioning, perception, safety, and scheduling management.

7.3 Market Trends of AGV/AMR Applications

01 Standardization

Industries can create new application models and standardized products for users by understanding their requirements, and technology platforms can achieve higher levels of standardization.

02 Specialized and Sophisticated

The mobile robot industry is becoming more specialized and sophisticated. Companies like GYRO, HITO, HANGCHA, and Standard Robots tend to focus on specific products or segments, and strive to develop and maintain their competitive edge. And the division of the industry chain is becoming more defined. Professional OEM manufacturers like Wellwit Robotics have emerged, alongside the emergence of dedicated after-sales teams.

03 Mobile Robots +

Mobile robots are becoming more versatile and will be used in a broader range of industries and processes, moving beyond logistics and handling to be integrated into production.

Mobile robots are crucial for system integration and their development is a top priority. Some mobile robot manufacturers are shifting towards being system integrators as well.

04 Exploring More Business Models

RaaS (Robots-as-a-service): RaaS was proposed by GEEK+, combining robotics hardware, system software, and AI algorithms to provide integrated operational services.

Rental: Manufacturers of AGVs/AMRs can provide rental services directly to users or through third-party organizations.

PART EIGHT

Forecasts

8

8.1 Forecasts

- Despite the economic downturn, the mobile robotics industry is expected to maintain growth resilience. While the growth rate may slow, more than 90% of mobile robotics enterprises remain confident in the industry's development.

- Mobile robots have a wide range of applications, from warehouse logistics to manufacturing. However, in most industrial settings, they are only used for simple handling tasks and their potential for more complex applications has not yet been fully realized. Mobile robots are expected to become more prevalent in the future, with a focus on deeper integration into various industries. They will be utilized not only for logistics and handling, but will also be incorporated into production processes.

- The market for natural navigation products with greater flexibility is expected to grow faster. However, traditional magnetic navigation products will still have their place in the market, as they are better suited for certain applications.

- Asia-Pacific, North America, and Europe will remain major markets for AGVs/AMRs, but with the development of technology, decreasing product costs, and upgrades in manufacturing and warehousing in other regions, AGV/AMR will further expand use worldwide.

- The competition in the field is primarily between Chinese enterprises and those from Europe and America. The technology gap between them is relatively small, but Chinese enterprises have been leading the world in terms of application and are expected to continue to drive the development of global AGV/AMR in the future.

Special Thanks

To truly represent the global mobile robot market situation, we conducted extensive research on upstream and downstream enterprises related to the sector. We would like to express our gratitude to the following enterprises for their contribution to data, charts, and other information in this report:

Geek+ | HAI ROBOTICS | SIASUN | GYRO SYSTEMS, INC. | Quicktron | HITO ROBOTIC SYSTEM

HANGCHA | 井智机器人 Wellwit Robotics | STANDARD ROBOTS | 沃美诺 WO MEI NUO | ifm | CoEvolution

SGS | DHL EXPRESS | BLOGIS 宝湾物流 | 一汽一大众 | BERKSHIRE GREY | 深粮控股 SZCH

FORVIA faurecia | VECNA ROBOTICS | Scallog SCALABLE LOGISTICS | Boston Dynamics | AGILOX | SEEGRID

EXOTEC | BALYO | AXTER AUTOMATION

WHEN YOU NEED TO BE SURE

SGS AGV/AMR VALUE CHAIN TESTING AND CERTIFICATE ONE-STOP SOLUTION

FOR AGV/AMR MANUFACTURER AND SYSTEM INTEGRATOR GLOBAL MARKET ACCESS

- EU Market
  - CE Machinery (ISO 3691-4, EN 1175, ISO 11161, ISO 12100)
  - CE EMC (EN 12895, EN 61000 series)
  - CE RED (EN 300, 301 series)
- NA Market
  - ANSI/CAN/UL 3100
  - ANSI/CAN/UL 583
- Functional Safety
  - ISO 13849 Performance Level (PL a~e)
- SEMI Safety Guidelines
  - SEMI S2, SEMI S8, SEMI S17
- International Type Approval
- Standard and Regulation Training Service

FOR AGV/AMR COMPONENTS SUPPLIER

- Battery, Charging Station, Controller, Motor and Motor Driver, Encoder, LIDAR
  - Safety and EMC Test and Certificate
  - Functional Safety IEC 62061/IEC 61508 Safety Integrity Level (SIL 1~4)
- International Type Approval
- Standard and Regulation Training Service

FOR BUYERS AND INVESTOR

- Factory Audit and Inspection
- Protocol Test
- Departure Spot Safety sCheck

CE MARKING | UKCA MARKING | ATEX MARKING | CHINA ROBOT | FUNCTIONAL SAFETY | KOREAN KCS | SGS NA Q MARK

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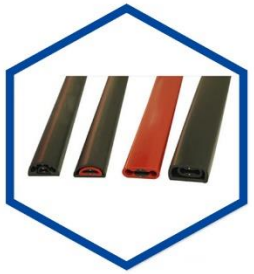
沃美诺
WO MEI NUO

Hebei Womeinuo Automation Technology Co.Ltd

Safety Edge Safety Bumper Safety Relay Safety Mat Professional Manufacturer


AGV pressure sensitive sensor


AMR pressure sensitive sensor


Self-adhesive safety edge


Waterproof safety edge


Anti-explosion safety edge


Pressure sensitive sensor


Safety bumper


Safety relay

ABOUT US

Our company is the creator and trademark holder of the "Womeinuo"! Hebei Womeinuo Automaion Technology Co.LTD is located in the Oinghe County. Hebei Province.which is “the capital of cashmere in China” and China auto parts manufacturing base.
Womeinuo alwavs adheres to the independent research and development of safety protection technology.We provide high quality security protection products and professional technical services and consultation for the intelligent industry.The safety edge sensor produced by the company is mainly used in the automotive field (electric middle door, electric tail door, electric side door.electric gull-wing door etc.) :Anti-collision switches in the fieid of intelligent logistics(AGV. AMR): Smart buildings (revolving doors. garage doors electric sunshade Windows, etc.) Safety bumper for stage performance (elevator stage, bumper car, smart car); Intelligent industrial field (machine tool, tire machine).

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PART NINE

About CMRA

9

About CMRA

CMRA（China Mobile Robot Alliance）is the overseas brand name for New Strategy Media Platform. CMRA focuses on global industrial mobile robots, promotes Chinese AGV/AMR enterprises and markets internationally, strengthens cooperation with overseas to explore opportunities, and seeks common development.

40W+ subscribers from our website and Social media account.

Held more than **50** events/conferences in 8 years

Operate the only mobile robot(AGV/AMR) alliance in China and more than **420** enterprises joined the alliance

Published **20+** Industry reports/bluebooks, and released **14** Industry Group Standards

The Only Mobile Robot (AGV/AMR) Alliance in China.

20+

Published more than 20 reports and BuleBooks

90%

Covering 90% of mainstream enterprises in this industry

400,000+

400,000+ followers in total (Wechat Official Account,Website,Media platform)

420+

More than 420 member enterprises

10%

10% member Enterprises are from other countries.

2000+

Influenced over 2,000 Enterprises

100+

100+ Experts in the Standards Committee

THANKS!

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