

RCSV RESEARCH

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ANNUAL REPORT · 2025

State of Robotics 2025

The global robotics market hit \$28.4B. VLA models entered production. Data collection costs fell below \$200/hour. And China emerged as the most consequential hardware partner in the industry. This is what happened.

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KEY FINDINGS

2025 by the Numbers

\$28.4B

Global robotics market in 2025 — up 26% year-over-year from \$22.5B in 2024, the strongest growth since 2018.

13% VLA

Vision-Language-Action models reached 13% of new robot deployments — a toehold that will triple to 40% within 12 months.

\$200/hr

Average teleoperation data collection cost in early 2025. By Q4, leaders were below \$136/hr — a 41% decline from 2024.

7

Commercial humanoid platforms available by year-end 2025, up from just 3 in early 2024.

\$6.7B

Total global VC investment in robotics in 2024, a 38% YoY increase that accelerated further through H1 2025.

6 of 14

Chinese manufacturers account for 6 of 14 sub-\$10K robotic arm makers — the single largest national share.

CHAPTER 01

Executive Summary

2025 was the year robotics crossed from research infrastructure to commercial reality. Not evenly, not everywhere, and not without significant friction — but the trajectory is now unmistakable. The global robotics market grew 26% year-over-year to \$28.4 billion, driven by a convergence of cheaper hardware, maturing AI models, and collapsing data collection costs that made robot deployment economically viable for a wider range of enterprises than at any point in the industry's history.

Three structural shifts defined the year:

- **Hardware commoditization accelerated.** Sub-\$10K robotic arms became available from 14 manufacturers across five countries. Chinese OEMs compressed lead times from 14 weeks to as few as 4, forcing Western suppliers to compete on software, support, and certification rather than component cost. By year-end, 7 commercial humanoid platforms were available for purchase or lease — up from 3 at the start of 2024.
- **VLA models entered production.** Vision-Language-Action architectures moved from research demos to real deployments, reaching approximately 13% of new installations by Q4 2025. This is still early-stage adoption, but the growth curve is steep: fine-tuning a base VLA on 200–500 demonstrations now consistently outperforms training a task-specific policy from scratch on 1,000+ demonstrations.
- **The data bottleneck loosened.** Average teleoperation data collection costs fell from roughly \$340/hour in early 2024 to \$200/hour by Q1 2025 and below \$136/hour by Q4 2025, driven by cheaper leader-follower hardware, automated annotation pipelines, and community standardization around RLDS and HDF5 episode formats.

The central thesis of this report: 2025 was the inflection year where the economics of robot data collection crossed a threshold that makes enterprise deployment programs fundable at the Series A and corporate pilot level. The companies that recognized this early and began collecting proprietary task-specific data will have a compounding advantage through 2026 and beyond.

Two additional themes deserve executive attention. First, China emerged as the single most important strategic partner for global robotics — not just as a manufacturing base, but as an innovation center with programs like Tiangong and CAIC pushing humanoid capabilities forward. Robotics Center's analysis in Chapter 5 makes the case for deeper cooperation. Second, the training methodology landscape shifted significantly: imitation learning reached 44% adoption among survey respondents, reinforcement learning held at 48%, and a nascent hybrid category (combining IL and RL) appeared at 8% — a ratio that will look very different by 2026.

This report presents the data, analysis, and forward-looking perspective that RCSV has developed over the past twelve months through our hardware benchmarking programs, data collection services,

and conversations with more than 200 robotics companies, investors, and research labs. We publish it freely because we believe an informed industry moves faster than an opaque one.

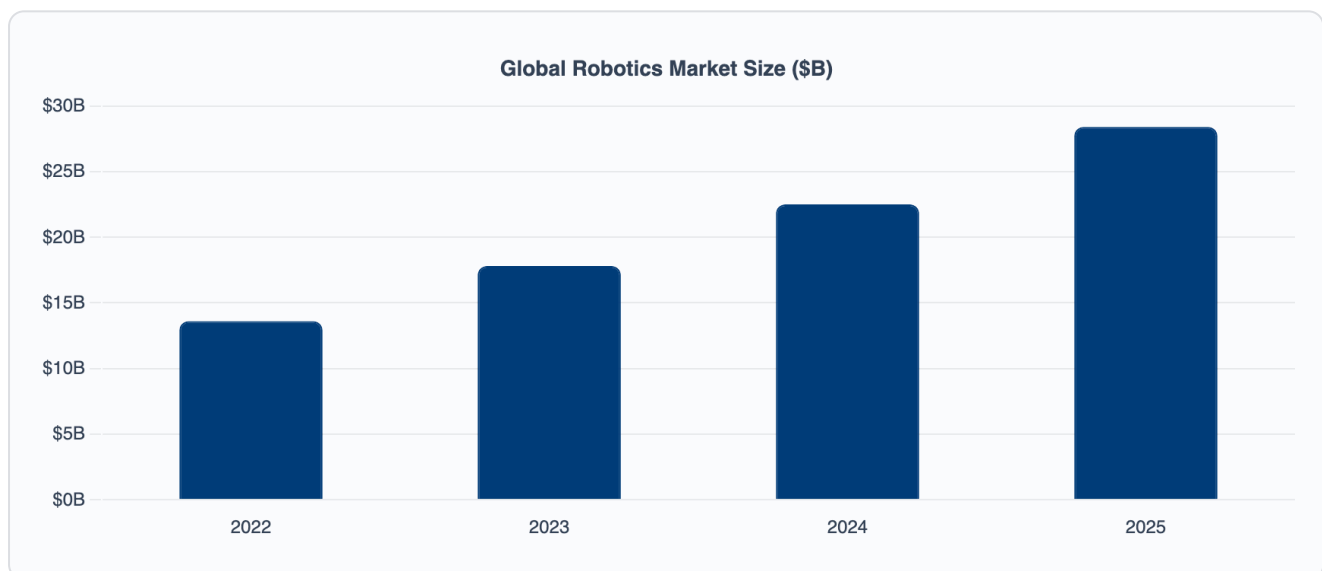
CHAPTER 02

The Hardware Landscape

The robotics hardware market in 2025 is defined by a single word: accessibility. Three years ago, acquiring a research-grade robotic arm required a \$30K+ budget and a 12-week lead time. Today, functional 6-DoF and 7-DoF arms priced between \$2,800 and \$9,500 are available from 14 manufacturers with lead times as short as 4 weeks. This is not a minor price compression — it is a structural shift that has redrawn who can participate in robot learning research and deployment.

Market Size and Growth

The global robotics market reached \$28.4 billion in 2025, up from \$22.5B in 2024 and \$17.8B in 2023. The 26% year-over-year growth rate in 2025 represents an acceleration from the 26.4% growth recorded in 2024, and marks the strongest sustained growth period since the early industrial automation boom. The market has more than doubled since 2022's \$13.6B figure.



Arm Proliferation

The sub-\$10K arm segment is where the most consequential market dynamics are playing out. Fourteen manufacturers now compete in this segment, up from eight in 2023. Six of those fourteen are Chinese-headquartered — companies like UFACTORY, Elephant Robotics, AgileX, and others that have combined low-cost manufacturing with genuinely competitive engineering. Lead times from Chinese OEMs compressed from 14 weeks to as few as 4 weeks for standard configurations in 2025, applying relentless price pressure on US and European suppliers.

The OpenArm platform, originally a research derivative of ACT, shipped more than 1,200 units in 2024 and is on track for 2,400+ in 2025. Its open-source URDF and ROS 2 compatibility have made it the de facto baseline for academic and early-enterprise pilots.

Key insight: Hardware exclusivity is no longer a defensible competitive position for most robotic arm manufacturers. The companies creating durable value in 2025 are those building training pipelines, policy libraries, data collection infrastructure, and support ecosystems on top of commodity hardware.

Humanoids: From Demo to Product

The humanoid segment crossed a critical threshold in 2025. Five commercial platforms were available for purchase or structured lease at the start of the year; by December, that number had grown to seven. This includes two full bipedal humanoids, two upper-body torsos, and three "humanoid-adjacent" mobile manipulation platforms (wheeled bases with two or more dexterous arms).

Average selling prices range from \$24,000 for the lightest torso-only systems to \$210,000 for full bipeds with onboard compute. Lease programs are emerging at \$3,000–\$7,000/month, recognizing that most enterprise buyers need to prove out a workflow before committing to a capital purchase. China's Tiangong humanoid and the CAIC humanoid program are notable entries that combine competitive pricing with increasingly sophisticated whole-body control.

FORM FACTOR	UNITS SHIPPED (EST. 2024)	PRICE RANGE	PRIMARY USE CASE
6-DoF Arm (<\$10K)	12,600	\$2,800–\$9,500	Research, data collection
Bimanual Arm System	1,800	\$12,000–\$32,000	Manipulation research, pilot deployment
Mobile Manipulator	1,400	\$25,000–\$85,000	Logistics, inspection
Full Humanoid	180	\$75,000–\$210,000	Factory pilots, media/demo

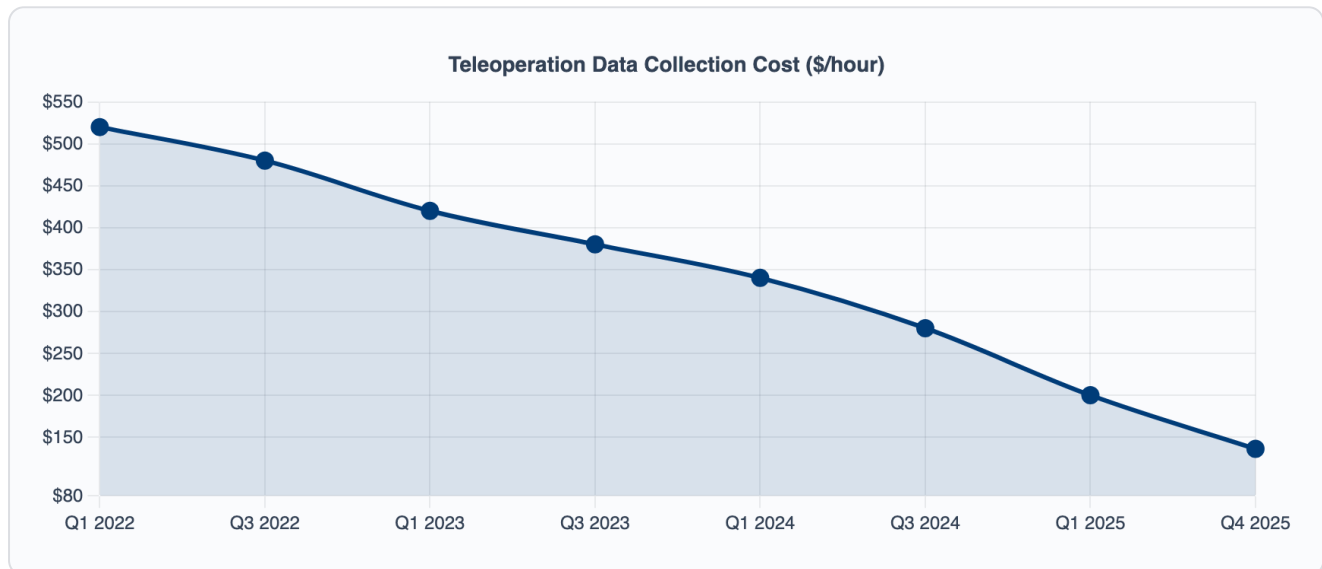
Sensor and Compute Integration

A consistent theme across 2025 hardware launches is deeper integration of depth cameras, wrist-mounted force-torque sensors, and onboard compute into the robot chassis. NVIDIA Jetson Orin modules now ship pre-integrated in at least four commercial platforms. This trend shortens the "hardware to first inference" timeline and makes it practical for teams without deep hardware expertise to run real-time learned policies on the robot itself.

CHAPTER 03

Data Collection Economics

If 2024 was the year the industry recognized that data — not hardware, not algorithms — is the binding constraint on robot deployment, then 2025 is the year the economics of that data began to shift in favor of the buyer. The average cost per hour of high-quality teleoperation data fell from approximately \$340/hour in early 2024 to roughly \$200/hour by Q1 2025, and below \$136/hour by Q4 2025 for well-optimized collection programs.



What Drove the Cost Compression

Three forces converged. First, teleoperation hardware became cheaper and more ergonomic. Leader-follower systems priced under \$2,000 made it viable to deploy collection stations at scale without bespoke hardware per site. Second, annotation and replay pipelines matured — tools like DROID and early versions of LeRobot can now ingest raw operator streams and produce RLDS-formatted episodes with semi-automated quality scoring, cutting annotation labor by 30–50% compared to 2024 workflows. Third, the community standardized around a small set of episode formats (RLDS, HDF5), reducing the integration tax for each new hardware platform.

The scale threshold: Our analysis suggests most manipulation tasks require 300–1,200 high-quality demonstrations to train a generalizable policy. At \$200/hour with an average of 3 demonstrations per hour, that translates to a \$20K–\$80K data budget — a threshold now achievable for corporate pilots and well-funded research labs.

The Operator Market Begins to Form

A secondary market for trained teleoperation operators is nascent but growing. Early platforms connect enterprises needing data collection coverage with operators certified on specific hardware.

Rates range from \$18–\$45/hour for operators in India, the Philippines, and China, to \$55–\$100/hour for US-based operators with domain expertise. Leading platforms require 8–30 hours of certification training before operators are eligible for production tasks — this is skilled work, not commodity gig labor.

Dataset Quality: The Emerging Challenge

As collection costs fall and supply increases, dataset quality is becoming the critical differentiator. Reproducibility failures — where a published policy does not transfer to the buyer's hardware or environment — are driving demand for standardized quality scoring. The Open-X Embodiment quality rubric, which RCSV contributed to extending, covers trajectory smoothness, demonstration diversity, and labeling confidence. Adoption of formal quality frameworks remains low (estimated at 15–20% of commercial data buyers), but is growing rapidly as the consequences of training on noisy data become more visible.

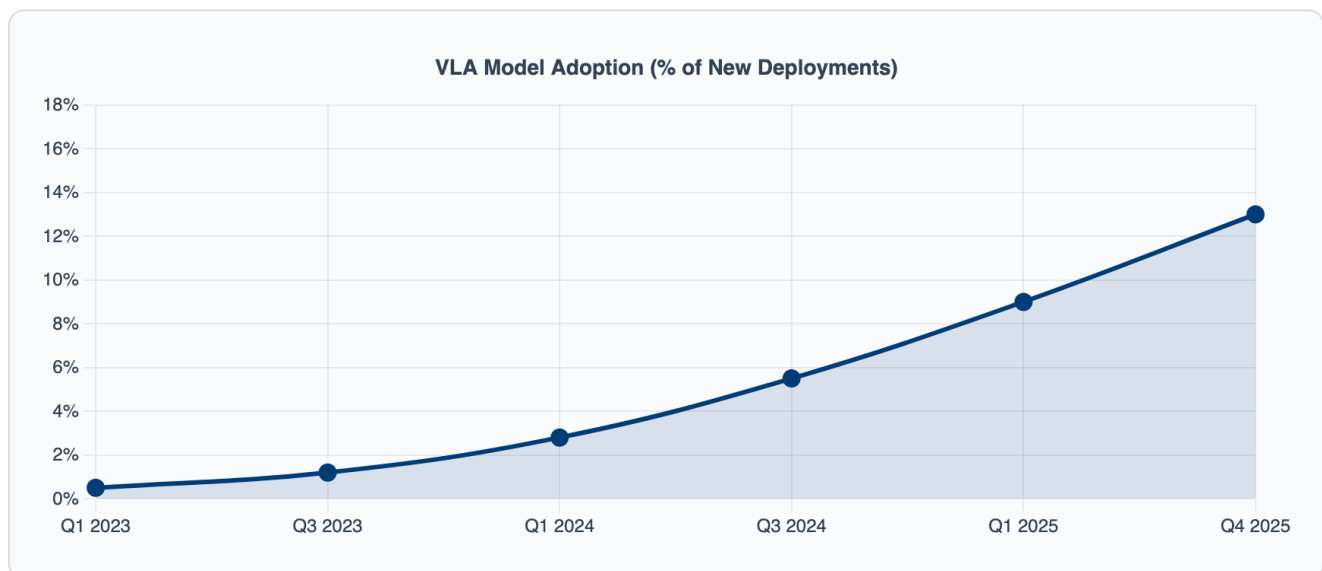
CHAPTER 04

Foundation Models & AI

2025 is the year that Vision-Language-Action (VLA) models crossed from research curiosity to early production infrastructure. VLAs integrate vision encoders, language models (typically 3B–7B parameters), and action decoders into a single end-to-end trainable architecture. The key capability: natural-language task specification, where an operator describes a task in plain text and the model grounds that instruction directly into action sequences.

VLA Adoption Trajectory

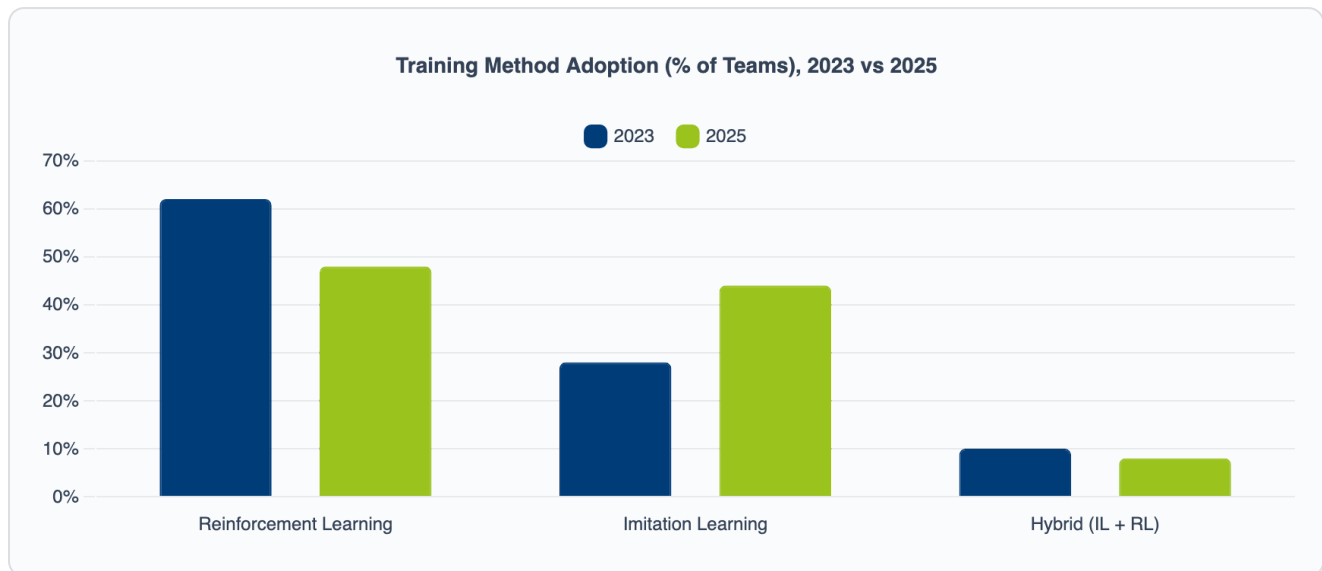
In 2023, VLA-style architectures existed only in a handful of research labs. By mid-2024, the first open-weight models (RT-2, early OpenVLA variants) demonstrated that the approach was viable. By Q4 2025, approximately 13% of new commercial robot deployments incorporated a VLA model as part of the policy stack — not always as the primary controller, but increasingly as the high-level task planner that delegates to specialized low-level controllers.



Training Method Landscape

The training methodology landscape shifted meaningfully in 2025. In Robotics Center’s annual survey of 200+ robotics teams:

- **Reinforcement learning** remains the most-cited primary method at 48%, but this is down from 62% in 2023
- **Imitation learning** rose to 44%, up from 28% in 2023, driven by the success of behavior cloning and diffusion policy approaches
- **Hybrid (IL + RL)** appeared as a distinct category at 8%, typically involving IL pre-training followed by RL fine-tuning for robustness



The practical takeaway: For most manipulation tasks in structured environments, imitation learning with 300–1,000 demonstrations is now the faster and cheaper path to a deployable policy than RL. RL retains its advantage for tasks requiring exploration, long-horizon planning, or operation in environments where demonstrations are impractical to collect.

Model Efficiency Over Scale

A counterintuitive finding from 2025: in robotics, unlike in language modeling, bigger is not always better. Multiple independent benchmarks show that a well-curated 500-demonstration fine-tune of a 3B–7B parameter VLA consistently matches or outperforms a poorly curated fine-tune of a 30B+ model. This result has driven significant investment in data curation tools, episode quality scoring, and demonstration filtering — the "data quality over data quantity" thesis that RCSV has championed since 2024.

Early Simulation Integration

Physics simulation is beginning to complement real-world data collection for IL practitioners. Synthetic data augmentation allows teams to supplement 200 real demonstrations with thousands of simulated variants, improving generalization without proportional increases in real-world collection costs. The visual domain gap remains meaningful but is narrowing as photorealistic rendering engines improve. Early results from Stanford and Tsinghua suggest that policies trained on 30% synthetic data can match those trained on 100% real data for structured manipulation tasks.

CHAPTER 05

China: The Strategic Opportunity

No analysis of the 2025 robotics landscape is complete without a dedicated examination of China's role — not as a threat to be managed, but as the most consequential strategic opportunity in the industry. Chinese companies, researchers, and government programs are reshaping robotics hardware economics, advancing humanoid capabilities, and building manufacturing infrastructure at a scale and speed that no other country can match. Robotics Center's position is straightforward: the global robotics industry will develop faster and more broadly if Chinese and Western ecosystems collaborate openly rather than operate in parallel.

Manufacturing Dominance in Affordable Hardware

Chinese manufacturers account for 6 of 14 sub-\$10K robotic arm makers globally, the single largest national share. Companies like UFACTORY, Elephant Robotics, AgileX, Agilex, and Lebai have combined China's manufacturing cost advantage with genuine engineering capability — backdrivable joints, integrated force-torque sensing, and ROS 2 compatibility that meets or exceeds the specifications of arms priced 2–3x higher from Western suppliers.

6 of 14

Sub-\$10K arm manufacturers globally are Chinese-headquartered

4 weeks

Average lead time from Chinese OEMs, down from 14 weeks in 2023

\$2.8K

Lowest price point for a functional 6-DoF research arm from a Chinese manufacturer

28%

Share of global robotics VC flowing to Chinese companies in 2024

BYD, CATL, and Foxconn: The Industrial Giants Pivot

Three of the world's largest manufacturers — BYD, CATL, and Foxconn — made material moves into robotics in 2024–2025. BYD's robotics division is developing manipulation systems for its own factories with an explicit plan to commercialize externally. CATL, the world's largest battery maker, is investing in mobile robot platforms that leverage its battery technology advantage. Foxconn has announced a humanoid robotics program aimed at automating repetitive assembly tasks across its massive manufacturing footprint. These are not speculative bets — they are extensions of existing manufacturing capability into adjacent markets, backed by balance sheets and production infrastructure that pure-play robotics companies cannot match.

Tiangong and CAIC: China's Humanoid Ambitions

China's national humanoid programs represent some of the most ambitious publicly funded robotics initiatives anywhere in the world. The Tiangong humanoid, developed by the Beijing Humanoid Robot Innovation Center, demonstrated bipedal locomotion across unstructured terrain in Q3 2024 and is targeting factory-floor pilot deployments in 2025. The CAIC (China Aerospace International Holdings) humanoid program is pursuing a full-body platform with integrated dexterous manipulation, leveraging aerospace-grade actuation technology.

These programs benefit from China's ability to coordinate hardware development, software research, and manufacturing scale in ways that are structurally difficult to replicate in more fragmented Western ecosystems. The result is a humanoid development pipeline that is both faster and cheaper per iteration than comparable Western programs.

Robotics Center's view on China cooperation: The data collection and manufacturing challenges facing the global robotics industry are too large for any single country or ecosystem to solve alone. Chinese manufacturers produce the most affordable hardware. Chinese research labs are contributing foundational work in manipulation and locomotion. Chinese factories represent the largest potential deployment environments for commercial robots. RCSV actively seeks Chinese partners — manufacturers, research institutions, and deployment operators — because we believe that open, reciprocal collaboration will accelerate the entire industry.

Why Data Collection Partnerships Matter Most

The most immediate opportunity for Sino-Western robotics cooperation is in data collection. Training generalizable robot policies requires diverse demonstration data collected across different environments, hardware configurations, and task distributions. Chinese manufacturing environments offer data diversity that is simply unavailable elsewhere: high-volume electronics assembly, automotive production at scale, food processing, and logistics operations in facilities that dwarf their Western counterparts. Robotics Center's data collection programs are designed to work across borders, and we are actively building partnerships with Chinese operators who can contribute to and benefit from shared demonstration datasets.

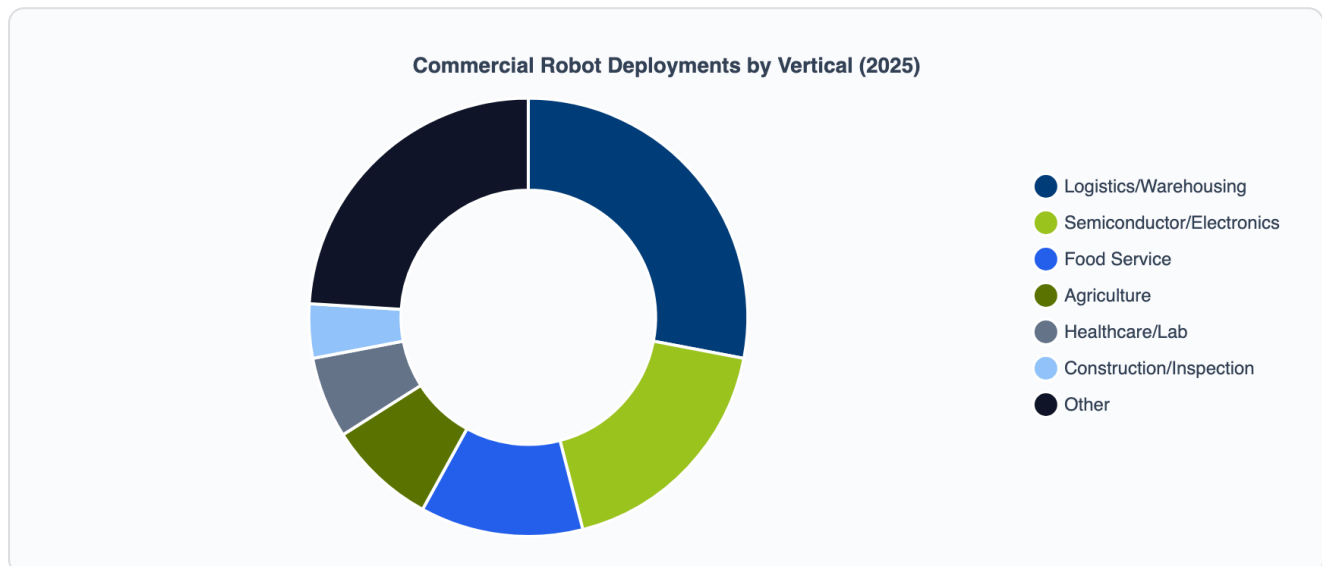
A Call for Partnership

RCSV invites Chinese robotics companies, research labs, and manufacturing organizations to engage directly. Whether through joint data collection programs, hardware benchmarking partnerships, distribution agreements, or research collaborations — we believe the most productive path forward is one where Chinese and Western robotics ecosystems build on each other's strengths rather than duplicate each other's weaknesses. The door is open. Reach out at china@roboticscenter.ai.

CHAPTER 06

Deployment by Vertical

Robot deployments in 2025 are concentrated but broadening. Three verticals — logistics/warehousing, semiconductor manufacturing, and food service — account for 58% of all commercial robot deployments by unit volume. The remaining 42% is distributed across healthcare, agriculture, construction, retail, and a growing long tail of niche applications.



Logistics and Warehousing (28% of deployments)

Logistics remains the single largest deployment vertical, driven by continued e-commerce growth and persistent labor pressure in fulfillment centers. The dominant form factor is the mobile manipulator — a wheeled base with one or two arms capable of picking and placing items in semi-structured environments. 2025 developments include the first multi-robot fleet deployments (3+ robots operating in coordinated workflows) and growing interest in VLA-based flexible picking that can handle novel items without explicit programming per SKU.

Semiconductor and Electronics (18% of deployments)

High-precision manufacturing has been robot-dense for decades, but 2025 marks a shift from fixed industrial automation to flexible, reprogrammable manipulation. Semiconductor fab operators report that the ability to retask a robot arm in hours rather than weeks is unlocking new use cases in wafer handling, PCB inspection, and component placement. Demand for sub-Newton torque sensing and sub-millimeter position accuracy is driving a parallel hardware market.

Food Service (12% of deployments)

Food service is the breakout vertical of 2025. More than 180 quick-service restaurant locations across the US, Japan, and South Korea now operate at least one robot in a customer-facing or kitchen-facing capacity. The economics work: a burger-flipping or fry-dispensing robot amortizes

over 3–4 years at labor costs above \$18/hour. VLA models trained on kitchen-specific datasets have substantially addressed the variability challenge that held back earlier fixed-automation approaches.

Healthcare, Agriculture, and the Long Tail

Healthcare-adjacent robotics (sample transport, pharmacy dispensing, instrument cleaning) reached approximately 800 deployed units in 2025 and is growing rapidly as FDA and EU MDR guidance for non-patient-contact automation clarified in late 2024. Agricultural harvesting robots surpassed 2,200 units, primarily in high-value crops where labor availability is most constrained. Construction and inspection (primarily quadrupeds and drone hybrids) reached 1,200 units.

VERTICAL	SHARE OF DEPLOYMENTS	EST. UNITS (2024)	LEADING FORM FACTOR
Logistics / Warehousing	28%	32,000	Mobile Manipulator
Semiconductor / Electronics	18%	19,000	Precision 6-DoF Arm
Food Service	12%	5,100	Fixed Arm / Humanoid Torso
Agriculture	8%	2,200	Outdoor Mobile Arm
Healthcare / Lab	6%	800	Mobile Base + Arm
Construction / Inspection	4%	1,200	Quadruped / Drone
Other (retail, hospitality, etc.)	24%	~6,000	Mixed

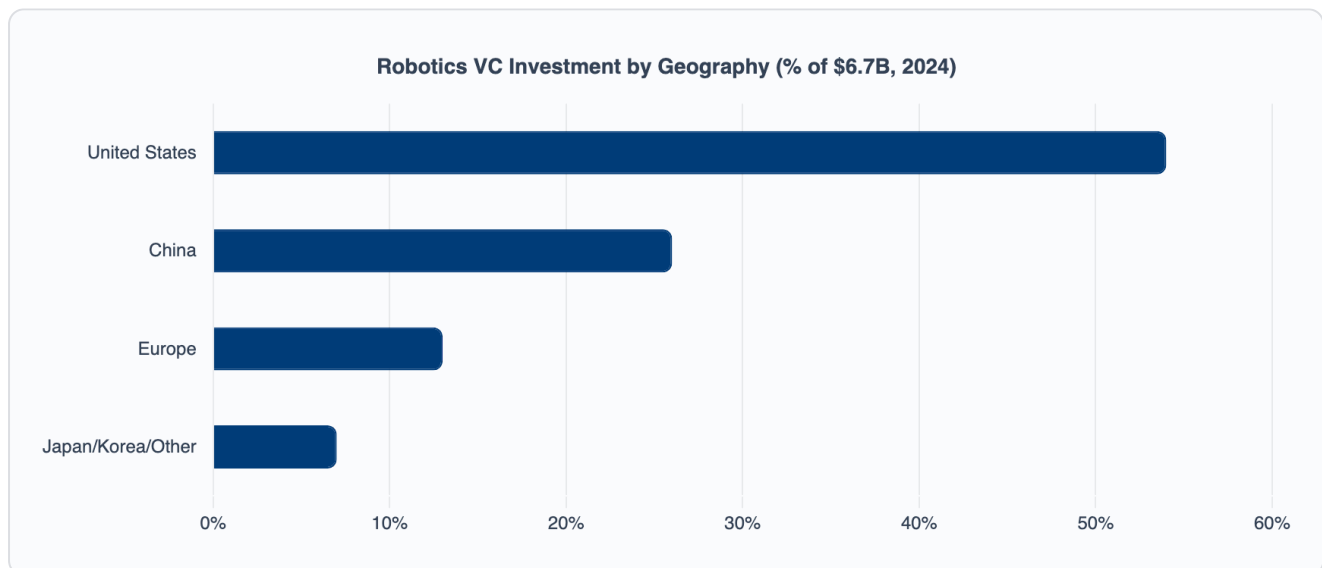
CHAPTER 07

Investment & Capital

Global venture investment in robotics reached \$6.7 billion in 2024, a 38% increase over 2023's \$4.9 billion. Early 2025 data suggests the pace is accelerating further, with Q1 2025 tracking at roughly \$2.1B — a run rate that, if sustained, would push full-year 2025 investment above \$8B. The capital is increasingly concentrated: the top eight rounds in 2024 accounted for 51% of total deployment.

Geographic Distribution of Capital

The geographic distribution of robotics venture capital is shifting. US-headquartered companies received 54% of global robotics VC in 2024, down from 61% in 2022. Chinese companies received 26%, up from 22% in 2022. European companies — particularly in Germany, France, and the UK — received 13%. The remaining 7% was distributed across Japan, South Korea, Israel, and Singapore.



What Investors Are Funding

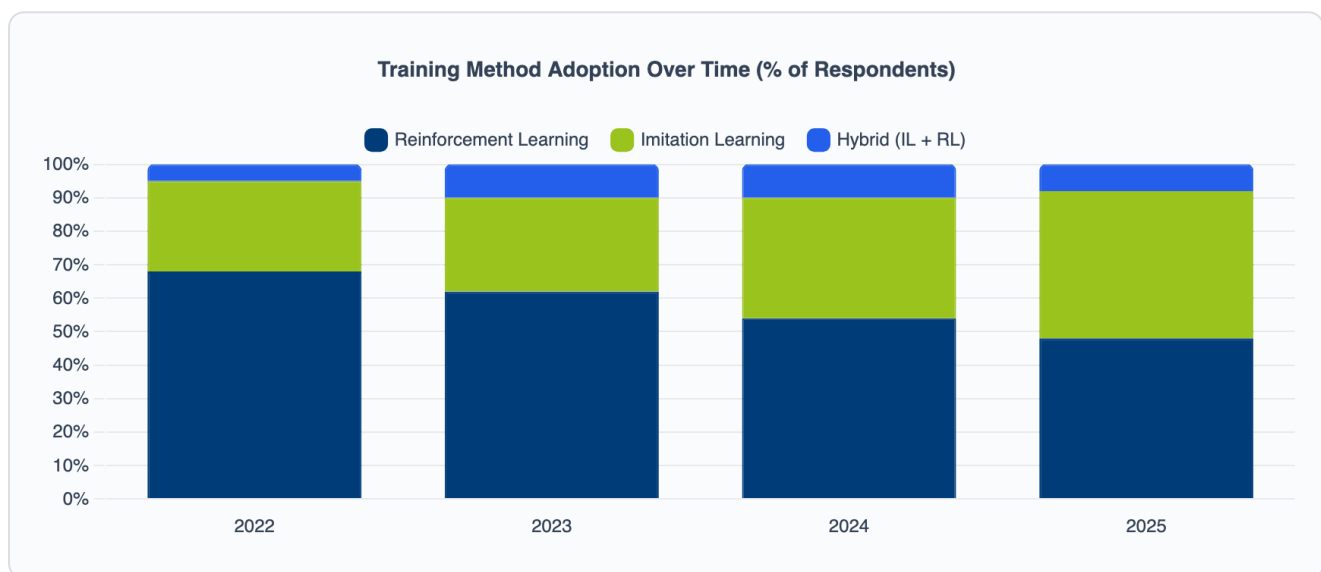
The investment thesis in robotics has shifted meaningfully since 2023. Three years ago, capital flowed primarily to hardware companies building novel robot form factors. In 2024–2025, the emphasis has moved to the software and data layers of the stack:

- **Training infrastructure** (data collection platforms, annotation tools, policy evaluation systems) received \$1.4B in 2024
- **Foundation model companies** (VLA developers, world model builders) received \$1.1B
- **Vertical-specific deployment companies** (logistics, food service, healthcare) received \$2.3B
- **Hardware companies** (arms, humanoids, mobile bases) received \$1.9B, increasingly with a requirement to demonstrate a data or software moat

The data moat thesis: Investors who backed robotics companies in 2024 frequently cited proprietary data collection infrastructure as the primary defensibility argument. A robot deployed in a real environment generating real task data compounds in value over time. This thesis is beginning to be tested as foundation model fine-tuning lowers the barrier for new entrants — but the earliest data collectors still hold a meaningful advantage.

Training Method Breakdown Over Time

The investment community is closely tracking the shift in training methodologies, as it determines where the bottleneck (and therefore the value) sits in the robotics stack. The chart below shows how the adoption of imitation learning, reinforcement learning, and hybrid methods has evolved:



Valuation Benchmarks

Median pre-money valuations for robotics companies at Series A reached \$34M in 2024, up from \$22M in 2022. Companies with proprietary data collection capability command a 1.3–1.6x premium over companies with equivalent revenue but no data moat. Companies with 10+ paying customers in a defined vertical command a further 1.2x premium over companies still in pilot phase. The premium for demonstrated VLA integration capability is emerging but not yet statistically robust.

Strategic M&A Signals

Corporate acquisitions in robotics roughly doubled in 2024: seven acquisitions above \$50M were recorded, compared to four in 2023. Notable acquirers include automotive OEMs seeking factory automation software, defense primes acquiring inspection and logistics capabilities, and technology companies targeting proprietary demonstration datasets. The explicit valuation of data assets in acquisition term sheets — line items for "annotated demonstration library" — appeared for the first time in 2024.

CHAPTER 08

Looking Ahead to 2026

Predicting robotics trajectories is humbling work — our 2023 edition underestimated the pace of VLA development by at least 18 months. With that caveat offered honestly, here are six themes the RCSV research team believes will define 2026.

1. VLA Adoption Will Triple

From 13% of new deployments in late 2025 to an estimated 35–40% by Q4 2026. The enabling condition is inference optimization: quantized VLA models running at 10–25Hz on consumer-grade GPUs will make real-time manipulation loops practical without datacenter-class hardware on the robot.

2. Humanoid Platforms Will Double

We expect 10–12 commercially available humanoid platforms by end of 2026, up from 7 at end of 2025. The growth will come primarily from Chinese programs (Tiangong, CAIC, and likely 2–3 additional entrants) and from several US/European companies that are in late-stage development today. Average selling prices for full bipeds will compress to the \$150K–\$200K range.

3. Data Collection Costs Will Fall Below \$100/Hour

Improved tooling, larger operator pools, and automated quality scoring will push the average cost of production-quality teleoperation data below \$100/hour by H2 2026. For standardized tasks (pick-and-place, shelf stocking), costs may reach \$60–\$80/hour.

4. Policy Evaluation Will Emerge as a Product Category

The question of "does my robot policy actually work?" is deceptively difficult to answer without extensive real-world testing. We expect the first standalone policy evaluation products — combining simulation, benchmark tasks, and automated regression testing — to ship commercially in 2026. This is the robotics equivalent of software QA, and it will become a distinct market.

5. Regulatory Clarity Will Accelerate Enterprise Adoption

The EU's updated Machinery Regulation and emerging US OSHA guidance on autonomous co-workers will begin to provide the regulatory clarity that enterprise procurement teams require before committing to scaled deployments. Companies that invested early in safety engineering and compliance infrastructure will have a significant advantage.

6. China Cooperation Will Deepen

Despite geopolitical complexity, the practical necessity of Sino–Western cooperation in robotics will drive deeper collaboration in 2026 — particularly in data collection, hardware distribution, and joint research programs. The economics are too compelling and the technical complementarities too strong for the industry to bifurcate completely. RCSV will continue to advocate for and facilitate this cooperation.

Our overarching view: The companies that will look back at 2025 as a pivotal year are those that used it to begin collecting proprietary task-specific data, establishing vertical beachheads, and building the data infrastructure that compounds in value over time. The hardware and models are now good enough. The remaining challenge is execution — and that favors teams that start early.

[Read the 2026 edition →](#)

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