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GLOBAL PHYSICAL AI

Framing the Forward Progress of Humanoids (with a Studied Focus on the Logistics Landscape)

While the market's AI focus in the past few years has been on the scaling of compute and the benchmark performance of AI models, there have been rapid advancements in physical AI, open-source tools, and rising global funding for these efforts. With this report our global research teams (across the automotive, technology & industrial landscape) examine how the landscape for physical AI has evolved across hardware, software, and semiconductors. On the back of that work, we are raising our humanoid robot market forecast. The global market is now projected to reach approximately 890,000 units by 2030 and 6.5 million units by 2035 (representing a $138 billion market opportunity). Across the report, we make a series of key conclusions to highlight for investors:

- Logistics and warehouse operations serve as the primary early adopters for general-purpose humanoids. eCommerce/Retail companies (like Amazon and Walmart) are leading this transition. We frame ~5.6% of leverage in Amazon's total cost to serve via automation by 2030, which is estimated to yield a ~$72 billion cost savings and a ~240 bps EBIT margin tailwind in our upside analysis from a wider deployment of robotics.
- While automotive body welding is highly automated, final assembly and parts sorting remain manual. Automakers are actively exploring humanoids to mitigate labor challenges. In a scenario analysis where companies adopt humanoids (priced between $20,000 and $60,000) at a 10% to 50% rate, we estimate it could drive a 1% to 6% operating margin expansion on a gross basis (although the net effect could be less if some savings are passed on in the form of lower vehicle prices).
- The mobility of humanoids is accelerating the shift from hardware-bound Programmable Logic Controllers (PLCs) to software-defined virtual PLCs (vPLCs). The vPLC market is projected to grow 20% to 30% annually, which would call into question the legacy hardware-software lock-in of dominant incumbents like Siemens, Rockwell Automation, and Schneider Electric.
- Humanoid proliferation represents a massive structural growth driver for the semiconductor supply chain. The semiconductor addressable market (SAM) is estimated at $3,000 to $6,000+ per humanoid, spanning high-performance

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compute modules ($1,500–$4,000+), analog/mixed-signal chips ($750–$1,050+), and edge memory ($600–$800+).

- We recently launched Executive Perspectives *powered by Goldman Sachs*, a new global initiative that looks to capture insights directly from companies across our global coverage. We detail full results from the first survey, which related to robotics and physical AI, and highlight that ~40% of respondents expect at least 10% of workflows to be automated in 3-5 years with general purpose robotics.

On the back of our industry and company-specific fundamental work, we would highlight a range of companies that stand to benefit as this theme builds in scale over the next 3-5 years - Amazon, Walmart, Nvidia, Tesla, Jabil, Inovance, Sanhua, Shuanghuan, XPeng, Hesai, Xiaomi, BYD, Toyota Motor, Daifuku, MinebeaMitsumi, Renesas Electronics, HL Mando, Hyundai Mobis, Robotis, Siemens AG, Schneider Electric, and Regal Rexnord.

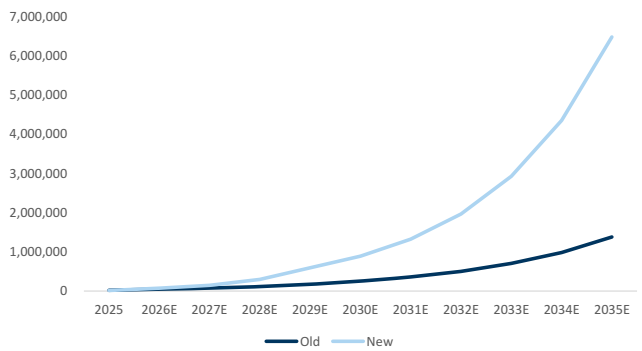
Executive Summary

Traditional robotics have been successful at automating certain tasks, but limits with respect to software capability and hardware flexibility have historically constrained adoption to certain areas that are more repetitive in nature. **We expect this to change going forward due to physical AI.** Physical AI, per Nvidia, is what enables machines such as robots and AVs to perceive, understand, and perform complex actions in the physical world.

Physical AI technology for robots is improving, and humanoid robots from several providers are increasingly set to move into larger scale prototypes and toward commercial production. This is being enabled in part as companies gather real world data to train AI software, including for both general reasoning and specific tasks (such as how to pick up an envelope or break an egg), which can't be done simply with digital data from the internet. The industry is also befitting from new open-sourced tools, rising funding, and government support. We also believe increasing deployments can help drive a positive flywheel effect, with the robots in operation helping gather data to further train and improve AI software. We believe this can support robotics becoming more general purpose in utility over time, including humanoids.

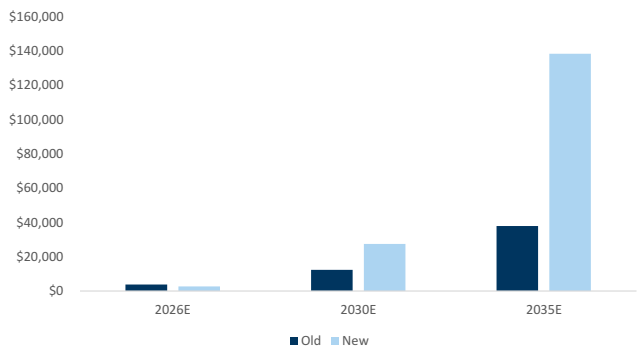
As a result of progress for the industry, and reflecting company specific plans, **we're increasing our humanoid market forecast.** We now expect the market to reach about 890K in 2030 and 6.5 mn in 2035 on a units basis, up from 256K and 1.4 mn prior. On a dollars basis, we expect the market to reach $138 bn in 2035.

Exhibit 1: Old vs new humanoid unit forecast, 2025-2035E



Source: Goldman Sachs Global Investment Research

Exhibit 2: Old vs new humanoid market forecast
in $mns



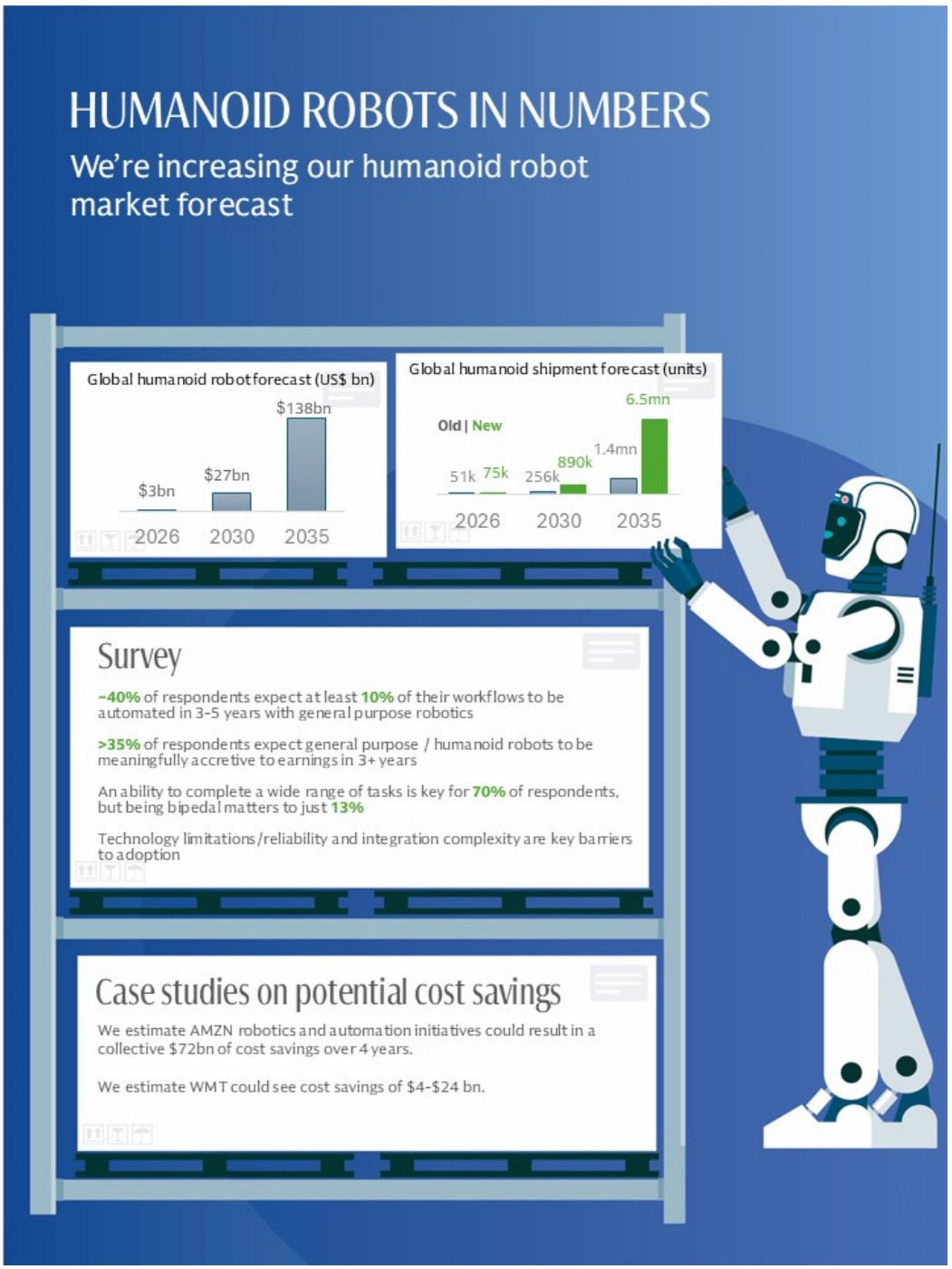
Source: Goldman Sachs Global Investment Research

Logistics and warehouse operations in particular are an early area for larger scale pilots and deployments for general purpose robots such as humanoids. These locations can be ideal given the opportunity to insert humanoids into roles with mixed tasks that may be too varied for traditional robots to automate economically, but still be in a structured environment and in a setting where challenges such as weather and privacy are manageable. **Companies including Amazon and Walmart are using robotics already to lower the cost to serve and increase inventory and sales velocity.** This has been done with a range of robotics, including traditional robotic arms and AMRs. For example, Amazon has deployed >1 mn robots across over 300 facilities (as of June'25), and 3.1k of Walmart's US stores are served with some level of automated freight and

over 50% of e-commerce fulfillment volume is processed through automated facilities (as of August'26). We have case studies on both Amazon and Walmart in this report, and **there is the potential in our view for general purpose robots to further improve margins and automation at these companies.** One scenario detailed in the Amazon case study is ~5.6% of leverage in the cost to serve from automation by 2030 resulting in a ~240 bp margin tailwind.

We also believe early use cases for humanoids in the automotive sector could include logistics type roles. While some parts of auto manufacturing are highly automated (e.g. body welding), and about a quarter of traditional industrial robots are sold to the auto industry, there are many jobs at auto OEMs and suppliers that are mostly manual (e.g. final assembly, wire harnesses) that could benefit from automation in the long-term as the technology improves.

As we consider the implications and potential areas of disruption for general purpose robots such as humanoids, we expect this to allow tech-forward e-commerce leaders such as Amazon and Walmart to **improve wallet share and customer stickiness**. The implications for labor could be more nuanced in aggregate, with the US BLS (Bureau of Labor and Statistics) noting that it believes there will be on average ~1.0 mn job openings in hand laborer and material mover roles from 2024 to 2034. **The robots will not only need to integrate safely to work alongside humans, but we see implications for the PLC industry that will help manage factory operations**.



Source: Goldman Sachs Global Investment Research

Exhibit 3: Select stocks positioned to benefit from physical AI/robotics and humanoids theme

Select stocks positioned to benefit from physical AI/robotics and humanoids theme					
Ticker	Company name	Rating	12 month price target	Current stock price	Upside/downside
AMZN	Amazon	Buy	$375.00	$266.43	40.7%
ADI	Analog Devices	Buy	$480.00	$361.78	32.7%
002594.SZ	*BYD	Buy	Rmb137.00	Rmb92.32	48.4%
1211.HK	*BYD	Buy	HK$134.00	HK$91.95	45.7%
6383.T	Daifuku	Buy	¥9,300.00	¥5,745.00	61.9%
HSAI	Hesai	Buy	$31.00	$17.42	78.0%
2525.HK	Hesai	Buy	HK$30.00	HK$17.35	72.9%
204320.KS	HL Mando	Buy	₩109,000.00	₩50,300.00	116.7%
012330.KS	*Hyundai Mobis	Buy	₩710,000.00	₩450,500.00	57.6%
2577.HK	InnoScience	Buy	HK$114.00	HK$46.28	146.3%
300124.SZ	*Inovance	Buy	Rmb92.90	Rmb62.05	49.7%
JBL	Jabil	Buy	$482.00	$301.45	59.9%
002600.SZ	Lingyi	Buy	Rmb21.20	Rmb12.47	70.0%
6479.T	MinebeaMitsumi	Buy	¥5,500.00	¥3,401.00	61.7%
NVDA	Nvidia	Buy	$300.00	$217.55	37.9%
NXPI	NXP	Buy	$325.00	$223.58	45.4%
ON	ON Semiconductor	Neutral	$95.00	$72.61	30.8%
RRX	Regal Rexnord	Buy	$240.00	$157.43	52.4%
6723.T	Renesas Electronics	Buy	¥5,500.00	¥3,417.00	61.0%
108490.KQ	Robotis	Buy	₩630,000.00	₩242,000.00	160.3%
2050.HK	Sanhua-A	Buy	HK$40.00	HK$25.64	56.0%
002050.SZ	Sanhua-H	Neutral	Rmb38.60	Rmb36.17	6.7%
SCHN.PA	Schneider Electric	Buy	€ 352.00	€ 301.75	16.7%
002472.SZ	Shuanghuan Driveline	Buy	Rmb45.50	Rmb35.70	27.5%
SIEGn.DE	Siemens AG	Buy	€ 319.00	€ 289.85	10.1%
TSLA	Tesla	Neutral	$360.00	$348.75	3.2%
TXN	Texas Instruments	Sell	$225.00	$258.64	(13.0%)
7203.T	Toyota Motor	Buy	¥3,900.00	¥3,116.00	25.2%
WMT	Walmart	Buy	$130.00	$103.09	26.1%
1810.HK	Xiaomi	Buy	HK$39.00	HK$27.82	40.2%
XPEV	Xpeng	Buy	$18.00	$11.53	56.1%
9868.HK	Xpeng	Buy	HK$69.00	HK$44.82	53.9%

*Companies on the Conviction List (CL). Price targets are for a 12-month timeframe; current stock prices as of market close on August 28th

Source: Goldman Sachs Global Investment Research, FactSet

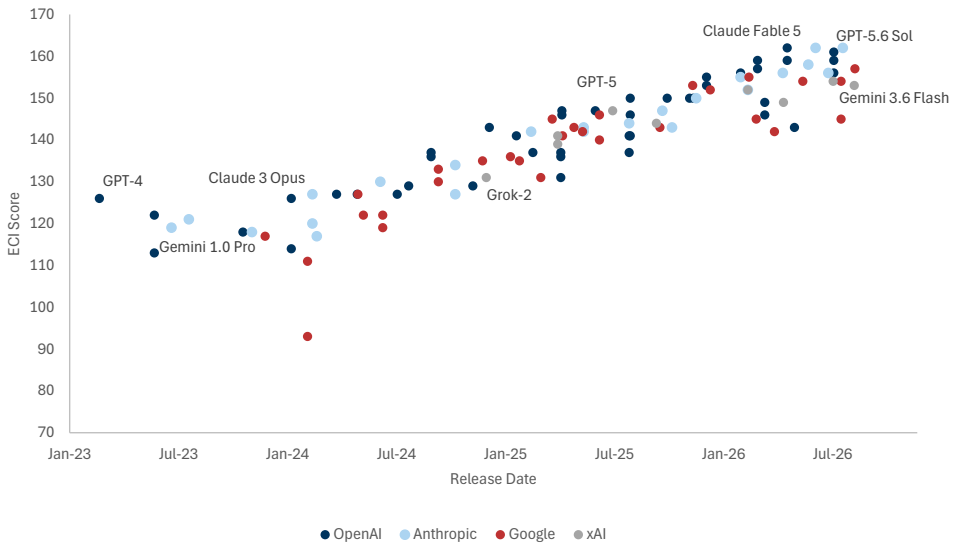
The frontier of robotics tech – humanoids and foundational models

AI technology continues to improve with focus areas including data collection, world models and safety

AI model performance continues to improve. One measure of progress with AI models is the Epoch Capabilities Index (ECI), which is a generalized benchmark intended to capture the overall capability of AI models by aggregating performance across several established tests covering reasoning, coding, math, and language. Unlike individual benchmarks which can saturate as models approach near-perfect scores, ECI adjusts for task difficulty and combines results to show relative differentiation across models and over time. Higher scores indicate broader capability, while models optimized for specific tests may perform well on individual benchmarks but rank lower on ECI due to limited generalization.

Models launched in 2023 were scoring around the low to mid 120s range, while models released in 2026 (GPT-5.4 Pro, Gemini 3.1 Pro, Claude Sonnet 4.6) are scoring in the mid to high 150s range.

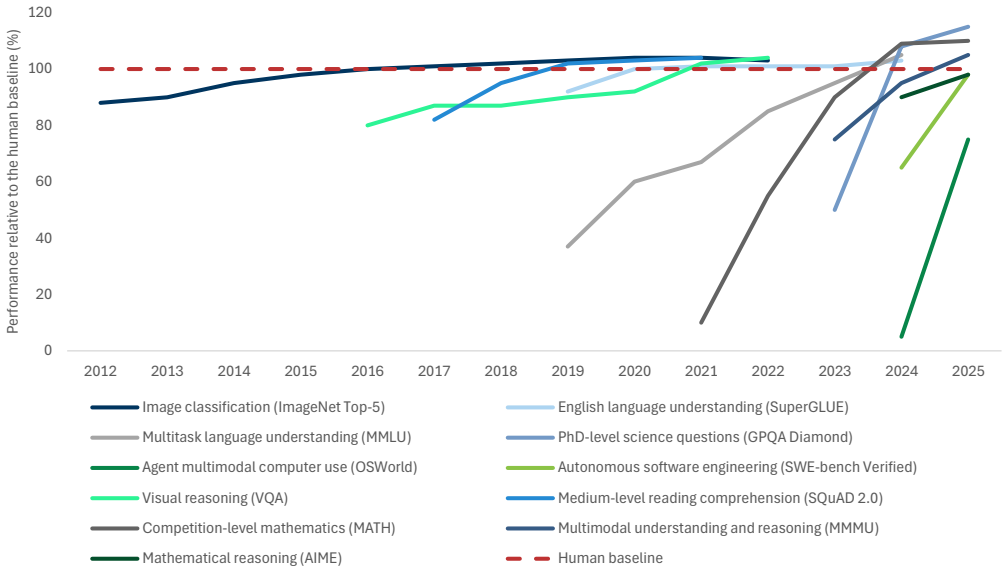
Exhibit 4: Select AI model performance on the Epoch Capabilities Index



Source: Epoch AI

It's also key to contextualize these scores relative to human benchmarks. The Stanford Institute for Human-Centered AI (HAI) details how AI models have improved over time and compared to humans, most recently in their 2026 AI index report. Per HAI, AI model performance has continued to trend higher overall, with AI models able to exceed human capabilities on several metrics. However, certain tasks remain more challenging for AI models, with the 2026 report discussing low accuracy from several models at reading analog clocks.

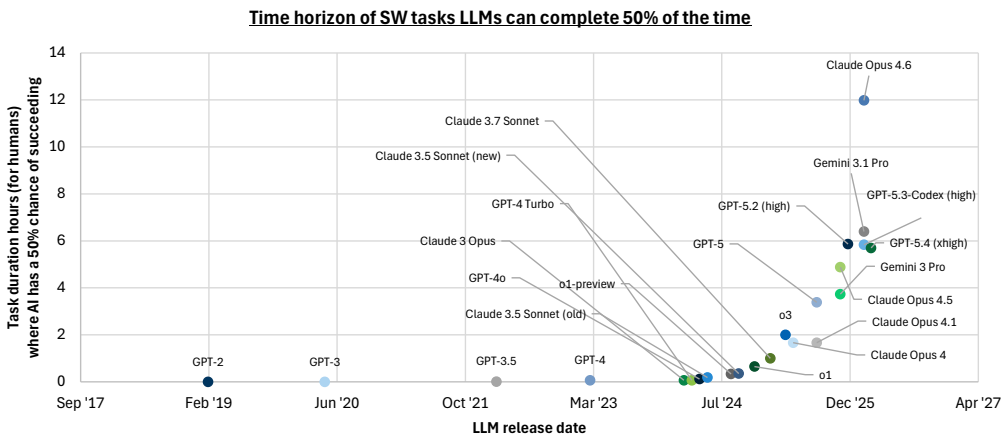
Exhibit 5: Select AI Index technical performance benchmark vs. human performance



Source: Stanford University Institute for Human-Centered AI, Goldman Sachs Global Investment Research

METR finds that the length of tasks (in human-time) that frontier models can complete at a 50% success rate has doubled roughly every 7 months since 2019, implying AI capability is compounding exponentially.

Exhibit 6: AI's tasks horizon doubled every 7 months



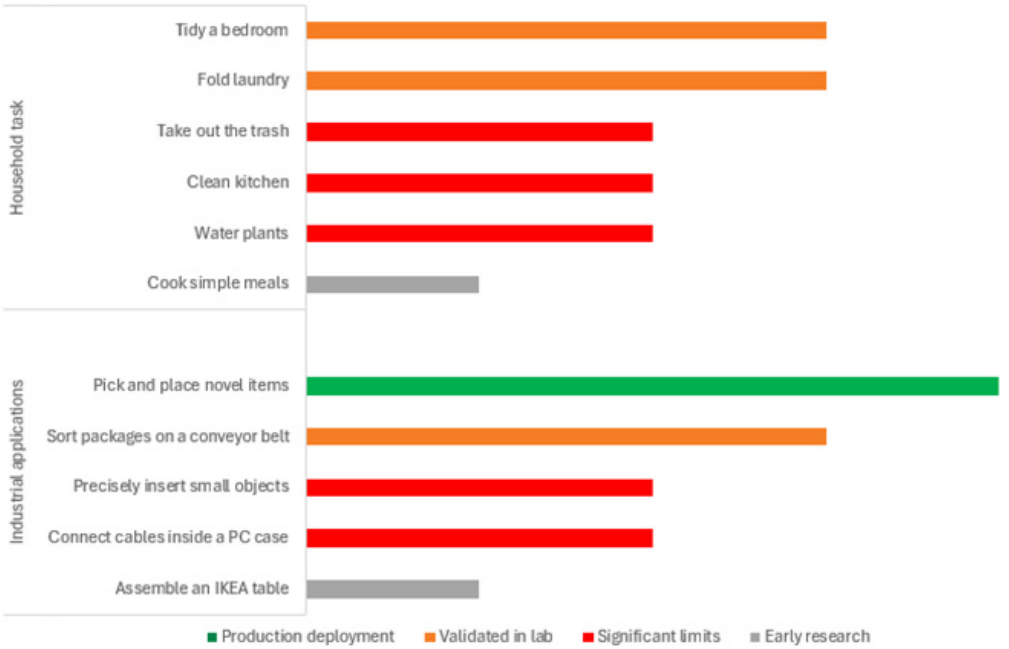
Source: METR

However, AI model performance in the physical world, especially in unstructured environments, has been a harder problem. A February 2026 Epoch report examined tasks across industrial and household applications and assessed what development stage the robots were in (including robots from Tesla, Amazon, Figure, Boston Dynamics and Unitree, among others). The study found that robots can handle tasks that are straightforward with stable and structured environments but still often struggle with higher levels of complexity and variability.

Importantly, if enough real-world training data is gathered, we think general

purpose robotics can see improved task performance similar to foundational models more generally. This data is being generated in multiple ways, including via pilot operations of humanoids, and with human-generated data being collected across a range of tasks in data labs.

Exhibit 7: Stages autonomous robots are at in real world tasks (per Epoch)

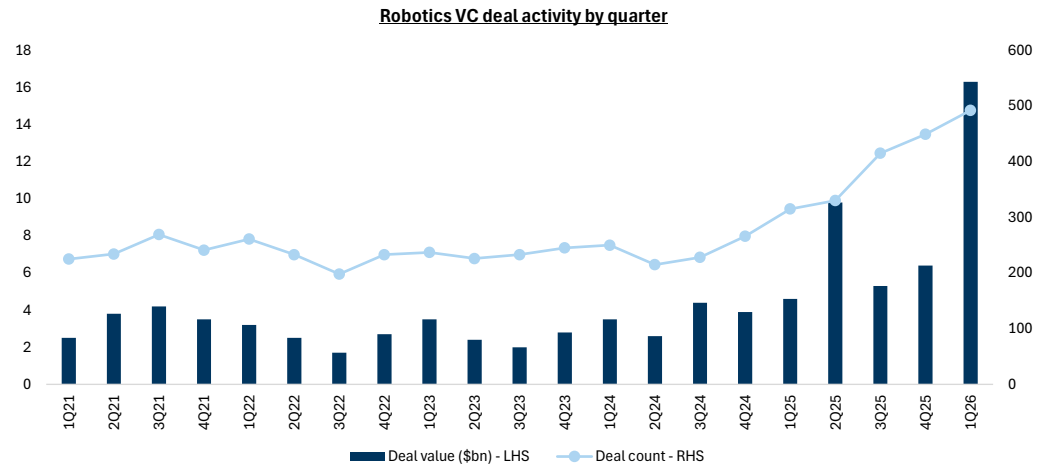


Source: Epoch AI

Model structure and tools are another area of tech development for physical AI. This includes work on both vision-language-action (VLA) models and world models, that help the robots reason about the broader environment and take the appropriate actions. There are also growing open-source tools, including the Nvidia GR00T model and training data, and its new Halos safety architecture. Moreover, Google recently launched Gemini ER 2.0 a reasoning model that functions as the high-level brain, while also able to manage orchestration of tasks and multi-robot interactions.

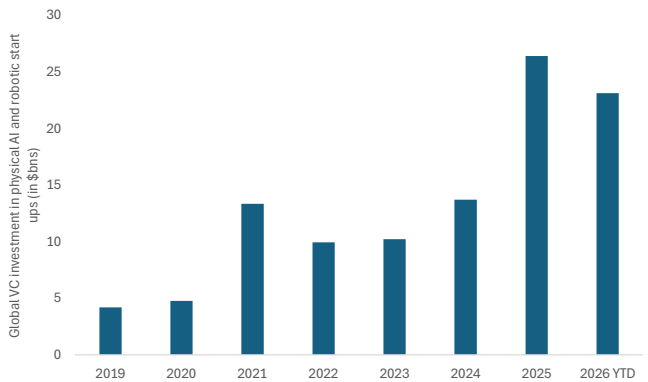
Many companies will also have more resources to utilize. One sign of evidence is the increasing pace of funding into robotics AI globally, per data from PitchBook on VC investments over the last several quarters and years (Exhibit 8 - Exhibit 9).

Exhibit 8: Global VC investment in robotics has been rising



Source: PitchBook

Exhibit 9: Global VC investment in physical AI and robotics companies annually



2026 YTD is through May 20

Source: PitchBook

We discuss key regional and company updates in the next section of this report.

Progress on humanoids by region

A) China -We identify three major types of players

- **AI native, model-driven companies are constantly innovating on AI model architecture and data collection in the pursuit for better intelligence.** Since 2026, model discussion is moving beyond a narrow VLA-only framing toward execution-oriented multimodal stacks: specifically, rapid VLA-world model integration followed by VLA refinement, such as VTLA i.e. adding touch where physical interaction quality matters most. World models were discussed less as a standalone model category and more as a functional layer alongside action models: VLA or VTLA handles policy and action generation, while world-model capabilities improve whether, when, and how actions should be executed through next-state prediction, action validation before commitment, and stronger planning and

robustness under real-world uncertainty. The VLA (Visual-Language-Action model) + WAM (World-Action-Model) with multiple layers of agents has become the industry's AI model mainstream, while different players' view on model training data strategy still diverge. Against that backdrop, model scale is moving higher, with the discussion around larger stacks in the c.40B-80B range vs. smaller single-digit-billion-parameter to 20B pre-training systems. Model players argue that multiple rounds of iteration are still ahead before these stacks are deployment-ready withconsistent quality. High-quality, real-world, multi-dimensional data remains the primary bottleneck to practical deployment, but the discussion has clearly moved beyond broad "data recipe" debates toward what scalable data acquisition architecture can reliably produce that data. Within that shift, human-centric and ego-centric collection increasingly looks like the preferred real-world collection method for high-fidelity data, especially where companies care about preserving natural motion, contact-rich interaction, and cross-embodiment transfer. Based on what we've observed during 2026 World Robot Conference (WRC), there is a growing emphasis on model engineering capability, scientific data collection methodologies, effective data frames, and efficient conversion into high-quality, usable data, underscoring a constructive balance between scalability, cost, and quality.

- **Motion Control/robot companies focus more on whole-body control and locomotion with impressive learning and demonstrations of different physical capabilities.** These companies have increasingly shifted from traditional dynamics control to reinforcement learning (RL) algorithm paradigms, while rapid domestic supply chain iterations have boosted joint power density, strengthening the dynamic adaptability and self-recovery capabilities of all-electric humanoids. The technology advancement in 2026 YTD are reflected in two key areas: (1) the deep integration of Whole-Body Control (WBC) has been bridging the gap between locomotion and manipulation, enabling robots to perform continuous upper-limb tasks while moving, such as wiping while walking or catching objects without slowing down; and (2) peak performance has improved materially, with outdoor running speeds surging to 5–6 m/s compared to last year's 2–3 m/s, paired with much smoother motion transitions during high-frequency tasks. The upcoming focus and challenges lie in deepening the high-frequency coupling of "hand-eye-foot" coordination, as well as enhancing thermal management, wear resistance, and the fatigue control of internal flexible wiring harnesses under harsh environments like dust, extreme temperatures, and oil stains to ensure long-term hardware reliability during high-intensity operations. Furthermore, the industry must still bridge the Sim-to-Real generalization gap, minimize control latency caused by brain-cerebellum coordination, and optimize algorithms to extract maximum torque output near the hardware's physical limits. The rate of improvement in the "cerebellum" layer remains impressive: at the 2026 World Humanoid Robot Games (WHRG), first-place results in track-and-field events showed material improvements over 2025 (e.g., 400m winning time improved by ~57% to 38.15 seconds), while tighter autonomy and time-limit rules made the Games a more demanding test of motion control, power/thermal management and system reliability.

- **Supply chain/hardware companies are proliferating from diverse backgrounds with blurring boundaries in the value chain and meaningful competition risks**. Over the past few years, China's humanoid robot component market has witnessed a massive influx of diverse players from sectors like electronics, automotive, home appliances, and traditional machinery. Through rapid product innovation and design optimization, these suppliers are driving down the costs of both individual components and complete humanoid assemblies—a deflationary trend that has been a strong foundation, enabling the fast iteration for the humanoid robot startups. We believe that the components for rotary and linear actuators currently face limited supply bottlenecks, thanks to the dynamic domestic manufacturing ecosystems. However, the dexterous hand remains a universally recognized challenge in terms of technical maturity and cost reduction. While the presence of dexterous hands grew visibly since 2025 with more players entering the market, dexterous hand technology routes remain fragmented, with no consensus on the optimal configuration. Notably, the 2026 WHRG's newly introduced dexterous-hand category within the real-world application events highlighted fine manipulation as a key remaining hardware bottleneck, but one with high commercial relevance given its importance to practical task execution. Amidst this intense competition, we note that the boundaries of the component-module-body value chain are blurring, with many players seeking a higher content value by expanding their product lines. Component suppliers are aggressively moving upstream into modular assemblies, while robot makers are internalizing component production to control costs, reshuffling the industry landscape.

B) North America -

- **Tesla** - On Tesla's 2Q26 call, the company commented that the first generation product lines for Optimus were being installed at the Fremont factory with anticipated production in 2026. Recall the company plans to use Optimus for internal purposes to start, and Tesla hopes to begin shipping to external customers by the end of 2027. Tesla's management has previously said that it believes it can get to >1 mn annual units per year for Optimus by the end of the decade. Notably, Tesla described Optimus as being a complex technical challenge with a likely quite flat and long initial ramp on the S-curve. Tesla also commented that it expects Optimus units to initially go to its academy for data collection and training, suggesting to us that it could take time before Optimus is deployed for useful work and/or external shipments in a material manner. On Optimus v4, management highlighted that it will be more integrated than Optimus v3 (e.g doing more of the PCB work in house). Finally, when we met with Tesla's head of the Optimus program and IR in March 2026 (note linked here), the company discussed that it was making good progress with the hand and forearm. Tesla has said historically that it believes the cost of Optimus can reach $20-$30K at scale.
- **Boston Dynamics (part of Hyundai)** - At CES 2026, Boston Dynamics unveiled its production ready version of its all electric Atlas bot. Notably, Hyundai and Boston Dynamics outlined a product roadmap including the intent to leverage Hyundai manufacturing infrastructure and large scale production data to train Atlas. In

addition, Boston Dynamics said it will collaborate with Google Deepmind and Nvidia on the software and foundation model for Atlas. Boston Dynamics and Hyundai will also set up a Robot Metaplant Application Center (RMAC) in 2026 to train Atlas with human collaborations. Management expects RMAC-trained Atlas will be deployed for repetitive sequence tasks by 2028 and for complex tasks by 2030. Boston Dynamics aims to achieve Atlas capacity of 30,000 robots/yr by 2028. Hyundai Mobis will be responsible for producing Atlas key components such as the actuators.

- **Figure AI** - In April 2026, Figure discussed that it increased production at its BotQ facility, highlighting that its production grew from 1 Figure 03 bot per day to 1 per hour. The company also stated that it has transitioned from the prototype phase to the production phase with dedicated lines for all critical modules of the system. Notably, the following month, Figure conducted a live stream of ~200 hours (over 8 days) with its Figure 03 bot sorting packages. The company stated on X that the robots were not teleoperated. Management also launched its Helix 02 model (Figure's VLA model) which enables full body control and connects to more sensor inputs vs its prior model.
- **Agility** - Agility gave company and business updates in June 2026. Notably, the company highlighted that it is planning to launch Digit v5 in 2H26, which expands the potential deployment environments for Digit. This includes the ability to safely work alongside humans, aided in part by utilizing the Nvidia Halos safety system, and improved functionality (e.g greater lifting capacity) as compared to Digit v4. The company also discussed its business model with both a RaaS and complete ownership offering, with more than $300 mn of contracts already secured for Digit v5 (with the majority of that under its RaaS business model that support ~1K bots). On BoM cost, management commented that it believes Digit v5 BoM can get down to ~$30K at 10K units a year (down from ~$125K for Digit v4 currently). Recall, management highlighted that its RoboFab has the capacity to scale to 10K+ robots a year. Lastly, Agility has also expanded its customer base with the company announcing commercial agreements with Toyota Motor Manufacturing in February 2026 (after a successful pilot, per Agility) and with Mercado Libre in December 2025. Recall Digit is already deployed with Schaeffler, GXO Logistics, and Amazon.
- **1X** - In October 2025, 1X launched its pre-order book for its home humanoid robot NEO. For a $200 refundable deposit, customers can indicate interest to purchase a NEO for $20K or lease/subscribe for $499 a month. 1X expects US deliveries to start in 2026. The company also highlighted in a blog post in April 2026 that pre-orders in the first five days exceeded its entire production capacity of 10K bots for the next year. Additionally, in the same post, the company commented that it plans to scale production to 100K+ annually by the end of 2027. Importantly, NEO will work autonomously for some tasks, but owners can schedule time with a 1X expert to help remotely when needed.
- **Mobileye** - On the Mentee robotics product roadmap, the company commented on its 2Q26 call that it is on track for a 2028 commercial launch of its v4 robot (expecting ~500 units in 2028), with v3.5 expected later this year and v4 production intent units in 1Q27. Notably, management discussed that it believes its humanoid deployments will begin with a B2C business model rather than B2B, citing the B2B

market as needing specific customization for each customer. Recall Mobileye acquired Mentee robotics in 1Q26.

C) Korea: Two Primary Roles in the Global Robotics Ecosystem

Key Enablers for Humanoid Developers (Ex-China): South Korea is uniquely positioned as a critical supply-chain partner for non-Chinese humanoid developers, leveraging its robust automotive-parts ecosystem to lead in humanoid actuator production. US-based developers are increasingly sourcing these critical components from Korean suppliers. For example, Boston Dynamics selected Hyundai Mobis to supply actuators for its next-generation Atlas humanoid, while HL Mando—already a supplier of quadruped robot actuators in the US—is preparing for a pivot into humanoid actuator mass production in the US. The country also features a mature domestic robotics ecosystem of established players and agile startups. Robotis (founded in 1999) is expanding its global footprint by preparing for mass actuator production at its new Uzbekistan facility. Additionally, South Korea has a high concentration of developers specializing in dexterous robotic hands, a capability that evolved from its strong industrial gripper manufacturing base.

Rapid Adoption of Humanoids: South Korea is poised to be a leading adopter of humanoid robotics, driven by its dense manufacturing base, early-adopter culture, and aggressive government backing. With the world's highest industrial robot density across the semiconductor, automotive, shipbuilding, and steel sectors, South Korea provides a vast repository of physical manufacturing and operational data. This real-world data is vital for training AI models and bridging the "sim-to-real" gap. This high exposure has also fostered strong public acceptance and a tech-forward culture. Rapid population aging and a heavy reliance on manufacturing create an urgent domestic need for automation. To address this, the South Korean government launched the K-Humanoid Alliance (and the broader M.AX Alliance for manufacturing AI transformation). The government aims to produce 1,000 humanoids annually by 2029, supported by a 700 billion won (approximately $500 million) funding injection in 2026. Furthermore, the state is accelerating the domestic robot foundation model ecosystem by allocating high-end GPUs (such as Nvidia's H200 and B200) to national AI projects.

Raising humanoid forecast, with early roles in logistics and warehouse operations; BOM costs set to fall as volumes rise

We are raising our forecast for the humanoid market, as robots from several providers are increasingly set to move into larger scale prototypes and toward commercial production. The industry is also benefiting from new open-sourced tools, rising funding, and government support.

Based on our industry discussions and company commentary, there is improved momentum in the near-term, especially in Asia, and for robots that may utilize certain lower cost capabilities (e.g. wheels, or having fewer degrees of freedom than a bi-pedal robot with dexterous hands). These solutions can be logical in our opinion in certain environments, including data gathering and/or more repetitive tasks that make sense for early deployments given that they can be structured but somewhat varied.

Our new base-case forecast is similar in overall volume to our prior bull case. We now expect shipments to reach 75K in 2026, 890K in 2030, and 6.5 mn in 2035, up from 51K/256K/1.4 mn previously.

Exhibit 10: Global humanoid robot TAM with updated breakdown on robot specs with respective ASP/BOM cost trends

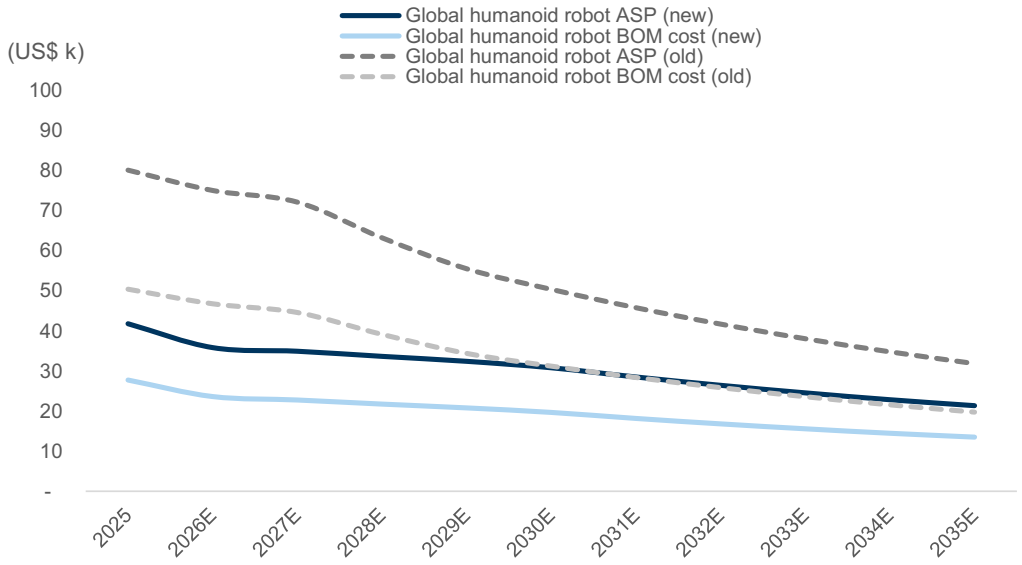
Global humanoid robot industry	2023	2024	2025	2026E	2027E	2028E	2029E	2030E	2031E	2032E	2033E	2034E	2035E
Global humanoid robot TAM (US$ mn)	**59**	**120**	**613**	**2,687**	**5,169**	**10,059**	**19,240**	**27,429**	**37,710**	**51,966**	**71,775**	**99,357**	**138,300**
yoy		102%	411%	338%	92%	95%	91%	43%	37%	38%	38%	38%	39%
High specs	-	9	44	370	1,109	2,861	6,679	10,469	15,076	21,705	31,246	44,990	64,801
yoy			379%	746%	200%	158%	133%	57%	44%	44%	44%	44%	44%
Mid specs	39	71	355	1,444	2,771	5,100	9,118	12,813	17,182	23,082	31,058	41,852	56,938
yoy		83%	400%	307%	92%	84%	79%	41%	34%	34%	35%	35%	36%
Low specs	20	40	214	873	1,289	2,098	3,443	4,147	5,451	7,179	9,471	12,515	16,561
yoy		95%	439%	307%	48%	63%	64%	20%	31%	32%	32%	32%	32%
Global humanoid robot ASP (US$)	**59,265**	**52,115**	**41,788**	**35,830**	**34,930**	**33,649**	**32,411**	**30,804**	**28,507**	**26,428**	**24,544**	**22,833**	**21,349**
yoy		-12%	-20%	-14%	-3%	-4%	-4%	-5%	-7%	-7%	-7%	-7%	-6%
High specs	394,363	198,805	149,208	123,380	107,056	95,705	86,547	78,379	71,230	64,930	59,359	54,417	50,017
yoy		-50%	-25%	-17%	-13%	-11%	-10%	-9%	-9%	-9%	-9%	-8%	-8%
Mid specs	86,354	68,531	53,743	42,797	37,451	33,453	30,117	27,150	24,507	22,148	20,038	18,147	16,584
yoy		-21%	-22%	-20%	-12%	-11%	-10%	-10%	-10%	-10%	-10%	-9%	-9%
Low specs	37,101	32,640	27,583	22,815	20,257	17,993	16,112	14,555	13,294	12,170	11,168	10,272	9,469
yoy		-12%	-15%	-17%	-11%	-11%	-10%	-10%	-9%	-8%	-8%	-8%	-8%
Global humanoid robot BOM cost (US$)	**39,543**	**34,541**	**27,744**	**23,624**	**22,765**	**21,744**	**20,794**	**19,668**	**18,166**	**16,809**	**15,581**	**14,468**	**13,505**
yoy		-13%	-20%	-15%	-4%	-4%	-4%	-5%	-8%	-7%	-7%	-7%	-7%
High specs	236,618	119,283	89,525	74,028	64,233	57,423	51,928	47,027	42,738	38,958	35,616	32,650	30,010
yoy		-50%	-25%	-17%	-13%	-11%	-10%	-9%	-9%	-9%	-9%	-8%	-8%
Mid specs	56,130	44,545	34,933	27,818	24,343	21,744	19,576	17,648	15,930	14,396	13,025	11,796	10,780
yoy		-21%	-22%	-20%	-12%	-11%	-10%	-10%	-10%	-10%	-10%	-9%	-9%
Low specs	25,971	22,848	19,308	15,971	14,180	12,595	11,278	10,188	9,305	8,519	7,818	7,190	6,628
yoy		-12%	-15%	-17%	-11%	-11%	-10%	-10%	-9%	-8%	-8%	-8%	-8%

Global shipment (unit)	2023	2024	2025	2026E	2027E	2028E	2029E	2030E	2031E	2032E	2033E	2034E	2035E
Base	**1,000**	**2,300**	**14,668**	**75,000**	**147,969**	**298,953**	**593,630**	**890,445**	**1,322,852**	**1,966,338**	**2,924,391**	**4,351,424**	**6,477,908**
yoy		130%	538%	411%	97%	102%	99%	50%	49%	49%	49%	49%	49%
High specs	-	46	293	3,000	10,358	29,895	77,172	133,567	211,656	334,278	526,390	826,771	1,295,582
Mid specs	450	1,035	6,601	33,750	73,984	152,466	302,751	471,936	701,112	1,042,159	1,549,927	2,306,255	3,433,291
Low specs	550	1,219	7,774	38,250	63,627	116,592	213,707	284,942	410,084	589,901	848,073	1,218,399	1,749,035

Source: Goldman Sachs Global Investment Research

With the market set to grow in volume, and in light of our expectation on mix, we update our BOM and ASP forecast which suggests a 7% per year decline in BOM costs and a 6% per year decline in ASPs (Exhibit 11).

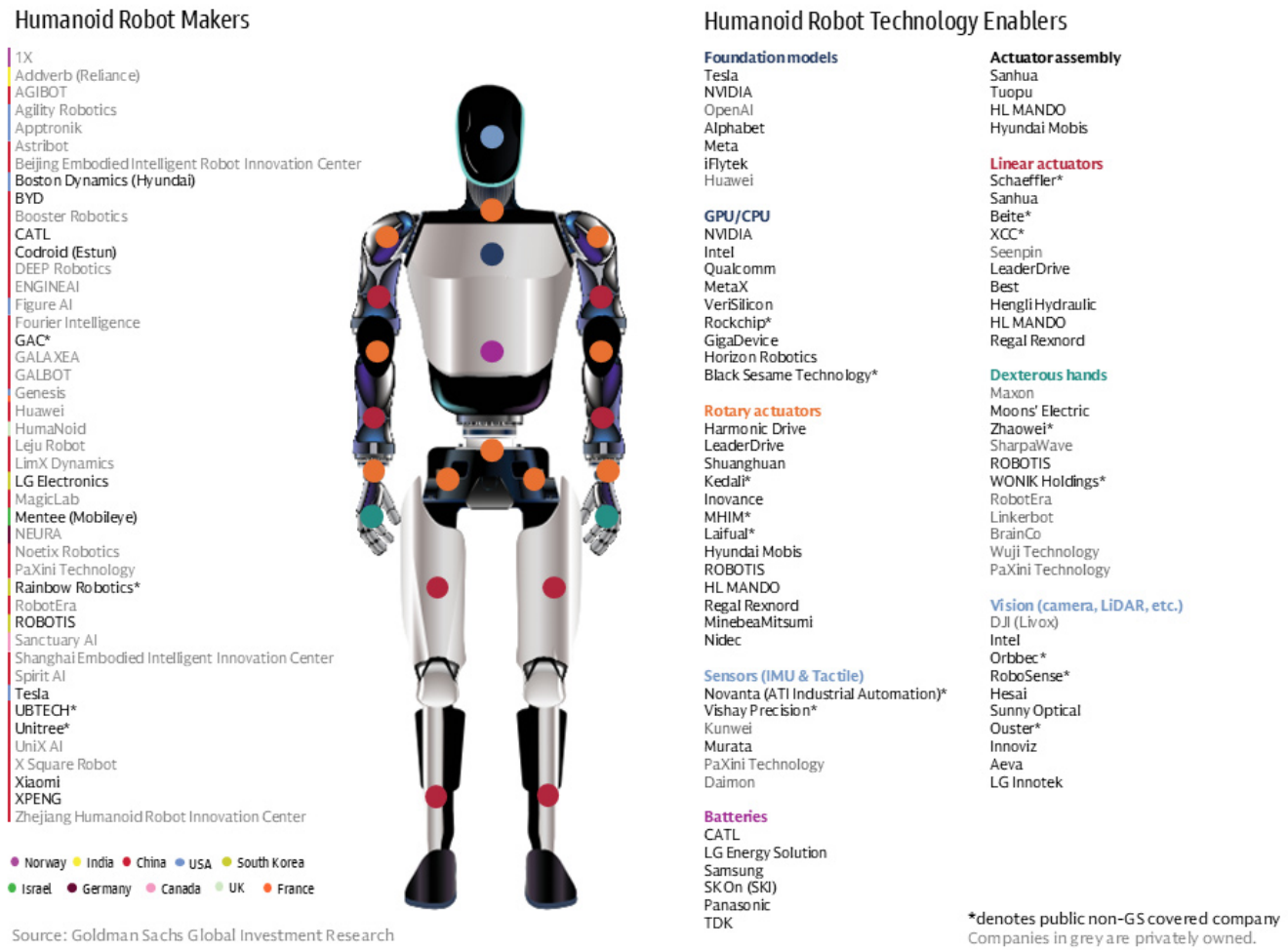
Exhibit 11: We see a 7% p.a. cost reduction for the global humanoid robot industry driven by scale and design optimization
Global humanoid robot ASP & BOM costs forecast (2025-2035E)



Source: Goldman Sachs Global Investment Research

We show an illustrative ecosystem of the global supply chain in Exhibit 12.

Exhibit 12: Mapping of global humanoid robot technology enablers



Source: Goldman Sachs Global Investment Research

The list of companies presented above is not exhaustive and the universe of companies involved is likely to be larger than what is presented.

Source: Goldman Sachs Global Investment Research

Robotics and Physical AI Survey highlights

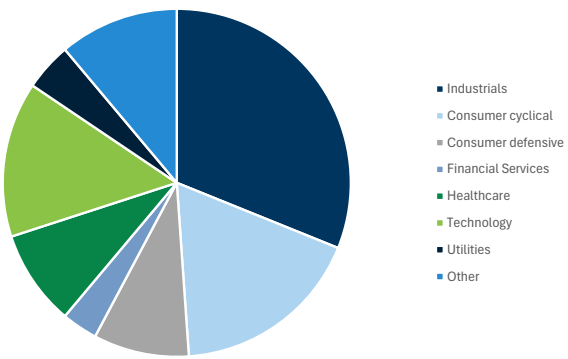
We recently launched our first **Executive Perspectives *powered by Goldman Sachs*** survey, a new global initiative that looks to capture insights directly from companies across our global coverage. For our first edition we received responses from >80 companies globally, across multiple industries, including industrials, autos, healthcare, utilities, consumer, and more, on robotics and physical AI, including humanoids. The survey gathered insights on adoption trends, investment priorities, and potential implications for productivity and financials over the next several years.

Some key takeaways include:

- ~30-35% of respondents are seriously evaluating/piloting use cases of general purpose robots and/or humanoids, and another ~35% of respondents have limited deployments
- ~70% of respondents currently use or expect to use general purpose and or humanoids for manufacturing/production.
- ~40% of respondents expect at least 10% of their workflows to be automated or materially enhanced by general purpose robotics/physical AI
- Respondents highlighted technology limitations/reliability and integration complexity as barriers to broader adoption.
- >35% of respondents expect general purpose robots/physical AI investments to become meaningfully accretive to earnings in 3+ years, while ~33% were uncertain of the impact or expected no impact to earnings.

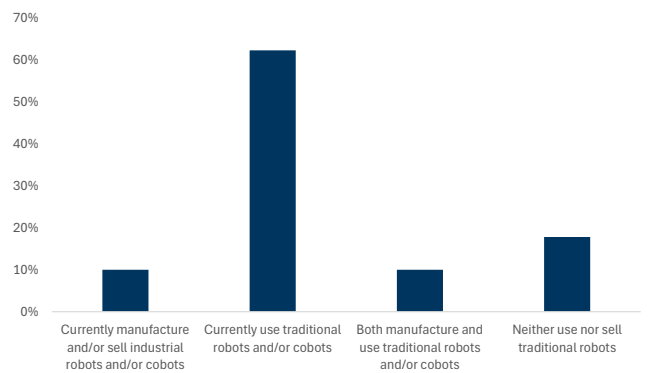
We detail the responses in the charts below.

Exhibit 13: Respondents by sector



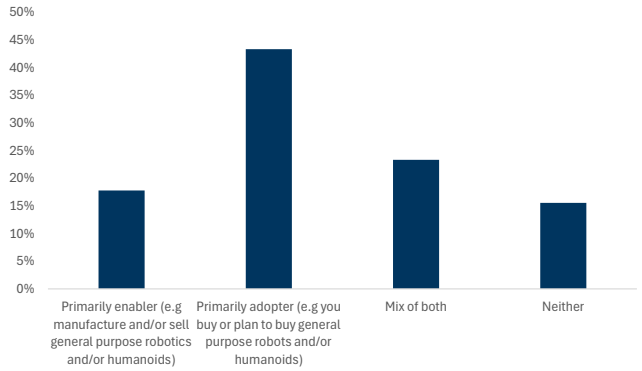
Source: Goldman Sachs Global Investment Research

Exhibit 14: Would you consider your company an enabler of physical AI/robotics (e.g. selling, manufacturing, and/or providing key technology or parts for general purpose/humanoid robots), or potential user of these robots (e.g. you buy or plan to buy general purpose robots and/or humanoids)?



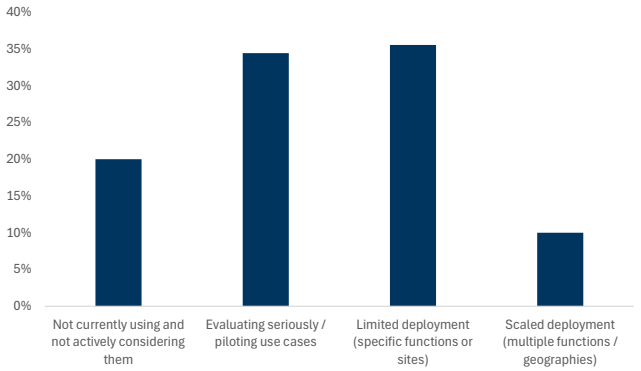
Source: Goldman Sachs Global Investment Research

Exhibit 15: Would you consider your company an enabler of physical AI/robotics (e.g. selling, manufacturing, and/or providing key technology or parts for general purpose/humanoid robots), or potential user of these robots (e.g. you buy or plan to buy general purpose robots and/or humanoids)?



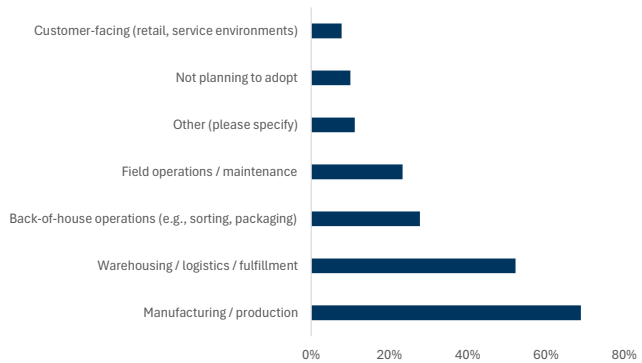
Source: Goldman Sachs Global Investment Research

Exhibit 16: With respect to using physical AI robotics, which best describes your company's current use of general purpose robots and/or humanoid robots?



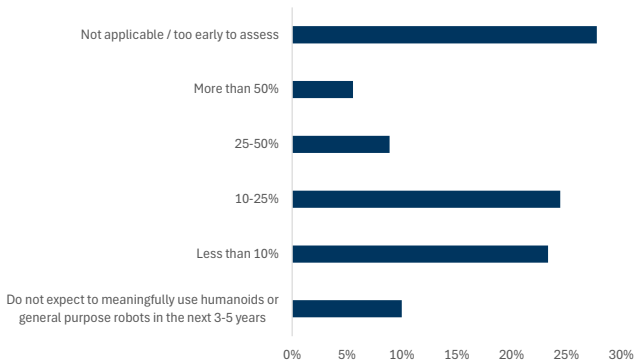
Source: Goldman Sachs Global Investment Research

Exhibit 17: Which functions do you currently use or expect to adopt general purpose and/or humanoid robotics for, enabled by AI? (select all that apply)



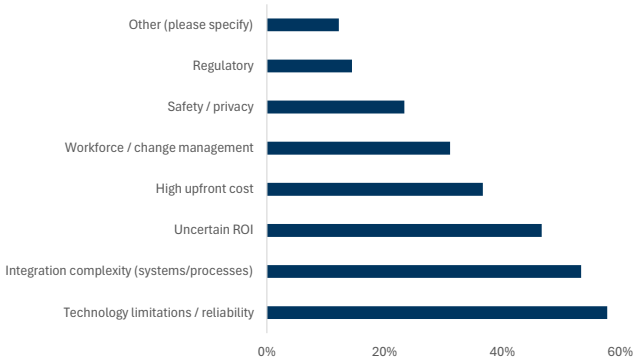
Source: Goldman Sachs Global Investment Research

Exhibit 18: What percentage of your company's relevant workflows or operational tasks could potentially be automated or materially enhanced by general purpose robotics / physical AI over the next 3-5 years?



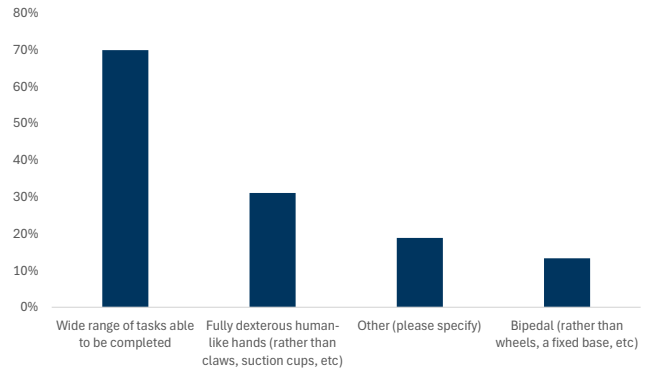
Source: Goldman Sachs Global Investment Research

Exhibit 19: What are the biggest barriers to broader adoption? (select all that apply)



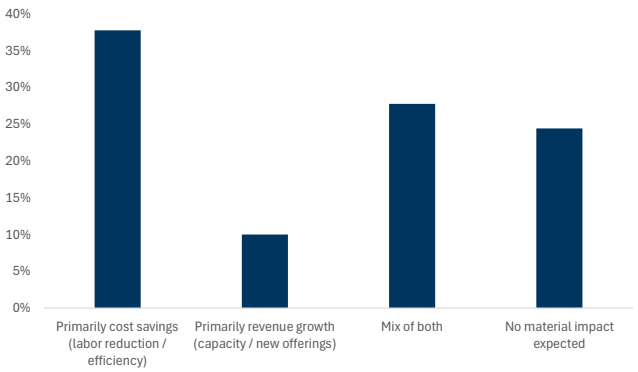
Source: Goldman Sachs Global Investment Research

Exhibit 20: Which features would a general purpose / humanoid robot need to have in order to be adopted by your organization (select all that apply)?



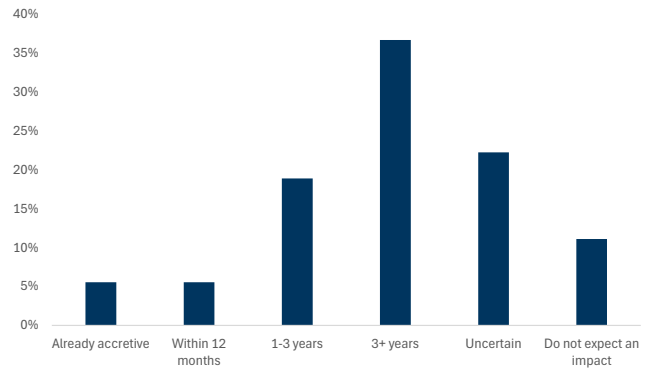
Source: Goldman Sachs Global Investment Research

Exhibit 21: What impact do you expect general purpose robotics / physical AI to have on your financials over the next 3 years?



Source: Goldman Sachs Global Investment Research

Exhibit 22: When do you expect general purpose robotics / physical AI investments to become meaningfully accretive to earnings?



Source: Goldman Sachs Global Investment Research

Warehouse automation - large potential to leverage a range of robotics and AI technology

We believe warehouse and logistics operations are a microcosm for automation, with deployments of various technologies including traditional robotic arms, machine vision/scanning tech, AMRs, and humanoids. As we discuss in this section, the market is likely still in the early innings of adoption, and we expect growing demand, in part from labor/supply chain trends.

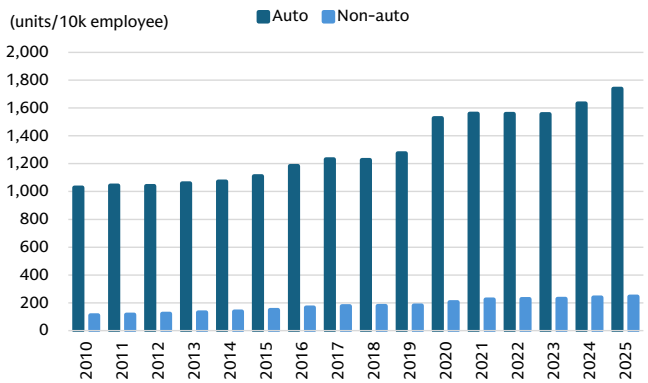
Warehouse automation remains underpenetrated, implies substantial upside potential for humanoids and other automation solution suppliers

Automation penetration in warehousing and logistics remains low relative to manufacturing verticals where robotics adoption is mature. The clearest reference point is automotive, where decades of investment have lifted robot density to nearly 1,800 units per 10,000 employees, versus 250 across non-automotive manufacturing industries (Exhibit 23). This comparison is directional rather than a direct measure of warehouse automation, as IFR or any other automation statistics do not fully capture

automated warehouse/logistics systems. Nevertheless, the concentration of robot adoption in standardized manufacturing processes highlights the substantial automation headroom remaining in labor-intensive warehouse activities.

Financials from our covered companies support this view - Daifuku, the global leader in material-handling systems, has compounded revenue at 10% over the past 15 years, materially ahead of the broader Japan capital-goods universe (Exhibit 24), or industrial robotics players such as Fanuc (4%) or Yaskawa (4%). We view this outperformance as evidence that warehousing is already moving from manual operations toward commercial adoption of automation, while remaining far from full penetration.

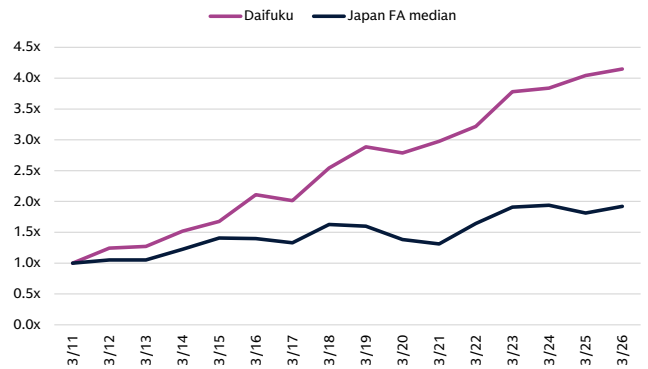
Exhibit 23: Penetration of automation solutions is rising for non-auto, but is still far behind the automotive industry in the US
Trends in US robot density (penetration) per 10k workers



Estimated robot volume captured through MOF. Workers in durable goods used to calculate non-autos penetration.

Source: U.S. Bureau of Labor Statistics, Japan's Ministry of Finance (MOF), Goldman Sachs Global Investment Research

Exhibit 24: Revenue growth of Daifuku, one of the very few listed warehouse automation players, continues to outperform the factory automation industry
Revenue growth comparison in between Daifuku vs Factory Automation peers



Most Japanese firms report in March Fiscal Year end. Daifuku changed its fiscal year-end in 2024. On the horizontal axis, FY3/25 corresponds to Daifuku's FY12/24, and FY3/26 corresponds to Daifuku's FY12/25.

Source: Company data, Data compiled by Goldman Sachs Global Investment Research

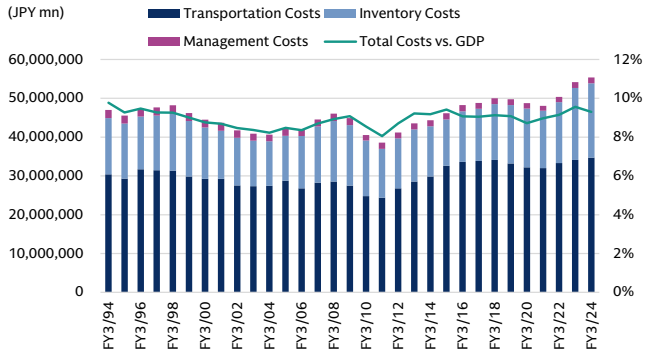
Logistics costs have faced and will face structural upward pressure

Logistics costs are subject to increasingly structural pressure from labor shortages, wage inflation, logistics pricing, and higher inventory intensity. The trend is particularly visible in Japan. Industry data shows warehouse operating costs rising over recent years (Exhibit 25), while the economy-wide logistics-cost ratio, after declining for much of the prior two decades, has re-inflected toward historically elevated levels (Exhibit 26).

The composition of the increase is important. Inventory-related costs are near historical peaks, with the burden concentrated in raw materials and work-in-progress rather than finished goods (Exhibit 28). This does not translate one-for-one into greater picking volume, but it does increase storage, handling, location management, sorting, and production-staging requirements, which are workflows directly addressable through automated storage and retrieval, conveyance, and sortation systems.

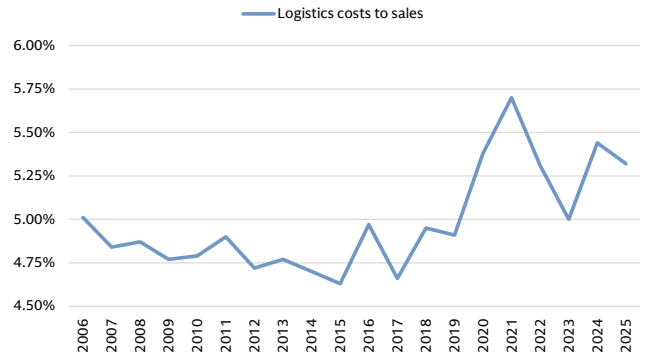
The US trend is less pronounced on the available inventory-management measures (Exhibit 32). Japan therefore appears to face the more immediate pressure, while also providing a potential leading indicator of the operational challenges that tighter labor markets and higher service requirements could create elsewhere.

Exhibit 25: Post GFC & Covid, we are witnessing structural increases in logistics costs
Trends in warehouse operating costs in Japan



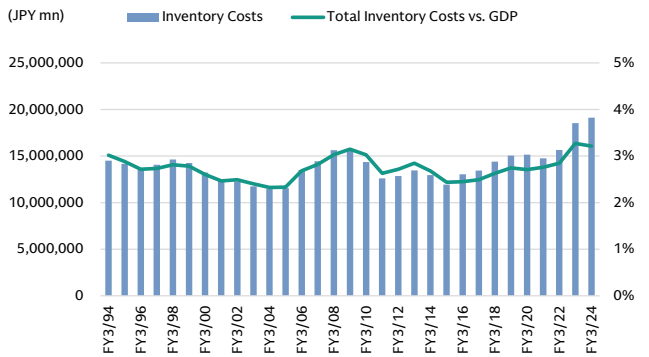
Source: Japan Institute of Logistics Systems, Data compiled by Goldman Sachs Global Investment Research

Exhibit 26: The importance of logistics costs became more visible since Covid
Trends in logistics costs to sales in Japan



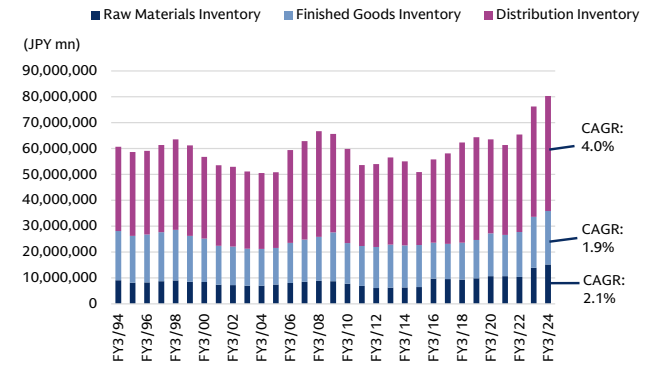
Source: Japan Institute of Logistics Systems, Data compiled by Goldman Sachs Global Investment Research

Exhibit 27: Cost burdens from inventories are on a solid increasing trend
Trends in inventory costs in Japan



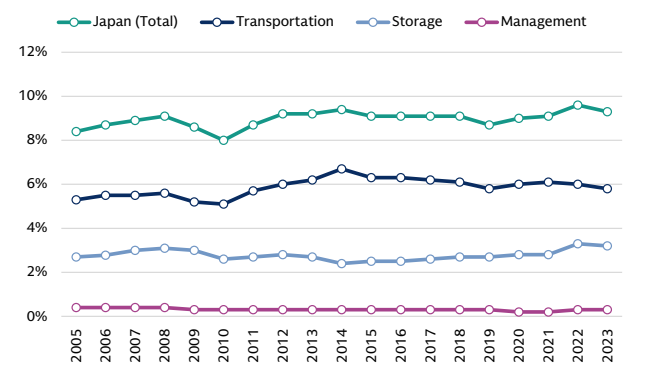
Source: Japan Institute of Logistics Systems, Data compiled by Goldman Sachs Global Investment Research

Exhibit 28: Distribution inventory has had the highest growth through last two decades
Breakdown of inventory components in Japan



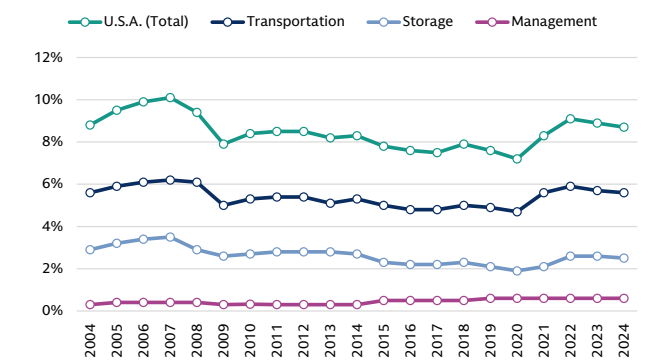
Source: Japan Institute of Logistics Systems, Data compiled by Goldman Sachs Global Investment Research

Exhibit 29: Transportation costs (of items/inventories) are becoming larger cost burden, further weighing on logistics costs in Japan
Japan: Logistics costs breakdown vs. GDP



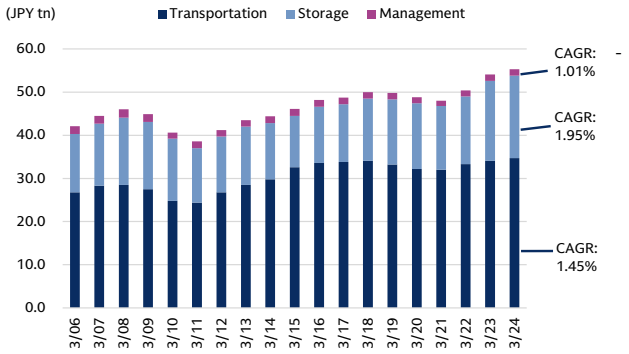
Source: Japan Institute of Logistics Systems, Data compiled by Goldman Sachs Global Investment Research

Exhibit 30: Acute increase visible in the US, especially after Covid
US: Logistics costs breakdown vs. GDP



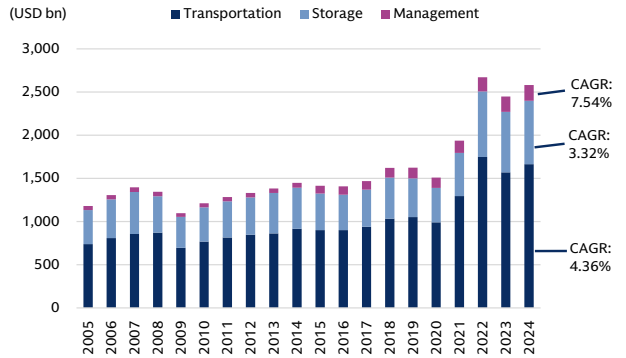
Source: Japan Institute of Logistics Systems, Data compiled by Goldman Sachs Global Investment Research

Exhibit 31: The rise in storage cost was the highest in Japan through FY3/24
Trends in logistics costs breakdown in Japan



Source: Japan Institute of Logistics Systems, Data compiled by Goldman Sachs Global Investment Research

Exhibit 32: The surge in the management cost and the transportation cost is visible in the US
US: Logistics costs breakdown



Source: Japan Institute of Logistics Systems, Data compiled by Goldman Sachs Global Investment Research

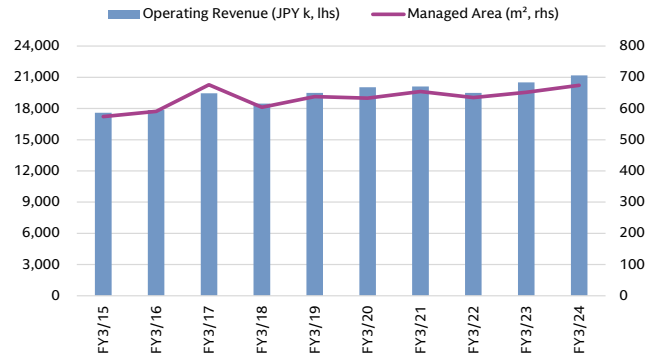
Rising work content and operating complexity tailwind for automation

The second structural driver is the expanding operating scale managed by each warehouse employee. Data shows floor area and revenue per worker increasing over time (Exhibit 33). These measures do not necessarily imply greater physical workload in isolation, but they indicate that warehouse operators must manage more activity and capacity with a more expensive labor base.

Demand-side complexity compounds the pressure. MonotaRO's expanding product line-up and inventory SKU count illustrate the growth in assortment breadth (Exhibit 34), while TRUSCO reports rising inventory items alongside higher labor cost per shipment line (Exhibit 35). Shorter delivery lead times have also shifted from a competitive differentiator toward a baseline customer requirement across manufacturing and distribution markets.

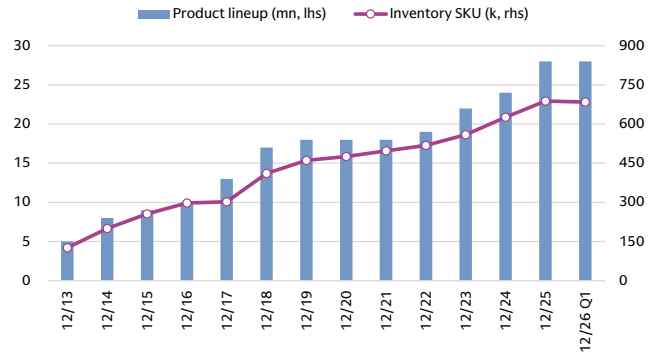
More SKUs, fragmented order profiles, faster turnaround requirements, and rising labor costs make continued expansion through manual labor increasingly difficult. We therefore see the need for warehouse productivity investment as structural rather than cyclical. The remaining question is not whether automation penetration rises, but which solutions—fixed automation, AMRs, robotic manipulators or humanoids—are best suited to each remaining workflow.

Exhibit 33: Burden/tasks done by each worker are seeing the constant increase through the cycle
Trends in floor area and revenue per worker in the logistics industries



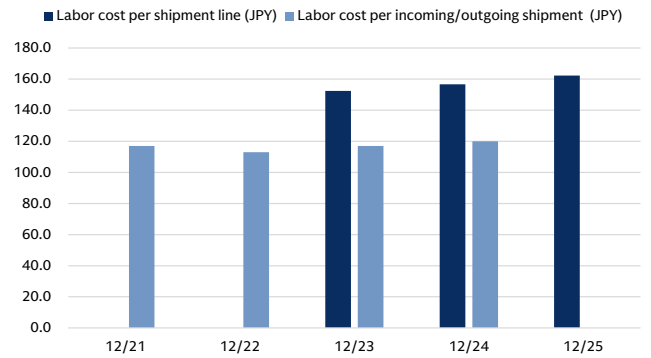
Source: Japan Institute of Logistics Systems, Data compiled by Goldman Sachs Global Investment Research

Exhibit 34: Japanese E-commerce company's annual data showing the complexity/diversification of products/SKUs resulting in more burden on workers
Monotaro (3064.T): Product line up and inventory SKU



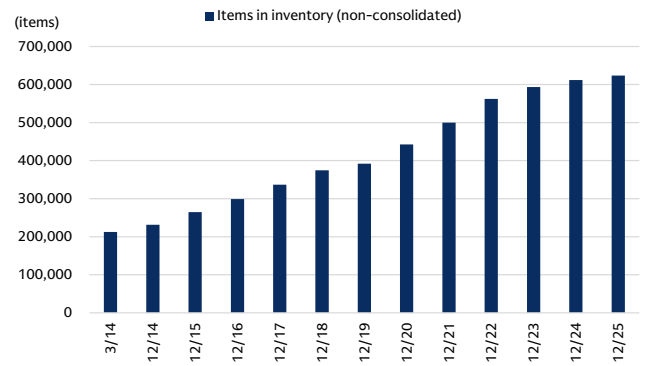
Source: Company data, Data compiled by Goldman Sachs Global Investment Research

Exhibit 35: Another Japanese E-commerce company's data shows the increase in labor cost inevitable trend
Trusco Nakayama (9830.T): Labor cost per shipment line/shipment



Source: Company data, Data compiled by Goldman Sachs Global Investment Research

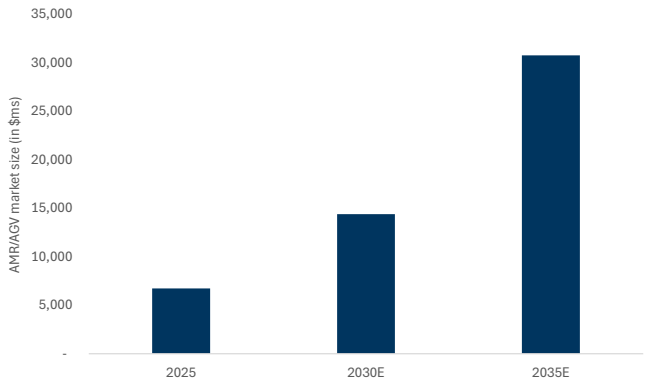
Exhibit 36: Number of items handled by these E-commerce players are steadily rising
Trusco Nakayama (9830.T): Items in inventory



Source: Company data, Data compiled by Goldman Sachs Global Investment Research

On a global basis, our analysis of AMR (autonomous mobile robot) providers and industry data suggests that the market is poised to expand from the historical $5-10 bn level or ~150-250K units. Assuming future growth rates on par with other robotics and tech industries, we estimate that this market could be ~$30 bn in 2035. We see AMRs/AGVs as a part of the range of solutions that will likely include humanoids and other general purpose robotic technologies in warehouse and logistics roles. **We detail robotics and automation trends at two of the biggest retailers - Amazon and Walmart - in the next section of this report**.

Exhibit 37: We expect the AMR/AGV market to grow



Source: Goldman Sachs Global Investment Research

Case studies on role of automation & robotics in warehouses for the retail industry - Amazon and Walmart

Amazon (AMZN)

Amazon's warehouse automation serves as an unlock for greater efficiency and margin expansion. Amazon is moving from singular point automation (e.g., robotic arms,pick and sort) towards system-level automation where AI coordinates the backend supply chain efforts for a warehouse. Amazon's commentary points to fulfillment automation as a way to localize inventory, reduce distance traveled and touches per package, increase units per box, and reduce cost to serve for same-day/next-day delivery. This becomes increasingly important as Amazon is expanding speed-sensitive categories such as everyday essentials and perishables. **Looking ahead, we believe Amazon remains in the early innings of extracting productivity gains from automation, robotics, and AI, providing a multi-year opportunity for shipping and fulfillment costs to grow below unit volumes and supporting continued core retail margin expansion.**

We expect that Amazon will continue to lower its cost to serve per unit, (defined as reported fulfillment expense excluding SBC and payment processing + shipping per unit) as management remains committed to improving efficiency levels in the Stores business. We currently forecast cost to serve per unit remains 4% above 2019 levels to account for cost input inflation (relatedly, we model a modest ~100 bps of leverage in fulfillment expense over the next 4-5 years) but believe there is additional room for cost reduction with more automation layered into the supply chain. **To illustrate this potential we estimate ~5.6% of leverage in total cost to serve from 2026E - 2030E (which translates into an ~11% reduction on a per unit basis by 2030E) could result in a collective ~$72 bn cost savings and represent ~240 bps of margin tailwind to consolidated EBIT by 2030.**

Cost to Serve per Unit To Decline In the Years Ahead...
Recent reductions in ASP (as AMZN leans into everyday essentials) have served as a headwind to margins and we see standalone/small everyday essential orders as

having poor (but improving) unit economics. Using its strategy of offering greater convenience and consistently low prices on frequently purchased items, Amazon increases customer engagement, purchase frequency, and ultimately its share of consumer wallet. However, our calculations point to Amazon likely losing money on orders that only contain a single low-ASP item, as there is likely not enough merchandise profit to cover Amazon's cost to serve. We estimate the breakeven ASP (i.e., the GMV per unit required to cover Amazon's cost) to be ~$20+. Assuming the cost to serve is effectively lowered though Amazon's automation efforts (from ~$6.50 to ~$5.60), we update our prior estimates and calculate $5+ (from prior $6+) of merchandise profit per unit to cover its cost to serve. We'd note this assumed breakeven ASP may be conservative given this assumes that cost to serve does not decline with ASPs (as the unit still needs to be shipped/fulfilled), so we could be overstating the loss per order as some low-ASP items can have a lower cost to serve (vs. our analysis applying our calculated average cost to serve across all units).

Exhibit 38: Essentials and Low ASP Items Likely Generate Lower Gross Profit per Unit
$MGP/Unit

AMZN 1P Merchandise Profit per Unit Analysis ($MP/U)

$MP/U	Merchandise Margin						
ASP	20.0%	22.5%	25.0%	27.5%	30.0%	32.5%	35.0%
$ 14	$ 2.8	$ 3.2	$ 3.5	$ 3.9	$ 4.2	$ 4.6	$ 4.9
$ 16	$ 3.2	$ 3.6	$ 4.0	$ 4.4	$ 4.8	$ 5.2	$ 5.6
$ 18	$ 3.6	$ 4.1	$ 4.5	$ 5.0	$ 5.4	$ 5.9	$ 6.3
$ 20	$ 4.0	$ 4.5	$ 5.0	$ 5.5	$ 6.0	$ 6.5	$ 7.0
$ 22	$ 4.4	$ 5.0	$ 5.5	$ 6.1	$ 6.6	$ 7.2	$ 7.7
$ 24	$ 4.8	$ 5.4	$ 6.0	$ 6.6	$ 7.2	$ 7.8	$ 8.4
$ 26	$ 5.2	$ 5.9	$ 6.5	$ 7.2	$ 7.8	$ 8.5	$ 9.1

Likely Zone for Low-ASP Essentials
Likely Zone for 1P Overall

Source: Company data, Goldman Sachs Global Investment Research

Exhibit 39: Despite low to negative contribution profits per unit, we are seeing improvements in $CP/U
$CP/U

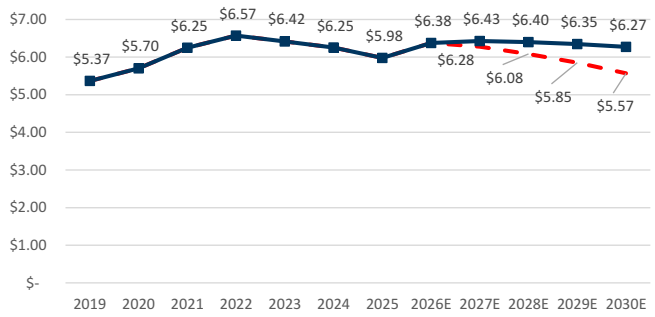
AMZN Contribution Profit per Unit Analysis Assuming 1 Unit Per Order ($CP/U)

$CP/U	Cost to Serve						
MP/Unit	$ 5.0	$ 5.2	$ 5.5	$ 5.7	$ 6.0	$ 6.2	$ 6.5
$ 2.0	$ (3.0)	$ (3.2)	$ (3.5)	$ (3.7)	$ (4.0)	$ (4.2)	$ (4.5)
$ 3.0	$ (2.0)	$ (2.2)	$ (2.5)	$ (2.7)	$ (3.0)	$ (3.2)	$ (3.5)
$ 4.0	$ (1.0)	$ (1.2)	$ (1.5)	$ (1.7)	$ (2.0)	$ (2.2)	$ (2.5)
$ 5.0	$ 0.0	$ (0.2)	$ (0.5)	$ (0.7)	$ (1.0)	$ (1.2)	$ (1.5)
$ 6.0	$ 1.0	$ 0.8	$ 0.5	$ 0.3	$ 0.0	$ (0.2)	$ (0.5)
$ 7.0	$ 2.0	$ 1.8	$ 1.5	$ 1.3	$ 1.0	$ 0.8	$ 0.5
$ 8.0	$ 3.0	$ 2.8	$ 2.5	$ 2.3	$ 2.0	$ 1.8	$ 1.5

Likely Zone for Low-ASP Essentials
Likely Zone for 1P Overall

Source: Company data, Goldman Sachs Global Investment Research

Exhibit 40: We see potential for a ~11% reduction in cost to serve per unit (from 2026E-2030E)
Cost to Serve Per Unit



Source: Company data, Goldman Sachs Global Investment Research

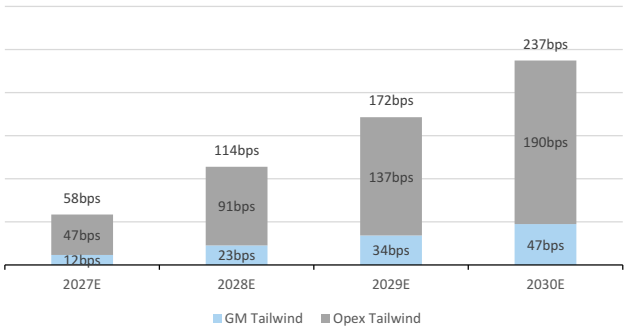
...Translates into an Improved Margin Profile

Assuming ~5.6% of leverage in cost to serve from 2026E to 2030E, we expect a total cost savings of ~$72 bn from robotics and automation efforts. We estimate ~80% of these savings to be in opex (defined as reported fulfillment expense excluding SBC and payment processing) and ~20% to be in COGS (shipping), which ultimately translates to a ~240 bps margin tailwind in consolidated EBIT by 2030 (with ~50bps of that coming from GM).

A lower cost-to-serve does more than simply reduce expenses, it improves Amazon's unit economics. This dynamic is particularly powerful given Amazon's scale, where modest reductions in per-unit cost to serve (~11%) translates to a more significant impact to bottom line (400 bps retail EBIT margin tailwind by 2030E). Improved economics also provides Amazon with greater strategic flexibility, whereby they can choose to reinvest profits into faster delivery speeds, lower consumer prices, or enhanced Prime benefits.

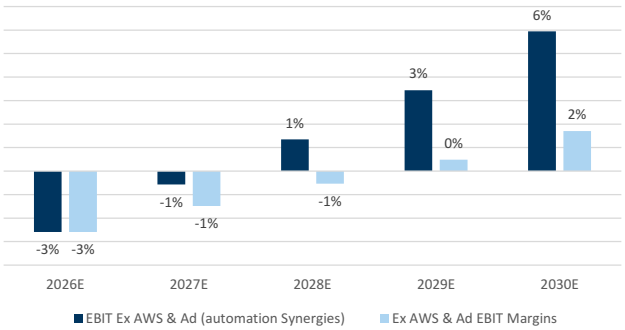
In our view, fulfillment efficiency is increasingly becoming a competitive differentiator rather than simply a cost center. As Amazon deploys robotics, AI-powered inventory placement, and autonomous warehouse technologies across its network, the gap between Amazon's fulfillment economics and those of smaller eCommerce competitors may continue to widen. This advantage not only supports margin expansion but also raises barriers to entry, as competitors lacking comparable scale and automation capabilities face a structurally higher cost-to-serve.

Exhibit 41: We should see most of the leverage from the fulfilment line
bps of leverage on consolidated EBIT



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 42: We expect to see a ~400 bps lift to EBIT margins in 2030
Retail Margins (current & with automation)



Source: Company data, Goldman Sachs Global Investment Research

To illustrate the robotics used in Amazon's warehouses we lay out their recent initiatives and note their post-COVID build out has significantly accelerated (Exhibit 43). We also note Amazon's comments around improved efficiency at their 12th-generation fulfillment center design that incorporates robotics inventions and simplifies stowing, picking, packing and shipping. This sped up fulfillment by 25% and increased the number of items they can offer same or next day by 25%. More recently, Amazon disclosed that it has deployed its over 1 million robots, across more than 300 facilities, and launched DeepFleet, a generative AI foundation model intended to improve robot fleet travel efficiency by 10%. These datapoints give us confidence that Amazon can continue to drive meaningful productivity gains, lower cost-to-serve, and sustained margin expansion over the coming years.

Exhibit 43: Amazon continues to infuse robotics into their warehouses

Robot	Launched	Description
Vulcan	2025	Amazon's first robot with a "sense of touch." Picks and stows items using force feedback and physical AI. Enables dexterous manipulation.
Sequoia	2023	End-to-end inventory storage and retrieval system that combines robots, AI, and computer vision. Allows inventory to be identified and stored up to 75% faster.
Sparrow	2023	Computer-vision robotic arm that picks individual items and places them into totes.
Packaging Automation	2023	Creates packages to fit dimensions, eliminating wasted materials.
Robin	2022	Robotic arm that identifies, picks up, and sorts packages from conveyor belts. Can also isolate damaged packages. Automates outbound package sorting.
Cardinal	2022	AI-powered robotic arm that selects packages, reads labels, and places them into the appropriate carts.
Proteus	2022	Moves carts of packages throughout facilities using onboard sensors and obstacle detection.
Hercules	2017	Mobile drive unit that moves inventory pods to employees for picking. Reduces employee walking time and increases pick efficiency.
Titan	2017	Larger version of Hercules capable of lifting roughly twice as much weight. Handles bulky products and heavier inventory pods. Enables automation of larger merchandise categories and increases storage density.

Source: Company data, Goldman Sachs Global Investment Research

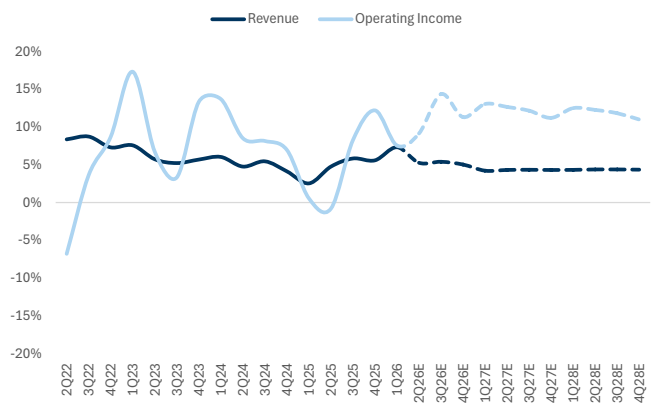
We maintain a Buy rating on AMZN. Our 12m PT of $375 is based on a sum-of-the-parts of EV/EBIT applied to North America and AWS segments, and EV/Sales applied to the International segment, all based on NTM+1 estimates. Key risks include: (-) Any impact to eCommerce or Cloud growth from competition; lack of success in scaling high margin businesses including Advertising, Cloud, third-party selling and the subscription business; investments across any array of initiatives creating a headwind to gross or operating margin; any product or platform changes necessary to comply with changes to the global regulatory environment; exposure to the volatility caused by the global

macroeconomic environment and investor risk appetite for growth stocks.

Walmart (WMT)

Walmart's supply chain automation represents a multi-year opportunity to drive efficiency gains while reinforcing the brand's value proposition. Walmart has made substantial investments in automation over the past several years, scaling the technology across its US supply chain as part of efforts to improve the efficiency of its grocery network and make it easier for associates to access inventory. These investments include new perishable distribution centers (DC), with five new high-tech perishables DCs expected to be built in total (three currently open) and four traditional perishable DCs to be expanded by adding over 500K sqft of automation per site. At these new DCs, associates work with high-tech systems to efficiently layer store orders (system puts fragile merchandise at the top and layers by department), easing the unloading process, maximizing truck space, and reducing transportation costs. Meanwhile, Walmart is also in the process of building five next generation fulfillment centers (four currently open), which leverage an automated, high-density storage system to streamline a manual 12-step process into 5 steps (unloading, receiving, picking, packing, shipping). When the company introduced these fulfillment centers (FC) in Jun'22, it projected that the new FCs could provide 75% of the US population with next- or two-day shipping on millions of items (95% when combined with Walmart's traditional FCs). We outline Walmart's other recent automation initiatives in Exhibit 45. **In our view, Walmart's efforts regarding automation and its second P&L with higher margin businesses (i.e., advertising, data, membership, fulfillment) are key contributors to the company's long-term algorithm of operating profit growth outpacing sales growth over time (Exhibit 44).**

Exhibit 44: We expect WMT's operating income growth to outpace revenue growth over the forecasted period
Y/Y revenue vs. operating income growth



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 45: Summary of notable automation initiatives at Walmart

Initiative	Launch	Description
Alphabot	2020	Autonomous carts that retrieve ambient, refrigerated, and frozen items for online grocery orders
Accelerated Pickup and Delivery (formerly Market Fulfillment Centers)	2021	Compact warehouse that stores items and uses automated bots to retrieve/transport items from the back of the store fulfillment center to a picking workstation
Symbotic Automation	2021	AI-powered system that leverages robotics and machine vision to break down pallets, store items at a case level, and build customer orders
Drone Delivery	2021	Drones that deliver customer orders directly to their door in 30 minutes or less
Next-Generation Fulfillment Centers	2022	Automated, high-density storage system that retrieves a purchased item, creates a custom-fitting box, and tapes, labels, and routes the item to designated area for shipping
FoxBot	2024	Forklifts that automate trailer loading and unloading
Symbotic Online Pickup/Delivery	2025	AI-enabled back of store micro-fulfillment platform that looks to accelerate online pickup and delivery options; Symbotic acquired the Accelerated Pickup and Delivery technology from Walmart

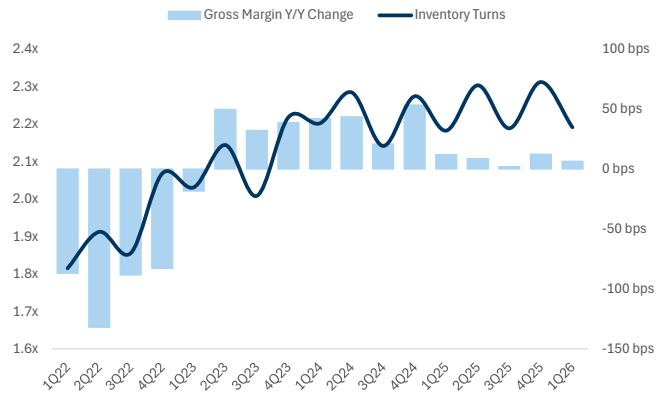
Source: Company data, Supply Chain Dive, Goldman Sachs Global Investment Research

Investment returns to-date have far exceeded productivity targets… Walmart's supply chain automation investments have attractive returns, far exceeding productivity targets (in some cases 30% better) as automation allows the company to better flow inventory at a lower cost with less manual labor. Notably, the company's automated FCs can manage 2x the capacity and throughput of an existing FC with the same footprint, with the excess space becoming available for 3P sellers. Automation has also increased inventory visibility and supply chain speed while lowering shipping costs (down consistently for several quarters in the 30% range as of Nov'25).

…and we see further margin upside in the long-term as Walmart continues to scale automation. As of Aug'26, 3.1k of the brand's US stores are served with some level of automated freight and over 50% of e-commerce fulfillment volume is processed through automated facilities, with automation contributing to Walmart US' e-commerce business achieving double-digit percentage incremental margins in F1H27. That said, Walmart believes it is only halfway through its progress, and we note that automation could serve as a lever for operating income growth in the coming years as it drives lower delivery costs, moderating labor growth, and an expanded 3P marketplace.

- **Lower inventory markdown activity.** We expect Walmart's gross margin to benefit from fewer overstocks and markdowns as automation increases inventory visibility. Management has called out lower markdown activity in recent quarters amid disciplined inventory management, due in part to automation initiatives. In Exhibit 47, we present a sensitivity analysis of Walmart's potential cost savings related to a further reduction in markdowns. We assume that the company has seen a 5-10% improvement in markdowns as a percentage of sales over the 2023-2025 period and will see an incremental low single digit percentage improvement going forward. Based on this analysis, we estimate that Walmart could see cost savings of $4.0 bn - $23.7 bn.

Exhibit 46: WMT's inventory turns has broadly improved, with better inventory management contributing to gross margin expansion
Y/Y gross margin change vs. inventory turns



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 47: Potential cost savings from a reduction in markdowns

Potential cost savings ($ in bn)		Historical markdown improvement		
		5%	7%	10%
Incremental markdown improvement	1%	$7.9	$5.7	$4.0
	2%	$15.8	$11.3	$7.9
	3%	$23.7	$17.0	$11.9

Source: Company data, Goldman Sachs Global Investment Research

- **Reduction in delivery cost per order**. In our view, Walmart will benefit from lower delivery costs as automation drives higher e-commerce penetration, largely due to increased batch density (number of orders per delivery truck) and closer household proximity (e.g., delivering a package to five houses on the same street vs. one house). Over the 2023-2025 period, Walmart US' e-Commerce sales grew 52.3% to $99.6 bn while delivery costs per order declined by 50%, suggesting a ~0.96% decline in per-order delivery costs for every 1% growth in e-commerce sales. That said, we expect Walmart to see diminishing returns as e-commerce sales continue to grow. Based on our sensitivity analysis in Exhibit 48, we estimate that delivery costs per order could improve by a further 2.4% - 12.9%.

Exhibit 48: Potential reduction in delivery costs per order

Potential reduction in delivery costs per order		% of historical benefit that WMT captures		
		50%	70%	90%
E-commerce sales growth	5%	2.4%	3.3%	4.3%
	10%	4.8%	6.7%	8.6%
	15%	7.2%	10.0%	12.9%

Source: Company data, Goldman Sachs Global Investment Research

- **Slower labor growth.** While we don't believe automation will reduce the size of the company's overall US workforce, we think that labor growth could moderate relative to historical levels as productivity improves, with Walmart calling out improved productivity in F2Q27 driven by associates' usage of technology in stores and

streamlined inventory flow related to supply chain automation. As productivity increases, we believe labor hours could be reallocated closer to the consumer to enhance the overall customer experience. Further, the Wall Street Journal highlighted that Walmart has seen significantly improved turnover and job satisfaction in automation-related roles at its Brooksville, FL warehouse, the company's first US warehouse to use automation to handle inventory, largely due to lower physicality required for the job. Symbotic is the key automation technology provider in that facility. As retention improves, Walmart would likely benefit from lower hiring expenses and training investments.

- **Expanded Walmart Marketplace.** We expect Walmart's 3P marketplace business to expand as excess capacity in automated FCs becomes available for 3P sellers. Through this channel, Walmart is able to attract customers via an expanded product assortment without incurring the costs associated with buying and holding its own inventory. This creates a flywheel effect in which a broader selection of goods increases traffic, attracting more sellers and greater product variety as well as fueling high-margin service offerings like fulfillment, advertising, and membership. Walmart has pointed to an average marketplace take rate of low-to-mid-teens, with higher take rates for higher margin categories like home and apparel and lower rates for consumables, grocery, and electronics. Notably, the company has called out its 3P marketplace as key to growing its general merchandise business, which derives ~50% of its GMV growth from marketplace. We note that general merchandise historically has a higher margin profile vs. grocery, representing a multi-year opportunity for Walmart.

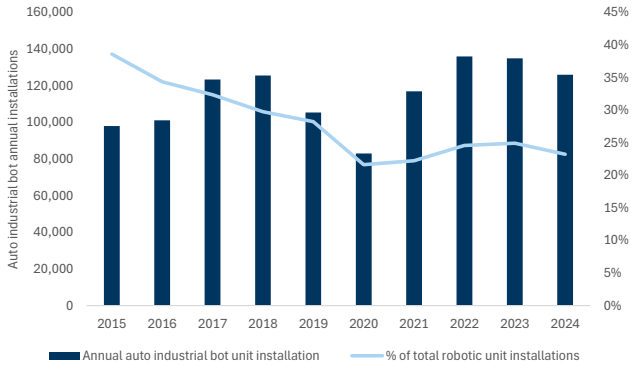
In our view, these cost savings could be reinvested into customer experience and price, supporting Walmart's everyday low prices. This would in turn reinforce the brand's value proposition and potentially widen the price gap vs. traditional brick-and-mortar peers who lack the scale and capital to match Walmart's automation investments.

We maintain a Buy rating on WMT. Our 12-month price target is $130 based on our risk-reward framework with downside/base/upside relative P/E multiples of 160%/165%/170%. Key downside risks include a slowdown in economic activity, more intense pricing environment, global macro/fx volatility, inability to use expense leverage to offset investments in e-commerce/pricing, pressure from wages or transportation costs, and impact from tariffs.

Auto industry has a long history of automation, and is exploring general purpose robots

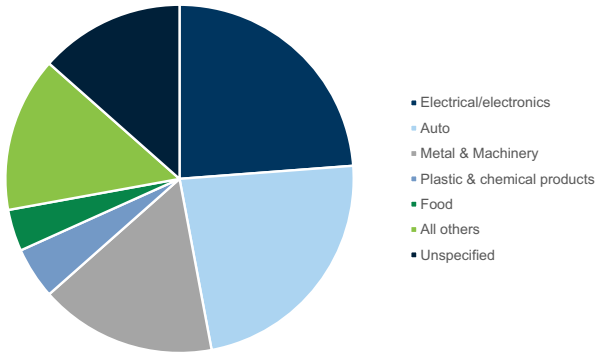
The automotive industry has already heavily automated certain repetitive tasks in the factory, such as body/welding lines, with the auto industry making up about a quarter of recent deployments for the broader market for traditional industrial robots (Exhibit 49 - Exhibit 50).

Exhibit 49: Global automotive industrial bot unit shipments over time



Source: IFR, Goldman Sachs Global Investment Research

Exhibit 50: 2024 installations of new industrial bots by industry



Source: IFR

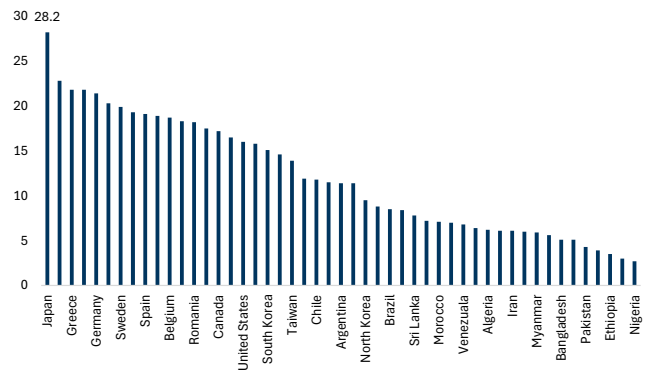
However, other aspects of the auto industry are still mostly manual, including final assembly, given the physical spaces the operator needs to reach and the varied tasks that must be completed. In fact, over-automating certain jobs was a challenge that Tesla encountered with the Model 3.

The auto industry is now exploring the increased use of general purpose and humanoid robots to help further improve efficiency. Growing labor constraints, including with tariff/on-shoring requirements, are adding to the demand (including at both suppliers and OEMs). Simpler tasks that are too varied to economically automate, such as in-bound parts sorting and inspection, is one area that humanoid and general purpose robots are being evaluated.

Labor shortage

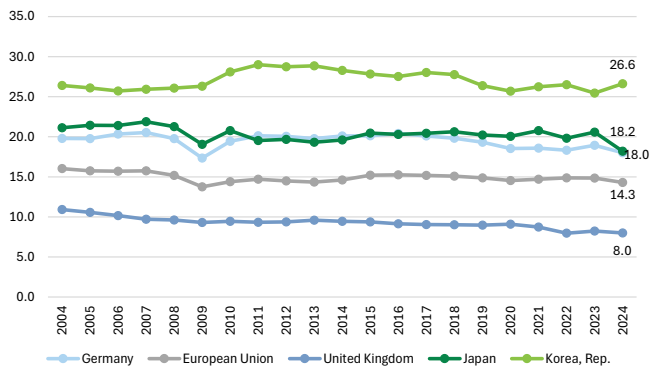
In regions such as the US and Europe, there are many cases where a higher local parts procurement ratio is required (from an industrial protection perspective), making automobile and auto parts production necessary in regions with relatively high labor costs. Given tariff and trade policies, optimized production expansion coupled with automobiles will be an essential element in building a sustainable business structure.

Exhibit 51: Aging population in developed economies
Mix of the population aged 65 and over



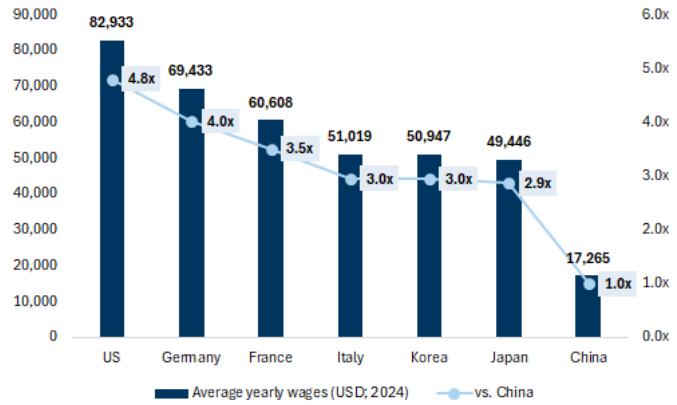
Source: World Bank

Exhibit 52: Manufacturing plays an important role in most developed countries
Share of manufacturing in GDP



Source: World Bank

Exhibit 53: High labor costs in developed countries
Wage comparison (USD)



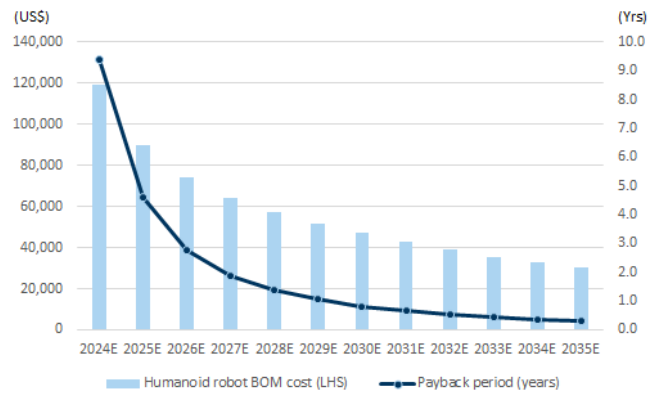
Source: Goldman Sachs Global Investment Research, OECD

Declining robot prices to bring about a crossover point

Several humanoid robot manufacturers, such as UBTech, have suggested the possibility of humanoid costs dropping rapidly. As of 2026, the manufacturing cost (BOM: Bill of Materials) for industrial and research humanoid robots is estimated to be around $74,000 for high spec units, but similar to other industrial products, this cost will likely decline significantly through mass production. With BOM costs likely to decline, we forecast the price of humanoid robots on average to fall from over $40,000 in 2025 (and about $150,000 for high-spec robots) to about $21,000 in 2035 (and about $50,000 on average for high-spec robots).

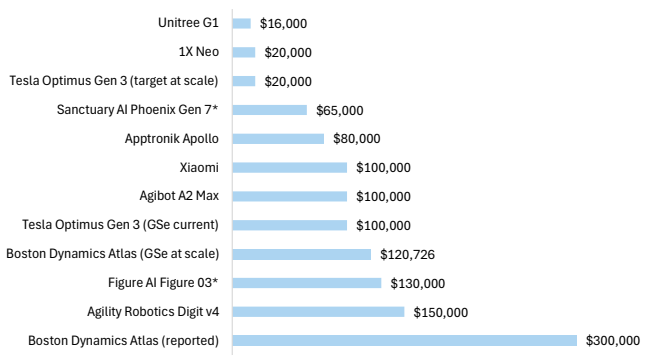
As a result, in applications where the technology is ready, we think the market will approach a "crossover point" where rising labor costs meet the falling price of the robots, shifting away from the current situation where robot implementation is not cost-effective. We forecast that the cost of factory-use humanoid robots will fall to the equivalent of 2.8 years of labor costs in 2026, and to the equivalent of 1.9 years in 2027 (assuming applications where the robotics technology is prepared for the task).

Exhibit 54: Cost for humanoid robots is expected to decrease
Cost and payback estimates for high specs robot



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 55: Wide price range
Estimated humanoid retail price (note some prices quoted are expected prices at scale production)



Source: Various media reports, Goldman Sachs Global Investment Research

Balance between price and performance is key

We think the societal implementation of humanoid robots, which will likely start more in commercial settings, will not spread to homes and streets in one fell swoop. A scenario of gradual proliferation in accordance with safety, cost, and technical maturity is likely realistic. First, automobile factories and large-scale logistics hubs with a pressing need for automation will function as early adopters, and we view the ability to accumulate data there and the expected cost reductions driven by mass production will serve as catalysts for humanoids to spread to other industries.

Phase 1: Automobile factories / Large-scale logistics hubs - Closed environments where safety management is easy (inside fences or restricted areas) - Mainly parts transportation, container loading/unloading, and simple picking tasks.

Phase 2: General manufacturing / Small-to-medium factories / General warehouses - Decline in unit prices due to mass production effects (assumed at the $20,000 to $30,000 level per unit) Establishment of safety standards as collaborative robots, executing tasks in environments mixed with humans.

Phase 3: Services / Nursing care / Infrastructure / Homes - Full-scale rollout begins in non-manufacturing sectors where labor shortages are most severe - Taking on autonomous operations in open environments where an unspecified large number of people are present.

Automakers Will Likely Pivot to Humanoid Robotics

We believe that the automotive industry—which mass-produces automobiles, one of the world's most complex industrial products, by the millions—is uniquely suited for the mass production of humanoid robots. We have scored global OEMs based on three core dimensions: Will (intent to enter the humanoid market), Should (stagnation of core business), and Could (financial and operational capability). Currently, Tesla and Hyundai are the most actively engaged in humanoid robotics. Among Japanese automakers, Toyota, Honda, and Mitsubishi Motors are relatively well-positioned.

Will: Companies with concrete mass-production plans for humanoid robots are scored "2", those with an intent or plan to enter are scored "1", and others are scored "0". Investments in humanoid-related companies were also factored into this score.

Should: Companies losing market share in their core automotive business are scored "2", while those maintaining or growing their share are scored "1". The trend of operating profit margins over the past three years was also taken into account.

Could: Companies with an annual global production volume of 3 million units or more are scored "2", those with 1 million to 3 million units are scored "1", and those with under 1 million units are scored "0". The absolute amount of net cash in the automotive business was also factored in.

Exhibit 56: Will/Should/Could analysis
Humanoid robot readiness

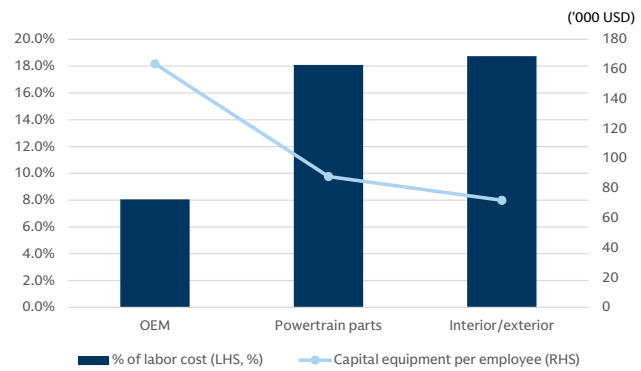
	Will		Should		Could		
	Expressed Interest	Minority/Majority Stakes	Core TAM Pressure	Margin pressure	Global Scale & Right Markets	Financial Ability	Total score
Tesla	2	2	1	1	2	2	9
Hyundai	2	2	1	1	2	2	9
Toyota	1	2	1	1	2	2	8
BMW	1	1	2	2	1	1	6
Mercedes	1	1	2	2	1	1	6
Honda	1	1	2	2	1	1	6
Mitsubishi	1	1	2	2	0	1	5
VW	0	0	2	2	2	1	5
GM	0	0	2	2	2	1	5
Ford	0	0	2	2	2	1	5
Nissan	0	0	2	2	1	0	3
Suzuki	0	0	1	0	2	0	3
Mazda	0	0	2	2	1	0	3
SUBARU	0	0	2	2	0	0	2

Source: Company data, Goldman Sachs Global Investment Research

Focus on robot adoption for parts manufacturing in the automotive industry

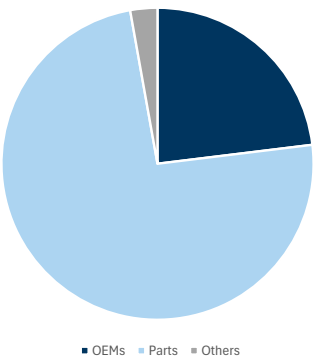
Furthermore, in automobile production processes that are not currently robotized, the areas where humanoid robots can currently be applied remain at a mere 2% of the total (parts sorting and simple logistics/transportation tasks). To adapt humanoids to the remaining 98%, which consists of advanced processes such as "complex parts assembly," "wiring and connector connection," and "visual/abnormal noise inspections," innovations in AI brains and robot hands are still needed. In the automotive industry in particular, parts manufacturing is labor-intensive and employs a large amount of people. While the deployment of more humanoids and robotics (as outlined in Phase 2) is highly likely to contribute significantly to alleviating labor shortages, curbing labor costs, and improving production quality, it will largely depend on the pace of technological innovation.

Exhibit 57: Parts manufacturers are labor-intensive in the automobile industry
labor cost mix comparison



Source: Company data, Goldman Sachs Global Investment Research

Exhibit 58: Auto parts account for the majority of workforce in the auto industry
Distribution of the workforce in the automotive industry



Source: METI, Goldman Sachs Global Investment Research

Humanoid Robots Offer Margin Upside for Manufacturing

The introduction of humanoid robots could lead to margin upside for the manufacturing sector. Needless to say, the labor cost-reduction rate will vary significantly depending on the price and performance of the robots, such as their continuous operating hours and multi-tasking capabilities. Taking the automotive and auto parts industry as an example, where the labor cost ratio typically ranges between 10% and 20%, we have set the baseline labor cost ratio at 15% for this scenario analysis. The analysis was conducted with robot unit prices ranging from $20,000 to $60,000. Assuming a robot adoption rate of 10% to 50%, the upside impact on the operating profit margin is estimated to be 1% to 6% on a gross basis (note the net effect could be smaller if cost savings also lead to

lower prices).

Additional potential upside to this analysis includes:

- **Continuous Operation:** While the operating days in this model are set at 250 days per year, robots can theoretically operate 365 days a year.
- **Performance Evolution:** The potential for robots to handle multi-tasking as their capabilities improve.
- **Productivity Gains:** Efficiency improvements driven by enhanced production quality and lower defect rates.

Exhibit 59: Returns Vary by Price and Performance
Estimation of Robot Cost-Reduction Effects

Cost reduction effects from Robot		
Robot Units price	30,000	USD
System integration costs	50%	
Annual maintenance costs	15%	
Power consumption	1	kW
Electricity rate	0.2	USD/kWh
Average annual wage	53,300	USD
Working days	250	Day
Working hours	8	Hours
Robot work capacity (relative to human)	25%	
Robot operating days	250	Day
Robot operating hours	6,000	Hours
Human equivalent working hours	1,500	Hours
Displaced full time equivalents	0.8	Person
Annual labor cost savings	40,000	USD
Initial investment	45,000	USD
Annual OPEX	5,700	USD
Annual depreciation	6,000	USD
Net annual savings	28,300	USD
Payback period	1.6	Year

Source: Company data, Goldman Sachs Global Investment Research

Exhibit 60: Operating Margin Expansion of 1% to 6%
Analysis of Potential Labor Cost-Reduction Effects

Robot ASP (USD)	Adoption rate	Cost reduction	Margin expansion
20,000	10%	85%	1.3%
	25%	85%	3.2%
	50%	85%	6.4%
40,000	10%	72%	1.1%
	25%	72%	2.7%
	50%	72%	5.4%
60,000	10%	58%	0.9%
	25%	58%	2.2%
	50%	58%	4.4%

Source: Company data, Goldman Sachs Global Investment Research

What may or may not get disrupted from general purpose robotics

Wages of workers in warehouse & logistics roles

We believe a key focus for investors in evaluating the economic effect of humanoid robots includes areas of disruption. Given that many of the early pilot deployments of humanoids are in warehouse and logistics roles, we believe **one main vector of analysis relates to human employment in hand laborer and material movers role**s. Importantly, US government data suggests there may be a shortage of workers in these areas, with the US BLS (Bureau of Labor and Statistics) noting that it believes there will be on average ~1.0 mn job openings per year in hand laborer and material mover roles from 2024 to 2034. Per the BLS, many of those openings are driven by the need to replace workers who transfer to different occupations or exit the labor force (e.g. retire). General purpose robotics therefore may not lead to direct job losses in aggregate in the near to intermediate term, but could impact new openings and the roles of human workers.

As of 2024, **there were approximately ~6.4 mn people employed in the US as hand laborers and material movers** (across all industries, with 987K of those in the warehousing and storage) per the BLS. This 6.4 mn breaks out into ~3.0 mn as laborers for freight, stock, and material movers by hand; 46.5K as machine feeders and offbearers; 592K as hand packers and packagers; and 2.8 mn as stockers & order fillers. The same data lists a median annual wage of ~$37.7K, **implying annual labor costs of ~$240 bn.** We note that we excluded cleaners of vehicles & equipment and refuse and recyclable material collectors from this analysis.

Impact on PLCs

Overview

The rapid development of humanoid robots has brought the advantages of virtual Programmable Logic Controllers (vPLCs) to the forefront of industrial automation. Both virtual and physical PLCs act as industrial computers to control and monitor manufacturing processes. However, while traditional PLCs are physically wired inside stationary control cabinets at specific workstations, vPLCs are entirely software-defined, enabling them to run as a centralized system commanding entire fleets of robots. **The global TAM for PLCs stood at an estimated c.$13bn in 2025 and is expected to grow at c.4% CAGR over the coming years** (GSe and third party sources Mordor Intelligence, Precedence Research, Global Market Insights), in line with historical growth rates (see Jacqueline Du's PLC note here). By contrast, Siemens expects **vPLC adoption to grow c.20-30% per year (see here) from a base of c.$0.5bn in 2025** (LSD percentage of global PLC TAM according to IoT Analytics, a source cited by Schneider Electric, see here). This is in line with **Schneider Electric's expectation for the global vPLC runtime size to reach c.$1.3bn by 2030** (see here)**.**

The top five traditional PLC suppliers contribute to c.75% of the global PLC market, with dominant players including Siemens, Rockwell Automation, Mitsubishi Electric and Schneider Electric. These incumbents have been pivoting to vPLCs in order to lead the software-defined era, but new entrants have been appearing including Codesys, Phoenix Contact, OTee, and Beckhoff. **The primary threat of vPLCs to established**

players is the disruption of the legacy hardware-software lock-in. With vPLCs, customers can choose to run high-performance control logic on open, commodity servers rather than proprietary hardware from a single vendor. Core components of a traditional PLC system that may be disrupted include the controller, the physical racks, and the physical input/output modules.

What are virtual PLCs and how do they compare to standard PLCs?

A Programmable Logic Controller (PLC) is a microprocessor-based industrial computer engineered to control and monitor manufacturing processes. Since their introduction in the late 1960s, PLCs have served as the backbone of factory automation, executing real-time control logic to ensure the seamless coordination of assembly lines and machinery. At its core, a PLC acts as the central orchestrator, continuously monitoring inputs from field sensors, processing this data according to a user-defined program, and executing precise commands to drive outputs such as motors, valves and actuators. For example, on a robotic assembly line, while an individual robot utilizes its own dedicated controller to manage precise joint movements, a PLC will sit above the controller, coordinating the robot's actions with surrounding equipment such as conveyors and safety barriers. Historically, market-leading automation providers such as Siemens, Rockwell Automation, Mitsubishi Electric, and Schneider Electric, have sold PLCs under a hardware-centric business model, requiring a dedicated physical controller for each machine or robot. This architecture inherently creates vendor lock-in, forcing manufacturers to purchase proprietary hardware and rely on the vendor's closed software ecosystems for programming and maintenance.

Virtual PLCs (vPLCs) perform the same real-time control functions as traditional PLCs but are entirely software-defined. When a new assembly line needs to be controlled, traditional PLCs oblige operators to buy new hardware which needs to be mounted inside electrical cabinets and wired to machinery. By contrast, vPLCs allow operators to deploy a new "PLC" when needed without installing new physical controllers. This confers various advantages: 1) vPLCs can run on standard, off-the-shelf computer servers, or on the cloud, meaning operators are not locked into a proprietary hardware ecosystem and can mitigate supply chain risks, 2) manufacturers can expand production lines and scale capacity at lower capex, 3) operators can update control logic remotely from a centralised console, reducing the need for on-site engineers.

The rapid development of humanoid robots has brought the advantages of vPLCs to the forefront of industrial automation. Unlike stationary industrial robots that rely on dedicated physical PLCs, mobile humanoids coordinate with their environments via software-defined vPLCs. This software-driven approach is essential because humanoid "brains" run on advanced AI models and computer vision algorithms powered by high-performance Systems-on-Chips (SoCs). Bridging these modern, software-defined platforms with rigid, hardware-bound physical PLCs is highly complex. vPLCs solve this integration bottleneck as they establish a centralized system which can directly control an entire fleet of mobile humanoids over high-speed virtual networks. This streamlines data exchange, simplifies the overall system architecture and enhances simultaneous coordination of distinct humanoids.

The global TAM for PLCs stood at an estimated c.$13 bn in 2025 and is expected to grow at c. 4% CAGR over the coming years (GSe and third party sources Mordor Intelligence, Precedence Research, Global Market Insights), in line with historical growth

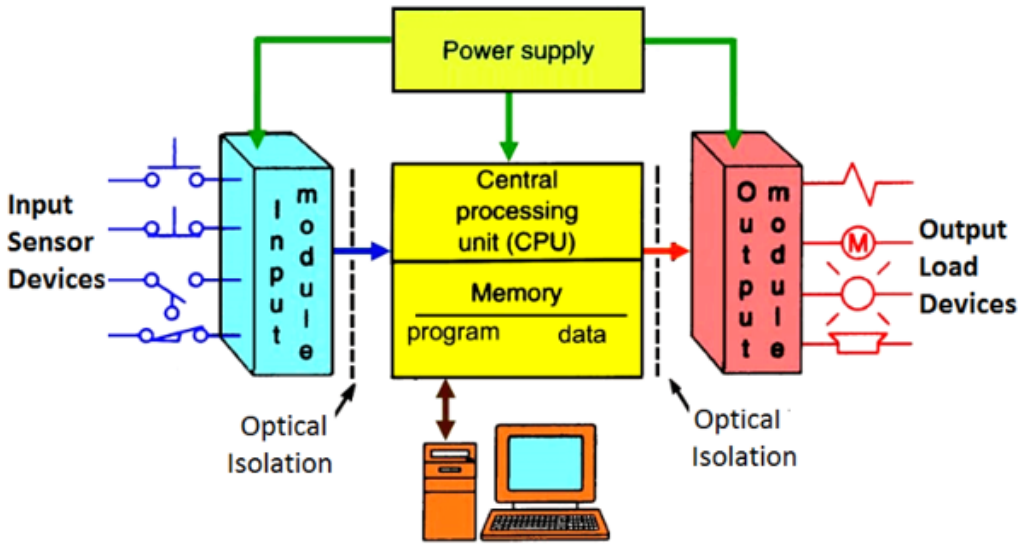
rates (see Jacqueline Du's PLC note here). By contrast, Siemens expects **vPLC adoption to grow c.20-30% per year (see here) from a base of c.$0.5bn in 2025** (LSD percentage of global PLC TAM according to IoT Analytics, a source cited by Schneider Electric, see here). This is in line with **Schneider Electric's expectation for global vPLC runtime size to reach €1.1bn by 2030 (c.$1.3bn at current conversion rates,** see here). IoT also expects c.25% of new PLC sales in 2030 to be virtual or soft.

Which traditional PLC components may be disrupted?
The primary threat of vPLCs to established players is the disruption of the legacy hardware-software lock-in. With vPLCs, customers can choose to run high-performance control logic on open, commodity servers rather than being forced to purchase expensive proprietary hardware from a single vendor. The core components of a traditional PLC system that may be disrupted include:

- ***Controller (CPU):*** the central processing unit of a traditional PLC system which executes user-written control logic. In a vPLC, these proprietary hardware processors are replaced by software runtime engines running on standard edge servers or industrial PCs. Key players include Siemens (SIMATIC S7 controller), Rockwell Automation (Allen-Bradley ControlLogix/CompactLogix - North American market leader), Mitsubishi Electric (MELSEC - dominant in Asia, particularly Japan), Schneider Electric (Modicon), Omron (Sysmac), and Beckhoff (TwinCAT).
- ***Physical chassis (rack):*** the physical foundation, backplane power, and high-speed communication path between the CPU, power supply, and I/O modules. Since the CPU is no longer a physical module, the proprietary rack or mounting rail used to house it is also eliminated. Key players include Rockwell Automation (ControlLogix Chassis), Siemens (SIMATIC Rail & Racks), Schneider Electric (Modicon Backplanes), and Mitsubishi Electric (MELSEC Base Units).
- ***Physical Input/Output (I/O) modules:*** connects the controller to physical field devices such as sensors, valves and actuators. vPLCs still need to connect to field devices but do so differently. Virtual systems replace local rack-mounted I/O with remote, decentralised I/O communicating over standard industrial Ethernet. Key players include Siemens (SIMATIC ET), Rockwell Automation (1756 I/O), Beckhoff (EtherCAT Terminals), WAGO (WAGO I/O), Phoenix Contact (Axioline F) and Advantech (ADAM Series).
- ***Rack-mounted power supply:*** converts plant power into the specific voltages required by the PLC's controller and backplane. vPLCs may shift this requirement to standard Information Technology/Operational Technology server power supplies. Key players include Siemens (SIMATIC PM/PS), Rockwell Automation (1756 Power Supplies), Schneider (Modicon BMXCPS), Phoenix Contact (QUINT) and Mean Well (SDR/MDR/HDR Series).
- ***Specialized communication and intelligent function modules:*** perform specialized high-level tasks such as motion control, high-speed counting, or protocol translation to offload processing from the main CPU. The need for expensive, single-protocol intelligent function modules can be reduced, as vPLCs can replace these expensive hardware modules with software applications. Key players include Siemens (SIMATIC CP & TM Modules), Rockwell Automation (1756 Network & Motion modules),

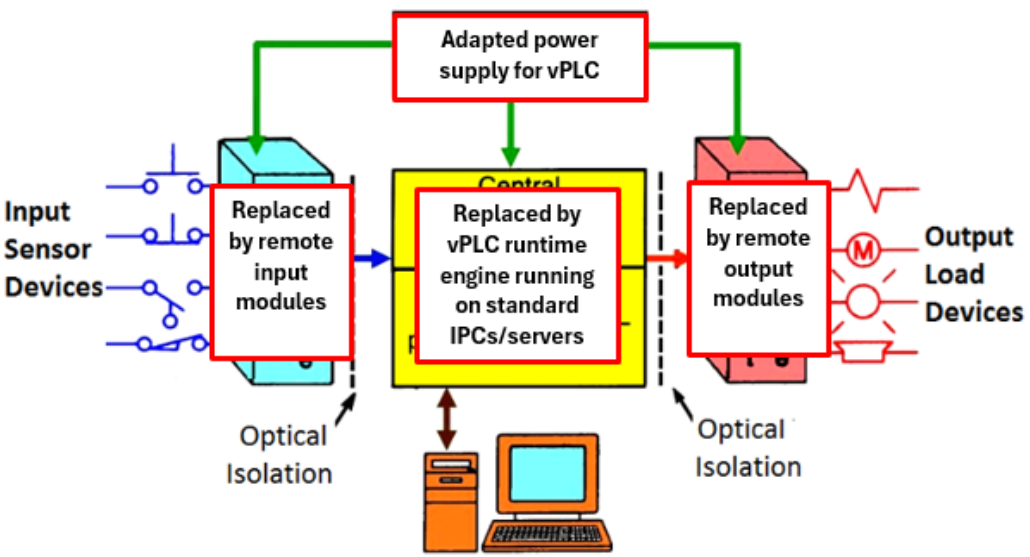
Mitsubishi Electric (MELSEC Network/Motion Modules), HMS Networks (Anybus) and ProSoft Technology.

Exhibit 61: Physical PLCs rely on physical CPUs, physical I/O modules and a dedicated power supply, all mounted on a rack
Schematic of physical PLC components



Source: Instrumentation Tools, Goldman Sachs Global Investment Research

Exhibit 62: ...whilst in vPLCs, the physical CPU and I/O modules are replaced by the vPLC runtime engine running on standard IPCs/servers and remote I/O modules
Schematic of physical PLC components that would get replaced in a vPLC



Source: Instrumentation Tools, Goldman Sachs Global Investment Research

Who are the old incumbents and new entrants?

Old incumbents vs new entrants are competing for dominance in the move to vPLCs (Exhibit 64). The top five traditional PLC suppliers contribute to c.75% of the global PLC market, with dominant players including Siemens, Rockwell Automation, Mitsubishi Electric and Schneider Electric. These incumbents have been pivoting to vPLCs in order to lead the software-defined era, but new entrants and start ups have been appearing

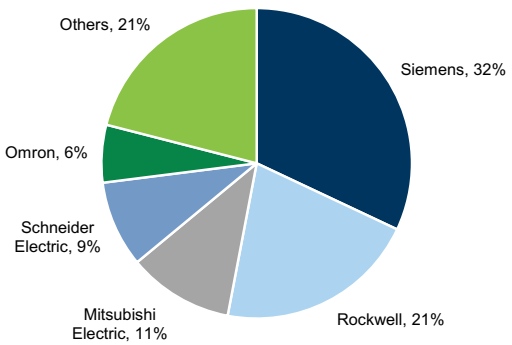
including Codesys (automation software company offering soft and virtual PLCs but no legacy physical PLC business), Phoenix Contact (announced its Virtual PLCnext Control portfolio in 2025), OTee (industrial startup that raised €5.3mn in 2026 to scale its hardware-agnostic virtual PLC) and Beckhoff (pioneer in PC-based control that expanded its vPLC capabilities with TwinCAT Runtime for Linux).

- **Siemens (covered by Daniela Costa)** is the definitive leader in the traditional PLC market, with a market share of c.30% (Exhibit 63). The company has made an entry into the virtual PLC space with its product SIMATIC S7-1500V. A major advantage of the S7-1500V is its complete compatibility with Siemens' Totally Integrated Automation (TIA) Portal, an industry-standard software suite. This provides them with a strong moat, as existing projects and engineering workflows can be easily migrated to a virtual environment, minimizing the learning curve for their vast user base. Siemens was also the first to receive TÜV failsafe certification for a virtual controller, meaning the controller can run with a high degree of functional safety without requiring dedicated safety hardware. This milestone eliminates the historical requirement for physical safety PLCs in order to meet strict international safety standards (up to SIL3/PL e), effectively removing the final hardware barriers to fully virtualizing factory floors. Based on a 2025 TAM of c.$13 bn and company-specific PLC shares estimated from Jacqueline Du's note (here), we estimate Siemens' PLC revenues to have reached c.$4.2 bn in 2025 (c.20% of Digital Industries revenues).
- **Rockwell Automation (covered by Joe Ritchie)** is the second-largest global player in traditional PLCs, and has the largest installed base of automation systems in North America. This allows them to upsell software and services to their existing customer base. Similar to other leading virtual PLC players, Rockwell's software-defined runtimes (such as FactoryTalk Optix) are designed to be interoperable; capable of running on anybody's hardware. However, unlike other players seeking to completely replace traditional PLCs, Rockwell intends to make their offering a complement to existing systems, focusing on non-disruptive modernization. Instead of replacing physical hardware on the factory floor, Rockwell's strategy is to create a digital twin for their controllers. This allows engineers to design, test, and run an entire factory virtually before physical commissioning. Based on a 2025 TAM of c.$13 bn and company-specific PLC shares estimated from Jacqueline Du's note (here), we estimate Rockwell's PLC revenues to have reached c.$2.7 bn in 2025 (c.45% of Intelligent Devices and Software & Control revenues).
- **Mitsubishi Electric (covered by Ryo Harada)** is also a dominant traditional PLC player. They are expanding their virtual integration capabilities, and they are mainly focusing on digital twin integration to simulate the control logic and network systems of an entire production site. Based on a 2025 TAM of $13 bn and company-specific PLC shares estimated from Jacqueline Du's note (here), we estimate Mitsubishi Electric's PLC revenues to have reached c.$1.5 bn in 2025 (c.30% of Factory Automation revenues).
- **Schneider Electric (covered by Daniela Costa)** has a considerable physical PLC offering but a smaller market share than the top 3 players. The company has been focusing on establishing an open software standard for the vPLC ecosystem to ensure universal accessibility. This strategy directly aligns with their

"plug-and-produce" approach, which allows users to seamlessly assemble software objects to build custom applications. Schneider currently leads the vPLC runtime segment, reporting a dominant 47% market share in the global vPLC runtime market at their 2025 Capital Markets Day. Based on a 2025 TAM of c.$13 bn for PLCs and company-specific PLC shares estimated from Jacqueline Du's note (here), we estimate Schneider's PLC revenues to have reached c.$1.2 bn in 2025 (c.15% of Industrial Automation revenues).

- **CODESYS is an automation software company offering hardware-agnostic soft and virtual PLCs.** In 2024, they generated revenues of €41 mn (c.$44 mn). While they do not produce traditional PLCs and are not tied to a single proprietary brand, Codesys has already partnered with over 500 hardware manufacturers. OEMs such as Eaton do not build their own programming software and instead download the manufacturer-specific version of the CODESYS development system. This gives Codesys a large potential user base for their virtual PLC market. They have also obtained TÜV-certified SIL3 safety for their virtual PLC.

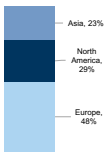
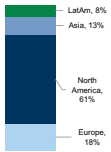
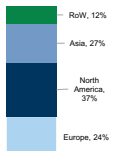
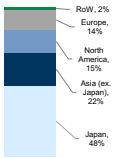
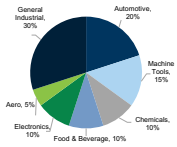
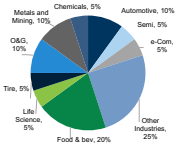
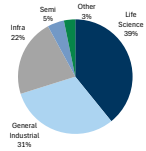
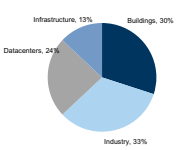
Exhibit 63: Siemens leads the global PLC market with a c.30% market share
Global PLC market share, 2025 (%)



*Estimated based on company data, previous GS research, and third party sources

Source: Company data, Goldman Sachs Global Investment Research

Exhibit 64: Competitive landscape for traditional PLC incumbents and vPLC new entrants

Company	Siemens	Rockwell Automation	Mitsubishi Electric	Schneider Electric
Group Revenues, $mn (2025)	92,644	8,342	36,822	47,171
Industrial Automation Revenues, $mn (2025)*	20,882	6,139	4,839	8,250
GSe PLC market share, %	32%	21%	11%	9%
GSe PLC Revenues, $mn (2025)	4,160	2,730	1,430	1,170
as % of industrial automation division	20%	44%	30%	14%
Group Revenues by Region (2025)				
Capex % of Revenues (2025)	3.1%	2.2%	3.5%	3.7%
R&D % of Revenues (2025)	8.3%	8.1%	4.1%	3.4%
R&D Treatment	100% Expensed	100% Expensed	100% Expensed	84% Expensed, 16% Capitalised
Group ROIC (2025)	12.2%	20.9%	10.5%	15.3%
End Market Mix (2025)				
Market Position in PLCs & vPLCs	#1 in global PLC market share #1st in receiving TÜV failsafe certification for its virtual PLC #1 in "value-for-money" PLC market in China (S7-200SMART hardware)	#2 in global PLC market share	#3 in Chinese PLC market (as of 2022)	#1 Virtual PLC runtime size
Management Commentary on PLCs & vPLCs	3Q26 earnings call: managmenet highlighted that vPLC and software-defined automation are driving demand for higher-performance Edge hardware	2024: management stated their PLC market share was slightly up	2025 Investor Day:decreasing sales of PLC is one of the reasons for decline in profitability of the FA system	2025 CMD: management stating they made a conscious choice of not being a leader in PLC, because the market is moving toward virtual PLC and they aim to lead the wave

Virtual PLC New Entrants	
Group revenue, €mn	**Codesys**: €41.2mn (2024) **Beckhoff Automation**: €1,240mn (2025)
Company	CODESYS, PHOENIX CONTACT, OTee, BECKHOFF, logiccloud, SOFTWARE DEFINED AUTOMATION
Country	SOFTWARE DEFINED AUTOMATION, OTee, BECKHOFF, PHOENIX CONTACT, CODESYS, logiccloud
Total funding, €mn	**Otee:** €5.3mn **Software defined automation:** €8.7mn
Latest funding round	**Otee:** Seed **Software defined automation:** Seed
R&D % of Revenues	**Beckoff Automation:** 6.5% (2025)
End markets & use cases	**Otee:** Energy, infrastructure, utilities, manufacturing **Codesys:** Factory automation, mobile machinery, energy **Phoenix Contact:** Factory automation, renewable energy, data center **Beckhoff:** Factory automation, data center **Software defined automation:** Automotive, life science, food&Beverage, energy, logistics, manufacturing
Market Position	**Codesys:** leading manufacturer-independent 61131-3 programming platform, implemented by Audi in its car body production lines **Beckoff:** one of the technological market leaders in software-based automation, covering PLC, motion, industrial communication, vision and AI.
Management Commentary	**Codesys:** Management sees a clear movement toward the use of IT infrastructures and cloud solutions in the automation industry, leading to a stronger convergence of IT and Operational Technology. **Beckoff 2025:** Management see strong development over FY2026, caution global uncertainty OTee: industrial control is one of the last major infrastructure layers still tied to proprietary hardware.

*All data for 2025 unless specified otherwise. For Rockwell, Industrial Automation is considered to be both Intelligent Devices and Software Control

Source: Company data, Goldman Sachs Global Investment Research

A prominent concern among investors is that humanoid robotics providers might bypass traditional automation incumbents by directly integrating vPLCs into their proprietary platforms. While this vertical integration could theoretically enable humanoid vendors to control deployment and command higher margins through a unified Robotics-as-a-Service (RaaS) model, such a scenario may not be plausible for various structural reasons:

- A humanoid robot is an autonomous agent designed to coexist and communicate with a factory's infrastructure and not to control it. Since factory machinery is built, commissioned, and warranted by specialized OEMs using established control architectures, it is more practical for humanoids to interface with existing systems via standard protocols rather than for robotics vendors to reverse-engineer and assume liability for the factory's entire legacy control layer.
- Industrial safety is governed by uncompromising international standards (such as SIL3/PL e) that have been developed over decades. For a humanoid startup, achieving the necessary functional safety certifications to control factory-wide heavy machinery, light curtains, and emergency stops represents a steep and cost-prohibitive barrier to entry.
- Modern manufacturers are actively transitioning to open software standards to escape proprietary ecosystems. Allowing a single humanoid vendor to control both the physical robot fleet and the underlying factory automation layer would create a

new highly concentrated form of vendor lock-in, directly contradicting the push toward building more flexible, inter-operable and vendor-neutral factory floors.

Why do physical PLCs still dominate? What are the risks associated with vPLCs?
Despite the rapid rise of software-defined automation, traditional physical PLCs remain superior to vPLCs in certain critical areas, explaining why they have not yet been fully replaced by virtual alternatives. These include latency, safety and complexity of deployment.

- **Latency and determinism.** Physical PLCs run on dedicated hardware with a real-time operating system which guarantees precise, deterministic, millisecond-level execution loops (typically 1-10 ms). By contrast, vPLCs operate on shared compute infrastructure where they must share CPU cycles with other applications. While vPLCs offer performance close to traditional PLCs, the introduction of virtualisation can result in additional and sometimes unpredictable latency. This poses a significant challenge for real-time applications that necessitate ultra-high-speed, synchronized response times such as high-speed motion control systems or high-speed packaging.
- **Functional safety and reliability**. Hosting multiple vPLCs on a single edge server introduces a potential single point of failure. If the host server experiences a hardware crash or power loss, it could result in simultaneous failures across several independent control systems, potentially halting operations across an entire factory floor. This is a significant risk for industries that rely on maximum availability and uptime, such as continuous process industries. While vPLCs have started to receive safety certifications (e.g. Siemens' TUV-certified SIMATIC S7-1500V with failsafe function), this is only a recent development. These safety-certified vPLCs have not yet been deployed long enough in real-world environments to prove they can match the decades-long reliability record of traditional physical PLCs.
- **Legacy plants and complexity of deployment.** The vPLC market is still highly nascent, with many legacy plants operating stable, fixed automation architectures that have reliably run on physical PLCs for decades. This leaves little operational incentive to undergo complex and costly migrations to virtualized environments. Deploying and managing vPLCs involves a level of complexity far beyond traditional PLC systems. It requires deep expertise in virtualisation technologies, IT infrastructure and network security; domains that are often unfamiliar to traditional automation engineers. Overcoming this skills gap may require organisations to invest heavily in training existing workforce or hiring new talent in order to effectively manage vPLC infrastructure.

How will the monetization model change?
The transition to software-defined automation (SDA) and vPLCs fundamentally alters how automation OEMs like Siemens, Rockwell Automation, Mitsubishi Electric, and Schneider Electric monetize their offerings. In short, it shifts the industry from a capital expenditure based model to an operational expenditure and Software-as-a-Service (SaaS) model. Historically, manufacturers generated high-margin upfront revenues by selling proprietary physical hardware such as CPUs,

chassis, and I/O modules, bundled with proprietary engineering software licenses. With vPLCs, the physical hardware is decoupled and vendors instead monetize the technology through software subscription licenses, consumption-based fees, and managed services. While this subscription-based, pay-per-use model may dilute upfront hardware margins, it establishes highly predictable, recurring revenue streams. It also allows vendors to capture additional value by upselling centralized edge management platforms, remote diagnostics, and advanced AI-driven analytics. Siemens has decoupled its hardware and software offerings through its Siemens Xcelerator portfolio, offering its primary vPLC product (SIMATIC S7-1500V) under an annual subscription model. Schneider has also introduced its EcoStruxure Automation Expert platform which enables software-defined automation to run on any compatible hardware.

Even players that transition to SaaS might face risks though, as with generative AI democratizing industrial programming it erodes the barriers to entry into the vPLC market and increases the risks from 'seat compression' of traditional SaaS industrials models, given the reduced need for headcount with licences. Historically, a factory floor required dozens of physical PLCs. With virtualization, multiple vPLCs can be consolidated onto a single edge server. As AI agents optimize factory-floor workloads, the demand will shift from paying "per vPLC instance" to paying for operational outcomes (e.g. charging based on throughput, uptime, or energy savings achieved by the virtualized control loop). Vendors slow to transition from static subscription licensing to dynamic, value-based pricing risk losing market share to agile, cloud-native competitors.

How will robotics accelerate share gains from brick-and-mortar retail?

In our view, companies that leverage robotics and automation, especially e-commerce retailers, will be well-positioned to gain share from traditional brick-and-mortar stores by compressing the cost to serve while simultaneously improving the customer experience.

- **Lower cost to serve**: Automation allows e-commerce operators to improve service levels while simultaneously lowering costs through reduced markdowns, lower shipping costs, and slower labor growth. For example, as highlighted earlier in the report, we present a scenario analysis around Amazon's cost to serve where we estimate that ~5.6% of leverage in total cost to serve from automation by 2030 results in ~$72 bn in total cost savings and represents ~240 bps of margin tailwind to consolidated EBIT by 2030. We continue to see Amazon invest in logistics and automation, and we view its transition from singular point automation towards system-level automation as a multi-year opportunity. Similarly, Walmart continues to invest in automation-forward DCs and FCs, with the company estimating that it is only halfway through its automation initiatives. While we note that we are in the early innings of this supply chain transformation and so far have seen e-commerce retailers re-invest into further automation, we see potential for cost savings to flow through to pricing investments, broader selection, and faster fulfillment in the long term.
- **Improved customer experience through faster delivery speeds**: Automated fulfillment centers, AI-driven inventory management systems, robotic picking and sorting solutions, and autonomous mobile robots allow online retailers to process significantly higher order volumes with greater accuracy and lower labor intensity.

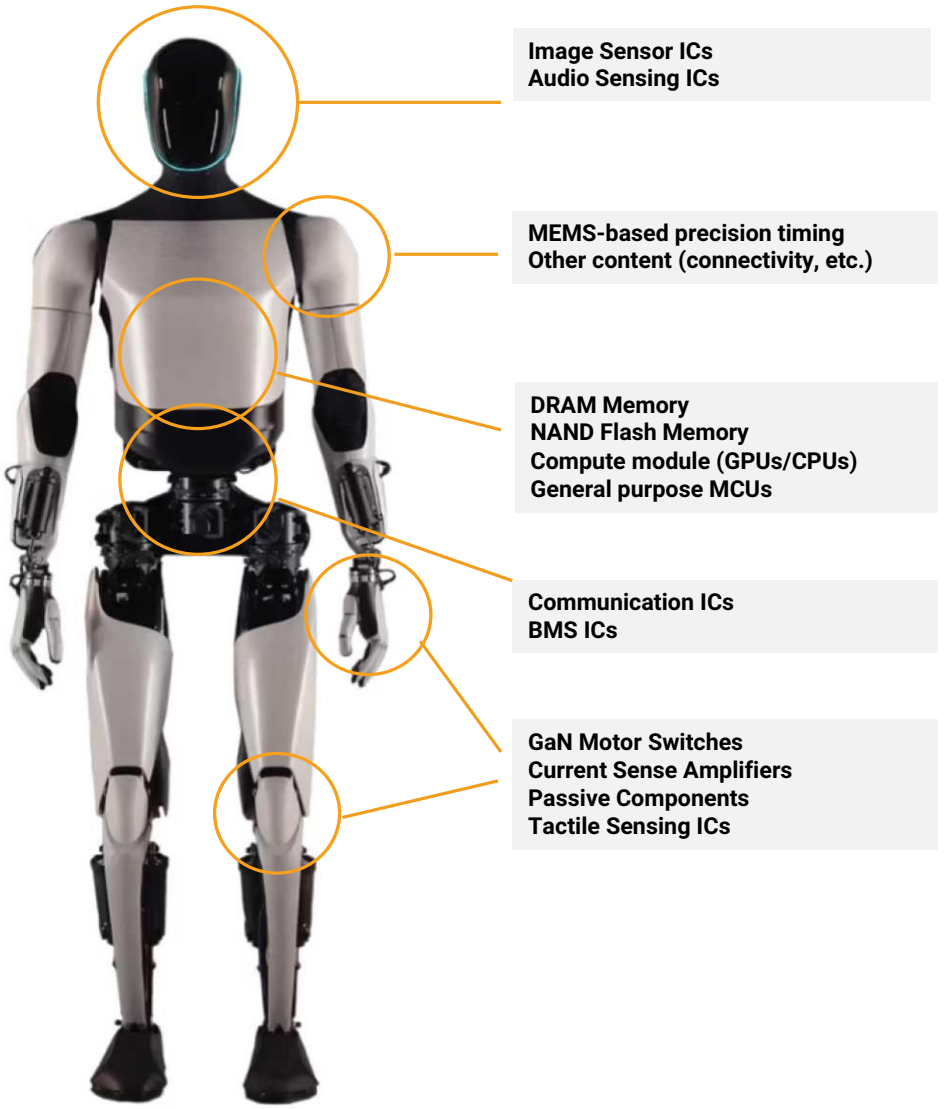
We expect these capabilities to enable faster throughput and delivery speeds at e-commerce retailers, with Walmart's next generation FCs streamlining a manual 12-step process into 5 steps. As fulfillment costs decline and delivery windows narrow, we expect consumers to be increasingly willing to shift to digital channels to purchase categories that were once considered inherently store-based, including groceries, everyday essentials, and urgent-need purchases.

Taken together, this creates a flywheel where better customer experiences drive higher online penetration, which in turn justifies additional automation investments, further widening the competitive gap with traditional retail formats. Over time, we believe advances in robotics, AI, and warehouse automation will continue to improve online commerce, accelerating the structural shift of retail spending from physical stores toward digital channels.

Semiconductors and Components as key enablers of physical AI

We see a significant commercial opportunity for semiconductors and precision components in physical AI / humanoid robotics - and this is also a target of growing investor attention and M&A activity. We see a Semiconductor SAM of $3,000-$6,000 per humanoid across digital, analog, and memory chips. Although digital-based computing modules remain the largest single cost driver in humanoids (at a rough cost of $1,500-$4,000+ per module), we see a meaningful and growing commercial opportunity in other semis categories for sensing, power management, and precise motor control, among other functions. We see significant upside in analog, a category which represents the vast majority of the components in such systems (up to 95%+), as well as memory, including DRAM/HBM and NAND, as more inference tasks are conducted at the edge.

Exhibit 65: Schematic representation of humanoid robot and semiconductor content



Source: Goldman Sachs Global Investment Research

Exhibit 66: Share of Humanoid BOM by Semiconductor Subcategory

Semiconductor Category	Product Examples	Key Vendors	Content in USD, Range
Analog and Mixed Signal	Power Semis Content (GaN + SiC motor drive switches, current sensing, etc.)	ROHM, Wolfspeed, Onsemi, Infineon, STMicro, NXP, Infineon, Renesas, Others	$350 - $500
	Communication ICs and FPGA	Microchip, NXP, Texas Instruments, Analog Devices, Altera	$150 - $200
	Optical components (cameras and image sensors, radar, etc.)	STMicro, Omnivision, Hamamatsu, Texas Instruments, Others	$150 - $200
	Other Sensors (positioning, proximity, audio, tactile, etc.)	Sony, Bosch, TDK, Hamamatsu, Honewell, STMicro, Murata Mfg., MinebeaMitsumi, Safran, Others	$50 - $100
	MEMS-based precision timing	SiTime, Microchip	$15 - $25
	Other Content (Connectivity ICs, Passive Components, Miscallaneous)	NXP, Microchip, STMicro, Texas Instruments, Onsemi, Infineon, Others	$25+
	Total Analog / Mixed Signal		***$750 - $1,050+***
Memory	DRAM Memory (LPDDR5, HBM)	Micron, SK Hynix, Samsung	$250 - $350
	NAND Flash Memory	SanDisk, SK Hynix, Samsung, Kioxia	$350 - $450
	Total Memory		***$600 - $800+***
Digital (ex. Memory)	GPUs	Nvidia, Qualcomm, Broadcomm, Intel, AMD, Tesla	$1,500 - $4,000+
	CPUs		
	Motor Control MCUs, Embedded MCUs	Renasas, STMicro, Texas Instruments, NXP, Microchip, AMD	$100 - $150
	Total Non-Memory Digital		***$1,600 - $4,150+***
Total Semiconductor Content			**$2,950 - $6,000+**

Source: Goldman Sachs Global Investment Research, Company reports

Opportunities for Analog:

Given the increasing motion and dexterity requirements of humanoids and higher number of motors needing precise control, we see a significant opportunity set across several categories.

- **GaN and SiC-based power semiconductors:** GaN (gallium nitride)-based motor drive switches play a vital role in attaining higher switching speeds and lack of reverse recovery vs. traditional Si-based MOSFETs and IGBTs. In a 30-motor humanoid robot using about 6 Gan-based switches per 2-phase motor, we estimate a SAM of approximately $250-$300 per unit for GaN motor switches alone, and a SAM of about $350-$500 per unit for power semis content overall, representing one of the largest single analog subcategory-level opportunities, with Onsemi (covered by James Schneider, PhD), Infineon (IFXGn.DE, covered by Alexander Duval), STM (covered by Alexander Duval), InnoScience (2577.HK, covered by Allen Chang), ROHM (6963.T, covered by Daiki Takayama), and Renesas Electronics (6723.T, covered by Daiki Takayama), among others, as some of the key vendors for this subcategory.
- **MEMS-based precision timing:** Needed for precise coordination and control and for which SiTime (SITM, covered by James Schneider, PhD) represents the primary vendor, in our view, and we believe the content per humanoid is ~$20.
- **Communication-related ICs and FPGA:** Needed to properly coordinate joint movements, these components typically constitute a combination of EtherCAT-, CAN-, and TSN-based solutions (depending on which parts of the humanoid the motor may be located in), and based on a 70%/25%/5% split across EtherCAT, CAN, and TSN, we see a SAM of ~$150-$200 for communication ICs and other FPGA, with Analog Devices (ADI, covered by James Schneider, PhD), Microchip (MCHP, covered

by James Schneider, PhD), NXP (NXPI, covered by James Schneider, PhD), Altera (Private), and Texas Instruments (TXN, covered by James Schneider, PhD), among others representing key suppliers.

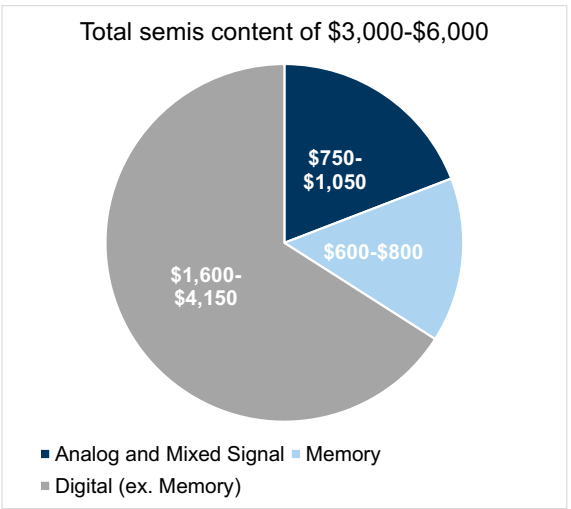
- **Optical components:** including image sensor ICs, radars, etc. are key to a humanoid's external perception. The cost of can vary, typically in-line with megapixel counts of the different cameras used, and we estimate an approximate SAM per humanoid of about $150-$200, with key suppliers including STMicro (STM, covered by Alexander Duval), Omnivision (603501.SS, covered by Allen Chang), Hamamatsu Photonics (6965.T, Not Covered), among others.
- **Other non-optical sensors:** including for positioning and proximity, audio perception, and tactile sensing, which are required given the complex and multi-sensory operating environments of humanoids. The content of these sensors can vary depending on the desired application, though we estimate a content of between $50-$100, with the primary vendors being Sony (6758.T, covered by Minami Munakata), Bosch (Private), Murata Mfg. (6981.T, covered by Daiki Takayama), TDK (6762.T, covered by Daiki Takayama), MinebeaMitsumi (6479.T, covered by Daiki Takayama), AAC (2018.HK, covered by Allen Chang), HON (covered by Joe Ritchie), and others.
- **Numerous other components:** including passive components, connectivity-related ICs (for WiFi, Bluetooth), and general purpose analog semis throughout a humanoid likely represent upwards of $25 or more in semiconductor content per humanoid, in our view.

On net, we see a total analog BOM per humanoid in the range of $750-$1,050+, which can increase as a function of dexterity (and more motors), increased precision requirements (and higher-end visual, audio, and tactile sensing content), and stricter energy efficiency requirements (which may increase the density of higher-priced GaN / SiC components).

Memory Content:
Although content can vary, we assume an average system (DRAM) memory of about 128GB for a single humanoid unit, with a non-volatile (NAND) memory of about 1TB. Prices for DRAM and NAND memory can vary, though we utilize the rough market price for memory at the time of writing in our assumptions given that many LTAs have been struck at these levels. Based on an assumed system memory of 128GB and a non-volatile memory capacity of approximately 1TB, we see a SAM range of between $250-$350 for DRAM and $350-$450 for NAND, for a total memory SAM of between $600-$800 or more per unit. Given the significant edge compute workloads of humanoid units, we expect that at least a portion of each system's memory will rely on HBM, which is primarily supplied by Micron (MU, covered by James Schneider, PhD), Samsung (005930.KS, covered by Giuni Lee), and SK Hynix (000660.KS, covered by Giuni Lee) where competition from Chinese memory makers (such as CXMT (covered by Allen Chang)) may be limited in the near-term, though whether humanoid manufacturers will decide to source HBM and traditional DRAM from separate vendors remains to be seen.

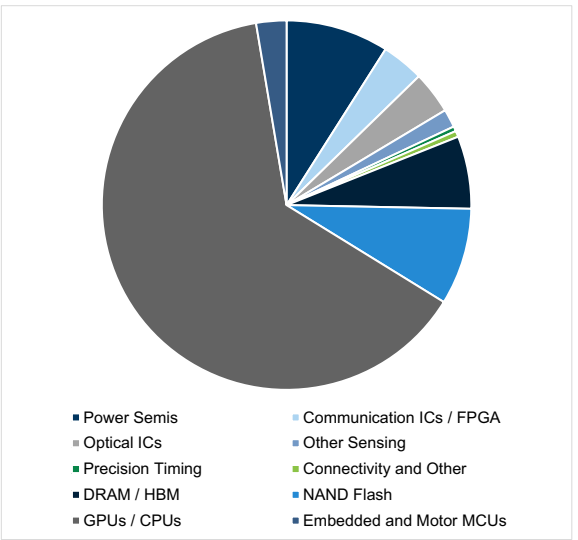
Other Digital Components:
The subcategory represents the most significant portion of semiconductor dollar content, with a vast majority attributed to specialized GPU/CPU consolidated modules from Nvidia (NVDA, covered by James Schneider, PhD) and others, the cost of which can vary. We estimate a cost of $1,500 for entry level modules at higher unit orders from these vendors with an upper range of about $4,000+ for the latest generations. Other digital components include motor control-related and other embedded MCUs, for which we see content of between $100-$150 based on a 30-motor humanoid at 1 MCU per motor and a handful of redundant and general purpose MCUs not otherwise included in our communication IC / FPGA count. While these components are considered digital and some are sold by AMD (AMD, covered by James Schneider, PhD), they are primarily supplied by analog-focused vendors such as Microchip (MCHP, covered by James Schneider, PhD), STMicro (STM, covered by Alexander Duval), SG Micro (300661.SZ, covered by Allen Chang), Renesas, and others. Net-net, we arrive at a total digital (ex. memory) BOM opportunity of between $1,600-$4,150 (see Exhibit 67).

Exhibit 67: USD Content Breakdown by Semiconductor Category



Source: Goldman Sachs Global Investment Research

Exhibit 68: USD Content Breakdown by Semiconductor Subcategory



Source: Goldman Sachs Global Investment Research

Business Opportunities for Humanoid Robot components and systems:
The Second Wave of AI Proliferation: As highlighted in our June 8 report, we believe the current AI-driven cycle in the Japan electronic components/semiconductors sector could be one of the biggest and longest ever, characterized by the ongoing technological evolution in AI server infrastructure **followed by a wave of device proliferation (physical AI/edge AI including humanoid robots)**. We believe components will be just as critical to this second wave of device proliferation as they are to the first wave of AI infrastructure. Consequently, the proliferation of humanoid robots represents a potential structural growth driver for the component supply chain in Japan. Below, we map key business opportunities across drive parts, batteries, passive components, and interconnects.

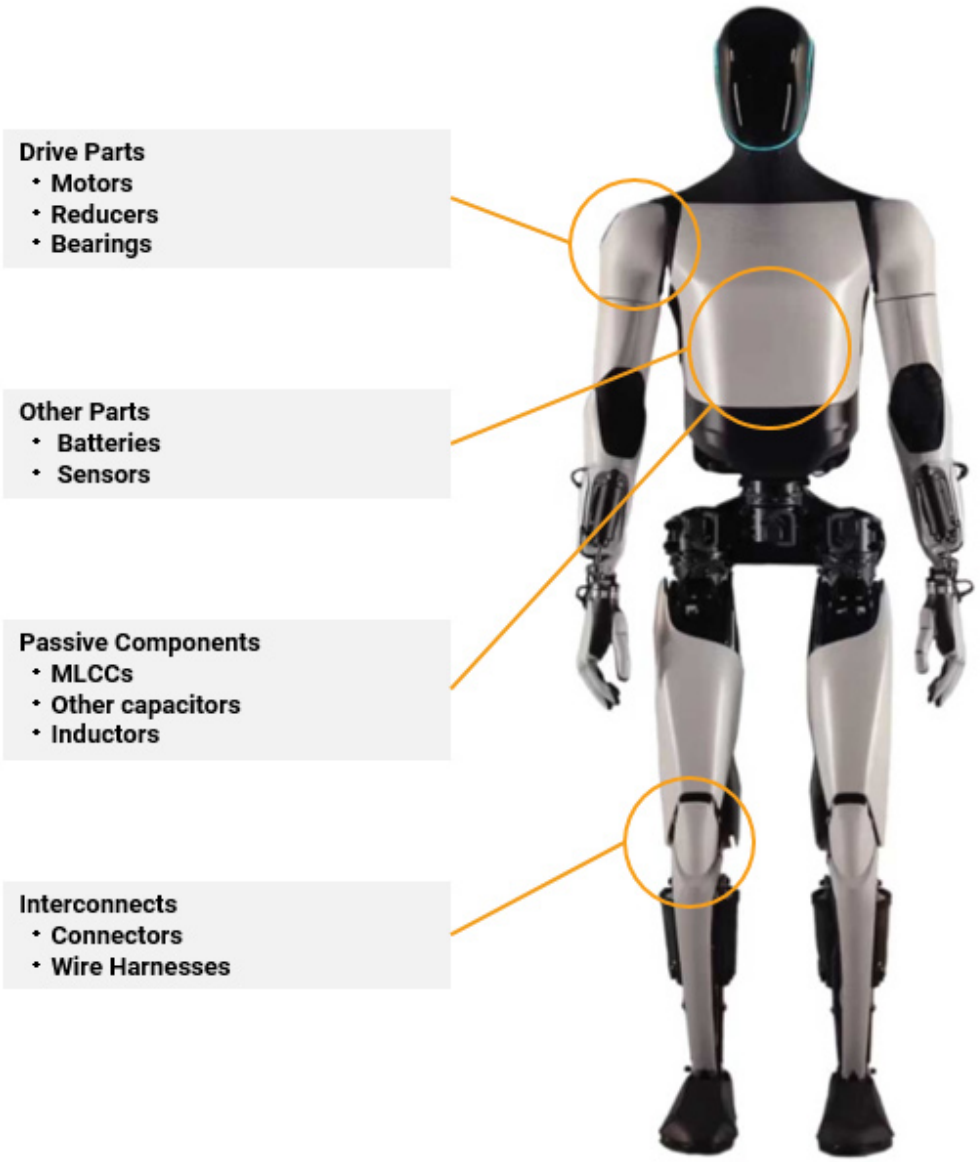
- **Drive Parts:** Actuators create the motion that allow humanoid robots to replicate human movements, with key engineering considerations including durability,

strength, precision, size, and quiet operation. Actuator systems are enabled by components including motors, reducers, and bearings among others. Beyond major joints, these components are also critical for achieving human-like hand dexterity. To illustrate the component density of humanoid robots, a single humanoid can require more than double the number of bearings vs high-end automobiles. **Potential Beneficiaries:** MinebeaMitsumi, Nidec, Mabuchi Motor (all three covered by Daiki Takayama), Denso, Aisin, JTEKT (all three covered by Kota Yuzawa), Harmonic Drive Systems, THK, Yaskawa Electric, Misumi Group (all four covered by Yuichiro Isayama), Mitsubishi Electric, Panasonic HD (both covered by Ryo Harada).

- **Batteries:** Battery performance is essential for the operational longevity of humanoid robots, requiring optimization of factors such as weight/size, energy density, safety, lifespan, and power output. LFP provides advantages in terms of safety, cost, and cycle length whereas nickel-based chemistries such as NMC or NCA may offer superior energy density. Solid-state batteries that enable higher safety, power output, and energy density, could represent the future technology roadmap for humanoid robots. **Potential Beneficiaries:** TDK, Murata Mfg. (both covered by Daiki Takayama), Panasonic HD (covered by Ryo Harada).
- **Passive Components:** Passive components, including small high-capacitance MLCCs and high-voltage MLCCs, enable stable power delivery within harsh, space-constrained operating environments to support the computing and movement of humanoid robots. Consequently, we expect this to open up a new growth market for passive component manufacturers. **Potential Beneficiaries:** Murata Mfg., Taiyo Yuden, TDK (all three covered by Daiki Takayama), Panasonic HD (covered by Ryo Harada).
- **Interconnects:** Interconnects for humanoid robots require durability to withstand harsh operating environments and continuous, strenuous movements. Simultaneously, maintaining high-speed communication and reliable power delivery to support real-time functions of humanoids robots are essential. We believe these dual requirements to could present an opportunity for connector and wiring harness suppliers. **Potential Beneficiaries:** Hirose Electric, Japan Aviation Electronics Industry (both covered by Daiki Takayama), Fujikura, Sumitomo Electric Industries (both covered by Ryo Harada), TE Connectivity and Amphenol (both covered by Mark Delaney).
- While Japanese semiconductor-related companies are as mentioned above, other Japanese companies are also involved in various non-semiconductor sensors.

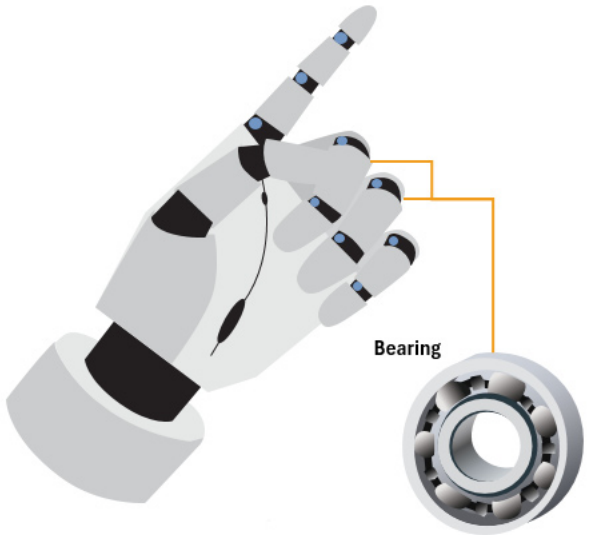
Ultimately, the capital invested per robot and the recovery of these investments are crucial considerations. To this end, from the standpoint of robot precision (directly linked to user experience) and service life (durability), the recognition of Japanese companies' high-quality, compact, lightweight, and thin component technologies, as well as precision-machined parts, could rise.

Exhibit 69: Schematic representation of components in humanoid robots



Source: Goldman Sachs Global Investment Research

Exhibit 70: Components are critical for achieving human-like hand dexterity



Source: Goldman Sachs Global Investment Research

With the ramp up of humanoid robots large-scale prototypes and commercial production ahead, we see opportunities for components and system assemblers that build factory and expand capacity, including Lingyi (002600.SZ, covered by Allen Chang), and Hon Hai (2317.TW, covered by Allen Chang). The system suppliers are able to cover the whole cycle of humanoid robot manufacturing, including core components, joint modules, and overall assembly and testing, along with the intelligent production lines and logistics. Lingyi rolled off its first batch of humanoid robots production line in Apr 2026. Hon Hai announced a collaboration with NVIDIA on the AI-powered industrial humanoid robot (Link).

Software: World Models may drive the next leg of token demand

Success with LLMs has catalyzed investment in World Models. We have had several industry conversations on the software stack for robotics in the last six months, including with founders at world model companies and academics at Stanford. We have two observations on why investment and progress is inflecting now:

1. Meaningful progress has been made on LLM research, but the industry is running into limitation with the types of problems that LLMs can solve, as LLMs are limited to text-based datasets, and the field of LLM research is becoming more saturated.
2. Researchers can apply learnings from LLMs to world model progressions. For

example, newer world model companies like Physical Intelligence (PI) and Generalist AI focus on training a single model across highly diverse tasks and then applying that model to narrow use cases, in an approach that parallels frontier LLM models and in contrast to task-specific robots.

The long-term moat is proprietary, deployment driven data. Locomotion and navigation algorithms are largely solved through simulation-driven reinforcement learning. However, real-world manipulation parameters (e.g., those tied to deformable objects, food preparation, tool use) are fundamentally un-simulatable and therefore data-constrained. As a result, world model companies orient their research and capital toward tasks where real-world interaction is unavoidable and where labor displacement potential is highest. Two examples:

1. Physical Intelligence has detailed a closed-loop system in which human-operated robots generate video and action data for specific tasks, models are retrained and validated on live robots, and subsequent deployments generate incremental proprietary data. Critically, this proprietary dataset improves with each deployment, reinforcing management's view that data accumulation is the primary competitive advantage.
2. Generalist AI's key differentiation is a) using visual images rather than sensors. The model observes an off-the-shelf commercial robot via cameras, converts the signal into tokens, and uses the AI world model to predict the next best movement for the robot arms in space; b) a focus on dexterity, scaling, tightly integrated feedback loops between research and deployment, and a talent-dense team.

In our view, new world model companies illustrate that the technical breakthroughs in AI in recent years may have meaningful implications well beyond the enterprise software TAM that we typically focus on. This may create a new class of companies that span the best of two business models: the Software business model (where code is the cornerstone of driving model performance for real world applications) and those business models with a physical moat (which may be more defensible in an era where the cost of code is low).

The token demand curve for Robotics will likely create another lever to longer-term data center demand dynamics. Recall we introduced our estimate that demand for tokens would increase 24x in the next 5 years in our agentic economy report. This estimate contemplates text to more complex imaging to more complex agentic step ups. The world models curve would layer on top of this. Industry experts argue that developing a competitive world model may require frontier-model-level scale in both compute and data. Internet-scale data is increasingly insufficient to train models, and more real-world data is generated every minute relative to the entire internet corpus. Taken together progress over the next several years may require select companies operating at similar compute scale to today's frontier LLM models.

Exhibit 71: One robot may generate 200x more data in one day than the entire frontier LLM training corpus

	GB equivalent
All of English Wikipedia: 25GB	25
Frontier LLM training corpus: 120TB	120,000
One robot's cameras, 30 minutes : 1.3TB	1,300
One robot, one day: 64TB	64,000
One robot, one year: 24PB	24,000,000

Source: Stanford

Hyperscalers and neoclouds have already announced several world labs as customers; in our coverage, we view Microsoft, Oracle and CoreWeave as well positioned. In our conversations with CoreWeave, our understanding is that relative to LLMs, world model customers value a) AI object storage, given more data; b) bandwidth performance, with Infiniband driving better performance than Ethernet; c) zero egress, given higher amounts of data egress. World model customers tend to use GPUs for both computing and data processing, whereas CPUs do the heavy lifting on data processing for LLMs).

Exhibit 72: Compute providers have already announced select world model customers that could drive step function changes in token demand in the next 2-5 years
Select customer announcements at compute providers

Compute provider	Customer	About	Detail
Microsoft	Figure AI	Humanoid robotics company developing Vision-Language-Action foundation models	Utilizes Azure's AI infrastructure, storage, and cloud capabilities to train and scale Helix, its proprietary generalist Vision-Language-Action (VLA) model. Microsoft participated as a key investor in Figure's $675mn Series B and its $1 bn Series C.
	Global Objects	Spatial intelligence company building 3D world models and digitized representations of physical objects and environments	Multi-year strategic collaboration with Microsoft to develop a retrieval-grounded world model trained on multimodally scanned 3D objects. Initial target to scale to ~1.67 mn objects. Global Objects products are distributed through Microsoft Marketplace and leverage Azure.
	AiFi	Spatial intelligence and digital twin platform	Built on Azure, Azure Databricks and Microsoft's AI stack. AiFi's platform processes 60mn+ human interactions per month; customers report 25%-40% shrink reduction and 300% throughput improvement.
	Wayve	Embodied AI and autonomous driving foundation models	Uses Azure services including storage, kubernetes and hosted Databricks to train and scale autonomous driving models; Microsoft participated in Wayve's $1.2bn Series D.
	Worlds	Physical AI platform and Large World Model (LWM) developer	Deploys the WorldsNQ platform on Azure. Uses Azure AI and cloud services to convert camera and IoT data into real-time operational intelligence.
Oracle	Applied Intuition	Physical AI developer serving automotive, defense and industrial markets	Uses OCI to scale simulation environments and physical AI model development
	Tensor	Autonomous vehicle and embodied-agent developer	Uses OCI to support training, simulation and deployment of autonomous driving systems. Tensor cites OCI's ability to support large-scale AI infrastructure, regulatory requirements and autonomy workloads.
CoreWeave	Decart	Developing real-time world models	Developed Oasis 3, the first API-accessible world model for physical AI, using CoreWeave's platform and integrated Weights & Biases for experiment tracking.
	General Intuition	Focused on world models and spatio-temporal reasoning	Uses CoreWeave ARENA to benchmark and scale world-model training. Trains on 1bn+ hours of video data from Medal.tv. Reported 20%-30% better multi-node performance and improved reliability for multi-day jobs. Uses production GPU clusters and CoreWeave's AI stack.
	World Labs	Developing spatial intelligence and Large World Models	Highlighted as a partner of choice for training and running Large World Models (LWMs) like Marble, which generates persistent, explorable 3D environments.

Source: Company data, Goldman Sachs Global Investment Research

Private Company Landscape

The intersection of artificial intelligence and the physical world **(Physical AI or Embodied AI)** has experienced a material increase in venture funding and technological breakthroughs. In the first half of 2026 alone, global venture funding for physical AI reached $47.4 billion across 521 deals (Crunchbase – link), nearly quadrupling the

capital raised in the latter half of 2025. This capital is flowing into a group of innovative, privately held companies that are building the physical bodies (humanoids and mobile robots), the foundational "brains" (robot foundation models), and the critical software infrastructure (simulation and validation tools) that allow machines to interact dynamically with the real world.

1) Autonomy Software, Simulation & Infrastructure
Rather than building physical robots, these companies provide the software infrastructure, simulation environments, and spatial intelligence required to develop, test, and deploy autonomous systems safely across land, air, and sea.

- **Applied Intuition:**
  - **Focus:** Simulation, validation, and vehicle autonomy software.
  - **Company Facts:** Focused on the horizontal layer of physical AI, Applied Intuition does not build hardware. Instead, they provide the software infrastructure that allows others to test autonomous systems in highly realistic virtual environments. They have achieved notable commercial penetration, counting 18 of the top 20 global automakers as customers (including Toyota, Volkswagen, and GM) alongside several U.S. Department of Defense contracts.
- **World Labs:**
  - **Focus:** Spatial intelligence and 3D world models.
  - **Company Facts:** Founded by AI pioneer Fei-Fei Li, World Labs is building "world models" that understand 3D physics, geometry, and spatial relationships. This technology is critical for enabling robots to predict the physical consequences of their actions in real-time.

2) Robot Foundation Models & "Brains"
These software-first companies focus on building the vision-language-action (VLA) models and universal intelligence layers that can be deployed across third-party hardware.

- **Skild AI:**
  - **Focus:** General-purpose robot foundation models.
  - **Company Facts:** Skild AI is building the "Skild Brain," their foundational model designed to control a variety of hardware form factors—from robotic arms to quadrupeds and humanoids—allowing different machines to generalize and perform novel tasks without needing custom, per-task programming.
- **Physical Intelligence (π):**
  - **Focus:** Universal robot foundation models.
  - **Company Facts:** The company is focused on the software laye
    training large-scale multi-modal models (such as their π-series
    plugged into any robotic platform to enable general-purpose
    like folding laundry or assembling boxes.



3) Full-Stack Humanoid Robotics

These companies are building both the advanced bipedal hardware and the end-to-end AI systems to deploy general-purpose humanoids in factories, warehouses, and eventually homes.

- **Figure AI:**
  - **Focus:** General-purpose humanoid robots.
  - **Company Facts:** Figure AI is a pure-play humanoid robotics startup - their flagship humanoid (Figure 03) utilizes their proprietary "Helix" AI model. Figure has successfully completed commercial pilots, including performing select assembly tasks at a BMW manufacturing plant, and is being deployed toward more complex, sequencing use cases.
- **1X Technologies:**
  - **Focus:** Safe, bipedal, and wheeled androids for homes and logistics.
  - **Company Facts:** 1X (formerly Halodi Robotics) has built a home-targeted humanoid, Neo, that utilizes quiet, soft-actuator technology designed to operate safely around humans. Neo expects commercial shipments to the U.S. market in 2026.
- **Apptronik:**
  - **Focus:** Industrial humanoid robots.
  - **Company Facts:** The University of Texas spin-out has emerged as a player in manufacturing automation. Their humanoid robot, Apollo, is designed for logistics and manufacturing, and is currently undergoing active pilot deployments with Mercedes-Benz and GXO Logistics.
- **Agility Robotics:**
  - **Focus:** Warehouse-optimized humanoid robots.
  - **Company Facts:** Agility is a pioneer in commercial deployment. Their bipedal robot, Digit, is integrated in commercial partner facilities including Amazon, GXO Logistics, and Mercado Libre.

4) Cognitive & Industrial Autonomy

- **NEURA Robotics:**
  - **Focus:** Cognitive humanoid and collaborative industrial robots.
  - **Company Facts:** Based in Germany, NEURA is a humanoid and cognitive robotics company. They specialize in integrating advanced sensors (force, torque, and vision) directly into robotic joints, allowing their robots to "feel" and safely collaborate with human workers on factory floors.

Stocks in Focus

Tesla (Neutral-rated): We believe that Tesla is well positioned to address the humanoid market utilizing its experience in hardware (e.g. the silicon and compute), software (e.g.

AI training, and an ability to train the robots in a factory), its ability to design power efficient full solutions, and its background in high-volume manufacturing. While Tesla has commented that it is looking to do many of the key components in house such as design its actuators (for IP, product capability, and scalability reasons), other aspects of the cost structure are in areas that we believe the company may have a cost advantage (e.g. sensors, compute, and manufacturing) due to the overlap with its other businesses. Given our view Tesla can leverage some of its expertise from vehicles/energy including for power electronics/semis, navigation related software, and manufacturing, we believe this could equate to a potential cost advantage that may reach several thousand dollars per robot. Additionally, we believe the company could benefit from both using Optimus internally (including having the factory environment that can be used to gather training data), and by selling it externally.

On the deployment timeline, Tesla highlighted on its 2Q26 call that the first-gen production lines are being installed for Optimus, with anticipated production in 2026. The company has discussed that it plans to utilize Optimus internally first and expects to start selling Optimus externally in 2027 with the company continuing to target 1 mn bots per year by the end of the decade. We would note that management reiterated that production will follow an S-curve with the initial production being low for a period of time. Tesla has also commented that early units will go to its academy for data collection and training.

In terms of the value for Tesla's Optimus business, assuming revenue grows at a ~45%-65% CAGR from 2030 through 2040 (following faster unit shipments in the next few years as Tesla ramps), with a ~20%-30% EBIT margin (along with other assumptions like an ~8% WACC and ~3% perpetuity growth in steady-state), we calculate implied 12-month forward value per share of ~$15-$170 for the humanoid business. We believe that this analysis suggests that the ultimate value of Tesla's Optimus business will depend on the degree to which it can scale and ramp Optimus to reliably do useful and generalized tasks, and sustain a strong margin profile (likely enabled by a meaningful subscription business). We appreciate that there are scenarios outside this range.

While we believe Tesla is well positioned to grow its revenue and profitability driven in part by its physical AI efforts including from Optimus, robotaxis, and FSD, we believe the growing competitive environment (as detailed both in this report and in our recent AV deep dive) will also be key to monitor, as it could limit the degree of earnings from its physical AI efforts.

We are Neutral rated on the stock. Our 12-month price target is $360 which is based on 150X applied to our Q5-Q8E EPS estimate including SBC. Using a similar framework to our past analysis, an upside scenario could be ~$500 (based on the 150X multiple applied to 2028E EPS ex SBC estimate), and a downside scenario could be ~$150 (based on a downside multiple of 60X our 2028E EPS inc. SBC estimate). We have an illustrative DCF scenario analysis by segment available for clients upon request.

Key downside risks to our view relate to potentially larger vehicle price reductions than we expect, increased competition in EVs, a larger than expected tariff impact or negative effects from government policy changes more generally, slower EV demand, delays with products/capabilities such as FSD/4680, key person risk, the internal control environment, margins, and operational risks associated with Tesla's high degree of vertical integration. Upside risks include faster EV adoption and/or share gain by Tesla, a

stronger macroeconomic environment for new vehicle sales more generally, earlier new product launches than we expect, an earlier/larger impact from AI-enabled products (e.g., FSD, Optimus and robotaxis), and a smaller than expected tariff impact than we currently anticipate.

Nvidia (Buy-rated): Nvidia is a foundational enabler of physical AI, providing the full technology stack that allows robots to perceive, reason, and interact with the real world through its Isaac Gr00t humanoid foundation models, Omniverse simulation platform, and Jetson edge computing systems. The company's strategy extends beyond silicon, positioning Nvidia as the operating platform for next-generation robotics by supplying the AI models, synthetic data tools, and simulation environments required to accelerate adoption. As physical AI transitions from research environments to large-scale deployment across factories, logistics networks, and service applications, we expect training requirements and token consumption to increase meaningfully. This should support a more durable AI investment cycle as enterprises invest in increasingly sophisticated physical AI models and infrastructure. Given its leadership across AI compute, software, and robotics platforms, we believe Nvidia is well positioned to be a key beneficiary of this trend.

Our 12-month price target of $300 is based on a 30X P/E multiple applied to our normalized EPS estimate of $10.00. Key downside risks include: (1) slowdown in AI infrastructure spending, (2) share erosion due to increased competitive intensity, (3) margin erosion due to increased competition; (4) supply constraints.

We believe EMS companies Jabil (JBL) and Flex (FLEX) are in a unique position to help with manufacturing (parts and potentially full robots), training (e.g. gathering data in a factory setting), and utilizing the humanoid robots in their factories with Jabil having over 134K employees and Flex having ~150K employees (we believe the majority of those employees are for manufacturing type roles). Jabil and Flex brings decades of experience in capabilities that include manufacturing, automation, supply chain, material sciences, compute, and power electronics.

- **Jabil (Buy-rated):** For Jabil, we believe this is highlighted by its press release in Feb 2025 announcing a collaboration with Apptronik to help with training and manufacturing, including giving the robots access to real world data and validation. Jobs used for testing and validation could include sorting, kitting, object placement, sub-assembly, and delivery per the release. While we don't expect humanoids to be a significant driver of Jabil's business for at least a few years, which is consistent with company comments at investor events, we think Jabil can benefit in the near to medium term with sales into the broader robotics/warehouse automation, datacenter, AV, and EV markets that use some of the same technologies as humanoids. As an example, Jabil expects its Digital Commerce end market, which houses its robotic and warehouse automation business, to grow 17% in FY26 and account for a high single digit percent of revenue. Moreover, given Jabil's relationships with companies including Tesla and Amazon that are developing robotics, we think it is well positioned to be a partner. By 2030, if Jabil generated $250-$45,000 of revenue per humanoid (with the lower end assuming parts/materials and the high-end full manufacturing) on 1-10% of global humanoid robots, and assuming humanoids can save 50-65% on 1-15% of its direct labor (with

Jabil dropping half of this to the bottom line), then we estimate this could equate to as much as $3 of EPS. At the lower end of these assumptions, the EPS impact would be minimal.

We are Buy rated on the stock. Our 12-month price target is $482 based on 27X applied to our Q5-8 EPS estimates. Key risks to our view relate to revenue growth (including due to macro factors, market share, and program mix), its ability to continue to expand margins vs. history, geopolitical uncertainty, and FCF.

- **Flex (Buy-rated):** For Flex, while the company has commented that humanoids are not a significant contributor to revenue in their industrial end market, management highlighted warehouse automation as a driver to growth for FY27. Flex has also highlighted a recent partnership with Teradyne where Flex manufactures key components for Teradyne's cobot and AMR products. Additionally, management also highlighted that its warrant deal with Amazon positions it for a wide range of business at this customer. By CY30, if Flex generated $250-$45,000 of revenue per humanoid on 1-10% of global humanoid robot shipments, and assuming humanoids can save 50-65% on 1-15% of its direct labor (with half of this dropping to the bottom line), then this could equate to as much as ~$0.85 of EPS. At the lower end of these assumptions, the EPS impact would be minimal.

  We are Buy rated on Flex shares. Our 12-month price target of $154 is based on 21X Q5-Q8 EPS including SBC. Key risks to our view relate to macroeconomic demand, supply/demand dynamics, Flex's ability to expand margins, tariff impacts and geopolitical uncertainty, and FCF.

We believe connector companies TE connectivity (TEL) and Amphenol (APH) are in a unique position to supply interconnect and antenna solutions designed to help support the motion controls, power, data and communications required for robotics, humanoids, and physical AI especially in a constrained and potentially harsh/rugged environment. We also believe these companies will continue to benefit from providing connectors and electronic/electrical components used to power datacenters, and the high-speed/low-latency connectors and cables required for racks and servers to train the broad AI market (including physical AI).

- **TE Connectivity (Buy-rated):** For TEL, at its 2025 investor day the company highlighted that in its Automation & Connected Living segment (which accounted for ~13% of revenue in FY 25), it expects to grow its robotics and motional control content from $60 to $100 per bot and its automation sensors and control content from $43 to $85 per bot over time. Specifically for humanoids, TE highlighted, per a company webpage, that it offers products focused on vision & sensing, control & communications, power distribution, and movement.

  We are Buy rated on TEL shares with a 12-month price target of $284, which is based on 21X our normalized EPS estimate of $14.25. Key downside risks relate to automotive/industrial/datacenter end demand, the impact of EVs and new car architectures on automotive content for TE, datacenter content opportunities tied to AI, market share, and margins (including potential tariff impacts).

- **Amphenol (Buy-rated):** While APH has not explicitly discussed its position in the humanoid market, the company discussed broader factory automation/robotics as a

driver of growth within its industrial segment in 2Q.

We are Buy rated on APH shares. Our 12-month price target of $204 is based on 30X applied to our normalized EPS estimate of $6.80. Key downside risks to our view relate to revenue growth, margins, the trade situation with China (given Amphenol's presence in the country, with several manufacturing sites), and Amphenol's ability to continue to execute well on M&A.

Hyundai Mobis (012330.KS, Buy): Hyundai Mobis is the sole supplier of actuators for Boston Dynamics, and has a targeted capacity of 350,000 units/year by 2028. We believe Mobis' core business remains solid, with auto-parts business poised for a recovery in margins next two years added by a buffer from highly resilient after-service (AS) margins. The company is well positioned to benefit from stable auto-parts business, while transitioning into a high-growth humanoid actuator player. In addition, the stake holding in Boston Dynamics is an additional merit. We rate Hyundai Mobis as a Buy, as current valuations do not fully reflect its long-term robotics growth, with the actuator business projected to contribute 7% of operating profit by 2035E. Our 12-month target price for Hyundai Mobis is W710,000, based on a target 2035E P/E of 15x, discounted back to June 2027E using a COE of 7.8%. Key risks for Mobis would be margin erosion from cost inflation (short term risk) and slower execution in humanoids (Boston Dynamics) or autonomous driving (Hyundai Motor and Kia).

HL Mando (204320.KS, Buy): We believe HL Mando has the potential to supply actuator assemblies to its North American customers, supported by its strong US presence, track record of supplying quadruped robot actuators since 2022 along with strong ties to US EV makers. However, uncertainties remain, as the company has yet to secure an anchor humanoid customer, and risks include no major orders by the end of 2027, higher North American capex, and cost inflation. We believe HL Mando's core business remains solid, underpinned by its leadership in steering, brakes, suspension, and ADAS, with a robust W61tn backlog. The company is well positioned to benefit from customer diversification in the US, India, and China, alongside rising adoption of high-margin steer-by-wire (SbW) systems. We rate HL Mando a Buy, as the market likely underappreciates its robotics transition, which is projected to contribute 18% of operating profit by 2035E. Our 12-month target price for HL Mando is W109,000, based on a target 2035E P/E of 15x, discounted back to June 2027E using a COE of 8.0%. Key risks for HL Mando would be no humanoid actuator orders by end of 2027, margin erosion from rising Capex in North America, and stagnant ADAS business.

Robotis (108490.KQ, Buy): We believe Robotis has the potential to supply actuator assemblies and humanoids to its global customers, supported by its 23-year footprint in precision actuators and a 17x capacity expansion in Uzbekistan targeting 5 million units by 2030. Although, one potential risk is execution, as the company has limited experience in mass production. We believe Robotis' core business remains solid, underpinned by its leadership in actuators. The company is well positioned to benefit from the launch of affordable quasi-direct drive (QDD) actuators and its unique action data factory in Uzbekistan starting in late 2026, which will bundle data with hardware to accelerate customer adoption. We also believe Robotis semi/bi-pedal humanoids will see volume momentum from next year. We have a Buy rating, given its early-mover advantage and diversified growth engines across actuators, humanoids, and data. Our 12-month target price for Robotis is W630,000, based on a target 2035E P/E of 60x, discounted back to June 2027E using a COE of 10.5%. Key risks for Robotis would be

execution risks in Uzebekistan plant, no major humanoid actuators orders until 2027/2028 and margin dilution from aggressive pricing.

XPeng (XPEV/9868.HK, Buy): XPeng targets to become an embodied intelligence company, with focus on its new products for volume production and commercialization starting from 2026. (1) humanoid robots to start volume production in 2026 (hardware and software integration in Apr 2026, volume production of advanced humanoid robots in 2026), (2) autonomous driving based on VLA 2.0 model to adapt to diverse driving scenario (pilot users in Dec 2025, VLA 2.0 to launch on Ultra model in 2026, Super LCC for global customers in 2026), (3) robotaxi trial operation with three models to launch in 2H26 and L4 enabled passenger vehicles, and (4) land aircraft carrier for commercial use in tourism in 2026 (volume production of land aircraft carrier in 2026, with 7k orders on hand).

While revenue contributions from these emerging businesses are still limited in 2026, we believe the start of volume production would be an important step into real-world applications to further drive technology advancement. We see XPeng's competitive advantages in (1) large data sets from its NEV fleet feeding into the autonomous driving model for L4 and robotaxi; (2) in-house vehicle design and production capability leading to time-to-market with cost advantage; (3) technology and cost synergies across different businesses.

We are Buy rated with 12m DCF-based (WACC 11.8%, TGR 3.0%) TPs of US$18/HK$69 for the ADR/H shares. Key risks include lower-than-expected sales volume, worse-than-expected price competition, weaker-than-expected market demand.

Hesai (HSAI/2525.HK, Buy): We believe Hesai, as a key LiDAR and actuator supplier to both Unitree and Sharpa, is well-positioned to benefit from the future development and general availability for related humanoid robot products. On June 1, 2026, Nvidia announced its Isaac GR00T Reference Humanoid Robot platform during GTC Taipei at Computex, featuring Unitree H2 humanoid chassis (i.e. humanoid robot body) and dual Sharpa Wave tactile five-finger hands (i.e. dexterous hands). For dexterous hands, Nvidia has chosen Sharpa to provide the tactile manipulation capabilities through its dexterous hand named "Wave" – each five-finger hand possesses 22-25 degrees of freedom. Per Sharpa, Nvidia GEAR Lab researchers demonstrated a 54% higher success rate in complex tasks like operating syringes and assembling model cars by pre-training on human video data using Sharpa's Wave hands.

In addition, Hesai announced that it is the LiDAR supplier for Unitree's G1/H2 models showcased at the 2026 Spring Festival Gala. Also, per Hesai's announcement, it has entered into a Supply of Products Framework Agreement with Sharpa from Mar 25, 2026 to Dec 31, 2026, where Hesai will supply LiDAR products and robotics actuators to Sharpa, with an annual cap of Rmb200mn for the transactions under this agreement in 2026. We also note that Sharpa is the supplier to Galbot (private)'s dexterous hands showcased at the 2026 Spring Festival Gala per QQ news, where the robot rotated walnuts in its hands to show its flexibility.

We are Buy rated on Hesai (H/ADR), a leading LiDAR solutions provider. Its products cater to applications across advanced driver assistance systems (ADAS), autonomous mobility, and robotics with 33% revenue market share in 2024 globally. Our 12m target prices of US$31/HK$30 for ADR/H shares are based on a 20x P/E multiple applied to

Hesai's 2030E non-GAAP EPS and discounted back to 2026E at a CoE of 11%. Risks include slower LiDAR adoption, intensified competition, customer pricing pressure, policy risk.

Xiaomi (Buy-rated): We believe Xiaomi has clear advantages in deployment scenarios including its own manufacturing factories and a vast home AIoT ecosystem, as well as technology and cost synergies within the company. With physical intelligence being one of the three monetization paths within Xiaomi's AI strategy, we expect Xiaomi Robotics to focus on more structured to-B commercial scenarios over the next 3-5 years, e.g. massive humanoid deployment at Xiaomi's factories (smart EV, smartphone and home appliance) and its partner factories, before expanding it to-C scenarios.

In Jul 2026, Xiaomi Robotics announced several achievements that imply an initial integration of its robotics framework across ontology/body, data and models, which may lead to a self-reinforcing loop toward general-purpose industrial and domestic automation. 1) Humanoids deployed at active automotive production lines, which by July 2026 have improved the task success rate to 98% at self-tapping nut loading stations, started taking on new logistics tasks (e.g. sorting flexible center console side covers, folding returnable boxes) with an initial 90% success rate, and achieved long-duration continuous operations with flexible workpieces for the first time. 2) Embodied data/scene synthesis with the Xiaomi-Robotics-U0 model that ranks No.1 on WorldArena and allows autoregressive scaling across modalities. 3) Robot foundation model with the Xiaomi-Robotics-1 VLA foundation model designed for end-to-end physical execution as the cognitive and physical control layer, which achieves SOTA among open-source models across multiple benchmarks.

We are Buy rated on Xiaomi with a 12m target price of HK$39, based on an SOTP valuation methodology. Key risks include intense competition within the global smartphone industry, GPM pressure on the smartphone/EV business, below-expected execution on brand premiumization and EV business, geopolitical risks and regulatory uncertainties.

Inovance (300124.SZ, Buy, on CL): We believe Inovance has unique advantages in serving China's domestic AI robotics supply chain, with offerings spanning key components and modules, including rotary actuators, linear actuators, and bionic arms. As an incumbent leader in factory automation, Inovance benefits from strong synergies between its existing industrial automation capabilities and AI robotics hardware requirements. The company has been building high-performance, in-house manufacturing capabilities across critical components, including motors, drives, gearboxes, encoders, and planetary roller screws, aiming to optimize products for robotic applications requiring high power density, efficient heat dissipation, and lightweight design. Beyond individual components, Inovance is also positioning itself as a module supplier while expanding its capabilities in motion-control software. We maintain a Buy rating on the stock, with our positive view driven by continued market share gains in both domestic and global markets, as well as strong end-market momentum across advanced manufacturing sectors, including semiconductors, PCBs, and batteries. Our 12-month target price is Rmb92.9, based on 35x 2027E P/E. **Key downside risks:** 1) Slower-than-expected industrial automation market share gains; 2) Weaker-than-expected margin trends; 3) EV component segment ramp-up coming slower than expected; 4) general manufacturing capex/automation demand slowing down.

Sanhua-H/A (2050.HK/002050.SZ, Buy/Neutral): We believe Sanhua has the potential to supply actuator assemblies to its North American customers, supported by long-standing customer relationships and a strong track record of joint R&D collaboration. However, uncertainties remain, as North American customers may choose to retain certain actuator assembly processes in-house. We believe Sanhua's core business remains solid, underpinned by its leadership position in global EV thermal management and HVAC components. The company is well positioned to benefit from rising global EV penetration, as well as increasing HVAC demand driven by data centers and energy storage systems (ESS). We maintain a Buy rating on Sanhua-H, given its wide valuation discount of 38% versus Sanhua-A (Neutral-rated), with further upside potential from possible participation in the North American robot supply chain. Our 12-month target price for Sanhua-H/A is HK$40.0/Rmb38.6, based on a 2030E P/E of 23x/25x, discounted back to 2026E using a COE of 9.5%.

Sanhua-A key upside/downside risks: (1) Faster/Slower-than-expected revenue contribution from humanoid robots; (2) Better/Worse-than-expected global EV sales; (3) Better/Worse-than-expected home appliance sales.

Sanhua-H key downside risks: (1) Slower-than-expected revenue contribution from humanoid robots; (2) Worse-than-expected global EV sales; (3) Worse-than-expected home appliance sales.

Shuanghuan (002472.SZ, Buy): We believe Shuanghuan could play a meaningful role in the humanoid robot supply chain, both domestically and overseas, primarily supported by its leadership in precision gears. As a domestic leader in EV gears and RV reduction gears, Shuanghuan has continued to innovate in next-generation reduction gear technologies. The company is developing new solutions positioned between harmonic drives and RV reduction gears, aiming to address the increasingly demanding requirements of AI robotics applications, including lightweight design, higher precision, and improved performance. We maintain a Buy rating on Shuanghuan, supported by our positive view on its global market share gains in EV gears, RV reduction gears, and intelligent plastic transmission modules. In addition, we see potential upside from its ability to participate in the robotic supply chain, leveraging its technology leadership and strong R&D capabilities. Our 12-month target price for Shuanghuan is Rmb45.5, based on 25x 2027E P/E. **Key downside risks:** 1) Lower-than-expected market share in NEV segment; 2) lower-than-expected new energy revenue outlook; 3) lower-than-expected industrial robot gears revenue.

Daifuku (6383.T, Buy): We reiterate our Buy rating on Daifuku. The company is one of the world's leading suppliers of warehouse automation solutions, and commands a position as the top supplier particularly for the semiconductor and automotive industries. Its presence in general industry automation, including e-commerce, is increasing—especially in the US—and its growth profile has risen to a level that compares favorably with other logistics automation majors. Its top-line growth capability far exceeds that of the FA sector, and as is clear from Exhibit 24 above this clearly supports the high growth potential of warehouse automation-related companies. On the adoption of physical AI solutions, including humanoids, we have highlighted since the start of the year that Daifuku is a player well positioned to be a major beneficiary ([LINK]). Given the strong appetite for adopting humanoid solutions across all kinds of industries, not just FA sectors, and given that whatever tasks end up being replaced by humanoids, these are likely to be incorporated as one component of the underlying

warehouse automation system in the first place—and that Daifuku has supplied a large number of these systems itself—we believe that the company's business opportunities are likely to continue expanding. In addition to its robust fundamentals, we recognize Daifuku as the top system supplier in the emerging humanoid and physical AI space.

Our 12-month target price of ¥9,300 is based on FY12/29E EV/EBITDA, applying the sector-average multiple of 10X and an 80% sector-relative premium, with the obtained theoretical value discounted back to the midpoint of FY12/26E and FY12/27E with capital cost of 9%. Key downside risks include slower investment from the tech, e-commerce, and automobile industries.

MinebeaMitsumi (6479.T, Buy): MinebeaMitsumi positions humanoid robots as one of its "Five Growth Areas," and aims to capture market opportunities through the integration of its wide-ranging technologies and product lineup. The company targets ¥100 bn in humanoid-related sales as a base case for FY3/35 (¥200 bn in an upside case), with a breakdown of ¥40 bn from bearings, ¥30 bn from motors, ¥20 bn from analog semiconductors, and ¥10 bn from sensors and other components. The plan highlights the potential match between the company's broad product portfolio and the component needs of humanoid robots.

The number of bearings installed per humanoid can be more than double that of a luxury car in some cases (a single hand can have 85 bearings), illustrating the high component density in MinebeaMitsumi's business domains. We believe that the company is winning orders for sensors and bearings from customers including major US players, and that inquiries for motors and various other components are also becoming more active. For robot hands in particular, the company aims to differentiate itself through the integration of its core technologies, and has commented that it is currently in joint development with three companies.

We are Buy rated on MinebeaMitsumi. Our 12-month price target is ¥5,500, based on FY3/29E EV/GCI vs. CROCI/WACC, applying the Japan electronic components/semiconductors sector average EV/DACF multiple of 10X. Our target price implies FY3/28E P/E of 20X. Key risks include sharper-than-expected rises in input costs, a decline in auto production, and forex swings.

Renesas Electronics (6723.T, Buy): Renesas views humanoid robots as an aggregation of four domains ("brain & motion," "sensing," "actuation & motor control," "power management"), offering products that correspond to each domain. Currently, the company's SAM covers about 30% of a humanoid's BOM. Against a backdrop of increasing robot complexity, such as the decentralization of intelligence and a rise in the number of joints and sensing needs, Renesas has outlined a plan to expand its coverage to 70% of the BOM in the long term.

Renesas has a distinct advantage in its ability to leverage proven technologies from the automotive sector. In addition, beyond its broad hardware portfolio, the company's competitive edge lies in its ability to support their customers' development through the "Renesas 365" platform, which facilitates design optimization in a virtual environment. As many players enter the humanoid market (a market with remarkable technological evolution characterized by high-mix, low-volume production and rapid change), we believe the value of "Renesas 365" (which enables efficient design, improvement, and lifetime management on a cloud platform) could be increasingly recognized. By

delivering solutions that integrate hardware and software, the company aims to capture share in this expanding market. Currently, in addition to its strain gauges being adopted in the hands of China-based Inspire-Robots, Renesas is actively engaged with numerous customers globally.

We are Buy rated on Renesas. Our 12-month target price of ¥5,500 is based on FY12/28E EV/GCI vs. CROCI/WACC, applying an EV/DACF multiple of 13X (30% premium to the Japan electronic components/semiconductors sector average, implying a FY12/27E target P/E of 16X). Key risks include a slowdown or delayed recovery in consumer electronics-related demand, stagnant automobile production, protracted reduction in semiconductor inventories, delayed recovery for industrial equipment applications, and yen appreciation.

Regal Rexnord (Buy-rated): We believe RRX is emerging as a supplier of precision-motion components and integrated actuation systems for humanoid robots. Management has identified 10 key OEMs developing humanoid platforms and, as of Feb'26, had supplied to 3 of these platforms. RRX remains in discussions with the other 7 targeted OEMs regarding integration of its precision-motion solutions.

RRX's opportunity is supported by its ability to combine products from across its portfolio into joint and actuation systems. Relevant products include actuator systems, frameless motors, miniature brakes, and precision bearings. Management has indicated its content can address approximately 30 to 50 axes of motion on a humanoid robot, spanning many critical motion joints. We believe this multi-component capability could support higher content per robot than a more narrowly focused component supplier. Commercial traction has begun to develop but remain tepid at this juncture. RRX closed FY25 with approximately $40mn of humanoid orders. The company is also pursuing an approximately $100mn humanoid opportunity funnel, within a broader $200mn robotics-actuation funnel that includes surgical robots and collaborative robots.

RRX's Automation and Motion Control business (AMC) is expected to deliver DD+ growth over the next couple of years (primarily related to E-POD and switchgear shipments to data-centers). Humanoids could become an additional long-term driver for growth, particularly if platforms progress from pilots to scaled deployment in manufacturing and logistics. That said, management has cautioned that humanoid robotics remains in its early developmental stages and should be viewed as a longer-term growth adjacency rather than a meaningful near-term driver of consolidated revenue.

We are Buy-rated on RRX with a 12-month price target of $240. Our price target is based on 13.0x Q5-Q8 EV/EBITDA multiple. Key risks include longer destocking, weaker discrete trends, price/cost headwinds and dilutive M&A.

Disclosure Appendix

Reg AC

We, Eric Sheridan, Jacqueline Du, Mark Delaney, CFA, Do Hyoung Kim, Yuichiro Isayama, Allen Chang, Kate McShane, CFA, Daniela Costa, Kota Yuzawa, Daiki Takayama, James Schneider, Ph.D., Gabriela Borges, CFA, Tina Hou, Joe Ritchie, Timothy Zhao, Will Bryant, Aman Gupta and Ayush Ghose, hereby certify that all of the views expressed in this report accurately reflect our personal views about the subject company or companies and its or their securities. We also certify that no part of our compensation was, is or will be, directly or indirectly, related to the specific recommendations or views expressed in this report.

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GS Factor Profile

The Goldman Sachs Factor Profile provides investment context for a stock by comparing key attributes to the market (i.e. our universe of rated stocks) and its sector peers. The four key attributes depicted are: Growth, Financial Returns, Multiple (e.g. valuation) and Integrated (a composite of Growth, Financial Returns and Multiple). Growth, Financial Returns and Multiple are calculated by using normalized ranks for specific metrics for each stock. The normalized ranks for the metrics are then averaged and converted into percentiles for the relevant attribute. The precise calculation of each metric may vary depending on the fiscal year, industry and region, but the standard approach is as follows:

Growth is based on a stock's forward-looking sales growth, EBITDA growth and EPS growth (for financial stocks, only EPS and sales growth), with a higher percentile indicating a higher growth company. **Financial Returns** is based on a stock's forward-looking ROE, ROCE and CROCI (for financial stocks, only ROE), with a higher percentile indicating a company with higher financial returns. **Multiple** is based on a stock's forward-looking P/E, P/B, price/dividend (P/D), EV/EBITDA, EV/FCF and EV/Debt Adjusted Cash Flow (DACF) (for financial stocks, only P/E, P/B and P/D), with a higher percentile indicating a stock trading at a higher multiple. The **Integrated** percentile is calculated as the average of the Growth percentile, Financial Returns percentile and (100% - Multiple percentile).

Financial Returns and Multiple use the Goldman Sachs analyst forecasts at the fiscal year-end at least three quarters in the future. Growth uses inputs for the fiscal year at least seven quarters in the future compared with the year at least three quarters in the future (on a per-share basis for all metrics).

For a more detailed description of how we calculate the GS Factor Profile, please contact your GS representative.

M&A Rank

Across our global coverage, we examine stocks using an M&A framework, considering both qualitative factors and quantitative factors (which may vary across sectors and regions) to incorporate the potential that certain companies could be acquired. We then assign a M&A rank as a means of scoring companies under our rated coverage from 1 to 3, with 1 representing high (30%-50%) probability of the company becoming an acquisition target, 2 representing medium (15%-30%) probability and 3 representing low (0%-15%) probability. For companies ranked 1 or 2, in line with our standard departmental guidelines we incorporate an M&A component into our target price. M&A rank of 3 is considered immaterial and therefore does not factor into our price target, and may or may not be discussed in research.

Quantum

Quantum is Goldman Sachs' proprietary database providing access to detailed financial statement histories, forecasts and ratios. It can be used for in-depth analysis of a single company, or to make comparisons between companies in different sectors and markets.

Disclosures

Logo Disclosure

Please note: Third party brands used in this report are the property of their respective owners, and are used here for informational purposes only. The use of such brands should not be viewed as an endorsement, affiliation or sponsorship by or for Goldman Sachs or any of its products/services.

Rating and pricing information

Amazon.com Inc. (Buy, $256.26), Amphenol Corp. (Buy, $161.38), Daifuku (Buy, ¥5,745), Flex (Buy, $115.30), HL Mando (Buy, W50,300), Hesai Group (ADR) (Buy, $17.49), Hesai Group (H) (Buy, HK$17.35), Hyundai Mobis (Buy, W450,500), Jabil Circuit Inc. (Buy, $312.22), MinebeaMitsumi Inc. (Buy, ¥3,401), Nvidia Corp. (Buy, $227.98), Regal Rexnord Corp. (Buy, $163.92), Renesas Electronics (Buy, ¥3,417), Robotis (Buy, W242,000), Sanhua Intelligent Controls (A) (Neutral, Rmb36.17), Sanhua Intelligent Controls (H) (Buy, HK$25.64), Shenzhen Inovance Technology Co. (Buy, Rmb62.05), Shuanghuan Driveline (Buy, Rmb35.70), TE Connectivity Plc (Buy, $203.00), Tesla Inc. (Neutral, $354.81), Walmart Inc. (Buy, $102.63), XPeng Inc. (ADR) (Buy, $11.33), XPeng Inc. (H) (Buy, HK$44.82) and Xiaomi Corp. (Buy, HK$27.82).

The rating(s) for HL Mando, Hyundai Mobis and Robotis is/are relative to the other companies in its/their coverage universe: Doosan Robotics, HD Hyundai Electric, HL Mando, Hanwha Aerospace, Hyosung Heavy Industries, Hyundai Mobis, Hyundai Motor, Hyundai Rotem, Kia, LS Electric, Robotis

The rating(s) for MinebeaMitsumi Inc. and Renesas Electronics is/are relative to the other companies in its/their coverage universe: Alps Alpine, Dai Nippon Printing, Hirose Electric, IRISO Electronics, Ibiden, Japan Aviation Electronics Industry, Kohoku Kogyo, Kyocera, MARUWA, Mabuchi Motor, Maxell Ltd., MinebeaMitsumi Inc., Murata Mfg., NGK Corp., Nichicon, Nidec, Nippon Ceramic, Niterra, Nitto Denko, Renesas Electronics, Rohm, TDK, TOPPAN Holdings, Taiyo Yuden

The rating(s) for Amphenol Corp., Flex, Jabil Circuit Inc., TE Connectivity Plc and Tesla Inc. is/are relative to the other companies in its/their coverage universe: Aeva Technologies Inc., Amphenol Corp., Aptiv Plc, Aurora Innovation Inc., Belden Inc., BorgWarner Inc., Cerence Inc., Flex, Ford Motor Co., General Motors Co., Gentex Corp., Innoviz Technologies, Jabil Circuit Inc., Keysight Technologies Inc., Lear Corp., Magna International Inc.,

Mobileye Global Inc., QuantumScape Corp., Rivian Automotive Inc., Sensata Technologies Holding, Symbotic Inc., TE Connectivity Plc, Tesla Inc., Versigent PLC, Vertiv Holdings, Visteon Corp.

The rating(s) for Amazon.com Inc. is/are relative to the other companies in its/their coverage universe: ACV Auctions Inc., Airbnb Inc., Alphabet Inc., Amazon.com Inc., Angi Inc., AppLovin Corp., Bending Spoons S.p.A., Booking Holdings Inc., Bumble Inc., Chewy Inc., Clear Secure Inc., Coursera Inc., DoorDash Inc., DraftKings Inc., Duolingo Inc., Ethos Technologies Inc., Etsy Inc., Expedia Group, Fiverr International Ltd., Frontdoor Inc., Genius Sports Ltd., GoodRx Holdings Inc., Grindr Inc., Groupon Inc., Ibotta Inc., Instacart, Liftoff Mobile Inc., Lyft Inc., Match Group, MediaAlpha Inc., Meta Platforms Inc., Netflix Inc., Neutron Holdings Inc., Nextdoor Holdings, Opera Ltd., Pattern Group Inc., Peloton Interactive Inc., People Inc., Pinterest Inc., Playtika, Reddit Inc., Roblox, Snap Inc., Space Exploration Technologies Corp., Sportradar Group, Spotify Technology S.A., StubHub Holdings, Take-Two Interactive Software Inc., Tripadvisor Inc., Uber Technologies Inc., Unity Software Inc., Upwork Inc., Wayfair Inc., Webtoon Entertainment Inc., Xometry Inc., Yelp Inc., ZipRecruiter Inc.

The rating(s) for Xiaomi Corp. is/are relative to the other companies in its/their coverage universe: Autohome Inc. (ADR), Autohome Inc. (H), Beijing Sinnet Technology Co Ltd., East Buy, GDS Holdings (ADR), GDS Holdings (H), KE Holdings (ADR), KE Holdings (H), Kanzhun Ltd. (ADR), Kanzhun Ltd. (H), Kingsoft Cloud, Ming Yuan Cloud, New Oriental Education & Technology (ADR), New Oriental Education & Technology (H), Offcn Education Technology, Range Intelligent, SUNeVision Holdings, Shanghai Athub, TAL Education Group, Tuhu Car Inc., Tuya, VNET Group, Weibo Corp. (ADR), Weibo Corp. (H), Weimob, Xiaomi Corp.

The rating(s) for Regal Rexnord Corp. is/are relative to the other companies in its/their coverage universe: 3M Co., ATS Corp., Allegion Plc, Carrier Global Corp., Cognex Corp., Core & Main Inc., Dover Corp., DuPont de Nemours Inc., EquipmentShare, Flowserve Corp., Forgent Power Solutions Inc., GE Vernova, Graco Inc., Honeywell International Inc., INNIO, ITT Inc., Illinois Tool Works, Ingersoll Rand Inc., Johnson Controls International Plc, Kennametal Inc., Lennox International Inc., Mirion Technologies Inc., Parker Hannifin Corp., RBC Bearings Inc., Regal Rexnord Corp., Rockwell Automation Inc., Roper Technologies Inc., Stanley Black & Decker Inc., Timken Co., Trane Technologies Plc, Vontier Corp., Zurn Elkay Water Solutions Corp., nVENT Electric Plc.

The rating(s) for Nvidia Corp. is/are relative to the other companies in its/their coverage universe: ARM Holdings, Accenture Plc, Advanced Micro Devices Inc., Amkor Technology Inc., Analog Devices Inc., Applied Materials Inc., Broadcom Inc., Cadence Design Systems Inc., Camtek, Cognizant Technology Solutions, Credo Technology Group, EPAM Systems Inc., Entegris Inc., GlobalFoundries Inc., Globant SA, Intel Corp., International Business Machines Corp., KLA Corp., Lam Research Corp., MKS Instruments Inc., Marvell Technology Inc., Microchip Technology Inc., Micron Technology Inc., NXP Semiconductors NV, Nvidia Corp., ON Semiconductor Corp., Onto Innovation, Qnity, Qualcomm Inc., SanDisk Corp., Seagate Technology, SiTime Corp., Synopsys Inc., TaskUs Inc., Teradyne Inc., Texas Instruments Inc., Western Digital Corp.

The rating(s) for Walmart Inc. is/are relative to the other companies in its/their coverage universe: Academy Sports & Outdoors Inc., Advance Auto Parts Inc., AutoZone Inc., BJ's Wholesale Club Holdings, Bath & Body Works Inc., Best Buy Co., Bob's Discount Furniture Inc., Boyd Group, Costco Wholesale, Dick's Sporting Goods, Dollar General Corp., Dollar Tree Stores Inc., Driven Brands Holdings, Five Below Inc., Floor & Decor Holdings, Genuine Parts Co., Home Depot Inc., Lithia Motors Inc., Lowe's Cos., National Vision Holdings, O'Reilly Automotive Inc., Ollie's Bargain Outlet Inc., Petco Health and Wellness Co., RH, Target Corp., Tractor Supply Co., Ulta Beauty Inc., Valvoline Inc., Walmart Inc., Williams-Sonoma Inc.

The rating(s) for Hesai Group (ADR), Hesai Group (H), XPeng Inc. (ADR) and XPeng Inc. (H) is/are relative to the other companies in its/their coverage universe: BYD Co. (A), BYD Co. (H), Fuyao Glass Industry Group (A), Fuyao Glass Industry Group (H), Guangzhou Automobile Group (A), Guangzhou Automobile Group (H), Hesai Group (ADR), Hesai Group (H), Li Auto Inc. (ADR), Li Auto Inc. (H), Minth Group, NIO Inc. (ADR), NIO Inc. (H), Ningbo Tuopu Group, SAIC Motor, XPeng Inc. (ADR), XPeng Inc. (H), Zhejiang Leapmotor Technology

The rating(s) for Sanhua Intelligent Controls (A), Sanhua Intelligent Controls (H), Shenzhen Inovance Technology Co. and Shuanghuan Driveline is/are relative to the other companies in its/their coverage universe: Best, Bochu, CRRC Corp. (A), CRRC Corp. (H), Centre Testing Intl Group, Estun Automation Co.(A), Estun Automation Co.(H), Faratronic, Haitian International Holdings, Han's Laser Technology, Hongfa Technology, Huaming, Kehua Data Co., Lead Intelligent (A), Lead Intelligent (H), Leader Harmonious Drive Systems Co., Luster LightTech Co., Megmeet, Moons' Electric, NARI Technology, Nantong Jianghai Capacitor Co., OPT Machine Vision Tech Co., Sanhua Intelligent Controls (A), Sanhua Intelligent Controls (H), Shanghai Baosight Software, Shenzhen Envicool Technology, Shenzhen Inovance Technology Co., Shenzhen Kstar Science & Tech, Shuanghuan Driveline, Sieyuan Electric, Techtronic Industries, Wuhan Raycus Fiber Laser Tech, Yiheda Automation, Yingliu, Zhejiang Supcon Technology Co., Zhuzhou CRRC Times Electric Co. (A), Zhuzhou CRRC Times Electric Co. (H)

The rating(s) for Daifuku is/are relative to the other companies in its/their coverage universe: AeroEdge, CKD, Daifuku, Daikin Industries, Fanuc, Harmonic Drive Systems, Hoshizaki, IHI, Japan Steel Works, Kawasaki Heavy Industries, Keyence, Makita, Misumi Group, Mitsubishi Heavy Industries, Okuma, Omron, SKY Perfect JSAT Corp, SMC, THK, Yaskawa Electric

Company-specific regulatory disclosures

Compendium report: please see disclosures at https://www.gs.com/research/hedge.html. Disclosures applicable to the companies included in this compendium can be found in the latest relevant published research

Distribution of ratings/investment banking relationships

Goldman Sachs Investment Research global Equity coverage universe

	Rating Distribution			Investment Banking Relationships		
	Buy	Hold	Sell	Buy	Hold	Sell
Global	50%	34%	16%	65%	59%	43%

As of July 1, 2026, Goldman Sachs Global Investment Research had investment ratings on 3,104 equity securities. Goldman Sachs assigns stocks as Buys and Sells on various regional Investment Lists; stocks not so assigned are deemed Neutral. Such assignments equate to Buy, Hold and Sell for the purposes of the above disclosure required by the FINRA Rules. See 'Ratings, Coverage universe and related definitions' below. The Investment Banking Relationships chart reflects the percentage of subject companies within each rating category for whom Goldman Sachs has provided investment banking services within the previous twelve months.

Price target and rating history chart(s)

Compendium report: please see disclosures at https://www.gs.com/research/hedge.html. Disclosures applicable to the companies included in this compendium can be found in the latest relevant published research

Target price history table(s)

Jabil Circuit Inc. (JBL)

Date of report	Target price ($)	Closing price ($)
17-Jun-26	482.00	374.98
21-May-26	384.00	356.41
13-Apr-26	336.00	305.37
18-Mar-26	308.00	258.67
15-Jan-26	282.00	253.18
17-Dec-25	255.00	216.30
25-Nov-25	238.00	203.98
25-Sep-25	252.00	210.20
11-Jul-25	237.00	222.02
18-Jun-25	215.00	204.66
09-Jun-25	188.00	177.38
12-May-25	165.00	161.74
10-Apr-25	146.00	132.04
21-Mar-25	175.00	145.22
23-Feb-25	179.00	162.61
18-Dec-24	160.00	143.69
10-Dec-24	145.00	132.75
30-Sep-24	136.00	119.83
20-Jun-24	132.00	111.79
21-May-24	143.00	117.79
18-Mar-24	151.00	124.18
04-Mar-24	161.00	148.62
26-Jan-24	141.00	123.22

Amazon.com Inc. (AMZN)

Date of report	Target price ($)	Closing price ($)
31-Jul-26	375.00	271.58
08-Jul-26	335.00	243.62
30-Apr-26	325.00	265.06
13-Apr-26	275.00	239.89
06-Feb-26	280.00	210.32
13-Jan-26	300.00	242.60
31-Oct-25	290.00	244.22
03-Oct-25	275.00	219.51
01-Aug-25	240.00	214.75
21-Apr-25	220.00	167.32
07-Feb-25	255.00	229.15
01-Nov-24	240.00	197.93
02-Aug-24	230.00	167.90
15-Jul-24	250.00	192.72
01-May-24	225.00	179.00
02-Feb-24	220.00	171.81
10-Jan-24	200.00	153.73
27-Oct-23	190.00	127.74
12-Oct-23	175.00	132.33

Hyundai Mobis (012330.KS)

Date of report	Target price (W)	Closing price (W)
11-Jun-26	710,000	576,000
02-Feb-26	460,000	436,000
05-Jan-26	360,000	372,000
27-Aug-25	330,000	302,500
24-Jan-25	270,000	263,500
25-Oct-24	265,000	256,500
26-Apr-24	235,000	240,500
26-Jan-24	245,000	204,000

Hesai Group (ADR) (HSAI)

Date of report	Target price ($)	Closing price ($)
20-Aug-26	31.00	18.62
17-Apr-26	35.00	23.25
13-Nov-25	34.00	19.78
22-Sep-25	36.00	29.71
15-Aug-25	26.30	25.59
27-May-25	23.30	21.26
11-Mar-25	20.40	24.08
21-Jan-25	19.00	15.91
14-Jan-25	18.40	15.00
27-Nov-24	5.50	7.35
20-Aug-24	5.30	4.17
11-Jun-24	6.00	4.89
03-Jun-24	8.40	4.84
12-Mar-24	9.60	5.16
01-Mar-24	10.90	4.44
02-Feb-24	11.30	4.15
14-Nov-23	12.80	11.00

Xiaomi Corp. (1810.HK)

Date of report	Target price (HK$)	Closing price (HK$)
18-Aug-26	39.00	26.18
26-May-26	40.00	29.76
09-Mar-26	41.00	33.68
23-Jan-26	47.50	36.24
18-Nov-25	53.50	40.78
01-Nov-25	56.50	43.20
25-Sep-25	66.00	59.45
19-Aug-25	65.00	52.40
26-Jun-25	69.00	56.90
27-May-25	65.00	51.55
18-May-25	62.00	51.00

Robotis (108490.KQ)

Date of report	Target price (W)	Closing price (W)
11-Jun-26	630,000	286,500

Xiaomi Corp. (1810.HK)

Date of report	Target price (HK$)	Closing price (HK$)
16-Apr-25	59.00	41.25
18-Mar-25	63.00	57.65
20-Feb-25	58.00	49.15
14-Jan-25	38.00	33.75
18-Nov-24	33.30	28.80
29-Oct-24	30.70	25.85
15-Oct-24	27.80	23.00
03-Oct-24	27.50	24.05
21-Aug-24	24.70	17.52
21-Jul-24	23.20	16.52
24-May-24	23.00	18.30
12-May-24	22.60	19.40
01-Apr-24	20.00	14.94
19-Mar-24	18.90	14.86
06-Feb-24	18.10	12.90
20-Nov-23	18.70	16.18
18-Oct-23	16.30	13.18
31-Aug-23	14.90	12.36

Robotis (108490.KQ)

Date of report	Target price (W)	Closing price (W)

TE Connectivity Plc (TEL)

Date of report	Target price ($)	Closing price ($)
22-Jul-26	284.00	200.28
22-Apr-26	286.00	221.04
13-Apr-26	270.00	234.33
21-Jan-26	306.00	231.00
15-Jan-26	304.00	241.92
09-Dec-25	301.00	236.20
29-Oct-25	289.00	240.76
29-Sep-25	263.00	217.78
23-Jul-25	228.00	202.04
11-Jul-25	200.00	177.11
12-May-25	184.00	160.98
24-Apr-25	175.00	143.52
10-Apr-25	170.00	127.35
30-Oct-24	190.00	151.79
01-Oct-24	179.00	147.46
25-Jul-24	189.00	154.54
10-Jul-24	184.00	153.51
24-Apr-24	186.00	140.00
01-Nov-23	175.00	122.86

Sanhua Intelligent Controls (A) (002050.SZ)

Date of report	Target price (Rmb)	Closing price (Rmb)
27-Aug-26	38.60	36.82
05-May-26	39.80	46.92
24-Mar-26	36.40	42.57
24-Feb-26	41.00	52.73
02-Nov-25	40.90	49.93
29-Aug-25	32.70	31.88
06-Aug-25	30.40	27.65
27-Mar-25	34.90	30.29
11-Mar-25	36.60	30.49
20-Feb-25	36.50	34.03
12-Jan-25	35.20	26.70
04-Dec-24	26.20	24.80
18-Oct-24	26.40	22.45
05-Sep-24	25.00	17.94
18-Jul-24	32.70	19.08
01-May-24	36.00	21.91
07-Feb-24	36.30	22.69
08-Jan-24	39.00	26.07
31-Oct-23	38.00	26.74
06-Sep-23	38.20	28.59

Shenzhen Inovance Technology Co. (300124.SZ)

Date of report	Target price (Rmb)	Closing price (Rmb)
01-Jun-26	92.90	74.50
28-Apr-26	86.00	61.36
24-Feb-26	75.40	74.35
26-Oct-25	82.10	78.38
02-Oct-25	82.50	83.82
06-Aug-25	75.50	65.86
13-May-25	80.50	69.28
30-Apr-25	74.80	71.59
11-Mar-25	87.10	78.05
26-Dec-24	61.20	60.08
18-Oct-24	61.10	58.50
05-Sep-24	54.20	42.58
27-Aug-24	65.00	41.70
01-Jul-24	70.60	49.90

Daifuku (6383.T)

Date of report	Target price (¥)	Closing price (¥)
28-May-26	9,300	7,263
14-May-26	8,600	7,502
09-Mar-26	7,500	5,359
14-Jan-26	6,400	5,363
13-Oct-25	5,700	4,768
07-Aug-25	5,000	3,976
20-Jun-25	4,500	3,628
11-Apr-25	4,400	3,439
14-Feb-25	5,000	3,155
12-Jan-25	4,500	3,190
08-Nov-24	4,400	2,951
08-Aug-24	4,300	2,367
12-Apr-24	4,100	3,498
08-Feb-24	3,600	2,878

Shenzhen Inovance Technology Co. (300124.SZ)

Date of report	Target price (Rmb)	Closing price (Rmb)
09-May-24	74.30	63.68
23-Apr-24	67.90	59.95
08-Jan-24	69.00	58.80
30-Oct-23	88.80	61.08
06-Sep-23	97.10	70.03

Daifuku (6383.T)

Date of report	Target price (¥)	Closing price (¥)
08-Jan-24	3,300	2,755
08-Nov-23	3,200	2,611
13-Sep-23	3,400	2,725

Flex (FLEX)

Date of report	Target price ($)	Closing price ($)
30-Jul-26	154.00	111.91
07-May-26	177.00	133.01
13-Apr-26	84.00	78.31
05-Feb-26	77.00	60.15
09-Dec-25	74.00	68.50
25-Nov-25	67.00	57.35
29-Oct-25	73.00	66.10
29-Sep-25	66.00	57.55
24-Jul-25	65.00	49.67
11-Jul-25	64.00	52.19
09-Jun-25	51.00	43.72
12-May-25	48.00	40.88
08-May-25	45.00	38.52
10-Apr-25	41.00	29.42
23-Feb-25	53.00	40.36
29-Jan-25	50.00	41.51
25-Nov-24	46.00	41.07
30-Oct-24	43.00	35.78
25-Jul-24	39.00	30.94
18-Jun-24	37.00	31.62
02-May-24	34.00	27.42
04-Mar-24	37.00	29.97
01-Feb-24	29.00	25.04
24-Jan-24	27.00	23.03
26-Oct-23	34.00	18.75

Regal Rexnord Corp. (RRX)

Date of report	Target price ($)	Closing price ($)
06-Aug-26	240.00	179.02
10-Jul-26	245.00	214.90
11-May-26	232.00	211.33
09-Feb-26	230.00	216.59
26-Jan-26	170.00	152.78
16-Dec-25	180.00	144.21
03-Nov-25	173.00	136.95
15-Sep-25	170.00	141.07
14-Aug-25	192.00	148.22
07-Jul-25	195.00	149.02
07-May-25	173.00	129.90
02-Apr-25	163.00	121.51
06-Feb-25	183.00	142.87
16-Jan-25	197.00	158.46
12-Dec-24	213.00	171.44
06-Nov-24	191.00	181.60
09-Oct-24	192.00	166.77
02-Aug-24	195.00	151.04
08-May-24	176.00	157.37
09-Feb-24	172.00	152.04
14-Dec-23	175.00	148.76

Sanhua Intelligent Controls (H) (2050.HK)

Date of report	Target price (HK$)	Closing price (HK$)
27-Aug-26	40.00	26.06
05-May-26	41.20	34.82
24-Mar-26	40.40	28.86
24-Feb-26	43.20	35.80
02-Nov-25	43.10	40.88
29-Aug-25	34.40	31.16
06-Aug-25	33.20	27.88

Shuanghuan Driveline (002472.SZ)

Date of report	Target price (Rmb)	Closing price (Rmb)
26-Aug-26	45.50	35.60
22-Jul-26	46.80	36.95
05-May-26	48.20	39.27
24-Feb-26	42.50	42.89
02-Oct-25	44.80	49.81
27-Aug-25	42.60	36.51
06-Aug-25	44.70	36.35
07-May-25	45.00	34.32
11-Mar-25	39.70	38.21
18-Oct-24	31.60	29.44
05-Sep-24	29.10	21.41
18-Jul-24	29.80	21.77
09-May-24	29.90	24.36
08-Jan-24	27.10	23.88
06-Sep-23	32.20	33.42

XPeng Inc. (ADR) (XPEV)

Date of report	Target price ($)	Closing price ($)
25-Aug-26	18.00	11.60
03-Aug-26	20.00	12.37
01-Jun-26	23.00	17.20
12-Feb-26	22.00	17.70

Tesla Inc. (TSLA)

Date of report	Target price ($)	Closing price ($)
23-Jul-26	360.00	319.69
02-Jul-26	390.00	393.45
02-Apr-26	375.00	360.59
29-Jan-26	405.00	416.56

XPeng Inc. (ADR) (XPEV)

Date of report	Target price ($)	Closing price ($)
19-Nov-25	25.00	21.17
17-Jun-25	24.00	18.57
19-Mar-25	16.40	23.80
21-Feb-25	14.60	18.40
21-Jan-25	12.80	15.00
21-Nov-24	12.50	12.29
16-Oct-24	11.70	11.05
21-Aug-24	10.60	7.06
23-May-24	12.10	8.10
22-Apr-24	11.50	6.98
20-Mar-24	17.20	9.51
27-Feb-24	19.40	9.38
15-Nov-23	20.00	17.39
20-Sep-23	20.50	16.35

Tesla Inc. (TSLA)

Date of report	Target price ($)	Closing price ($)
02-Jan-26	420.00	438.07
23-Oct-25	400.00	448.98
03-Oct-25	425.00	429.83
17-Sep-25	395.00	425.86
24-Jul-25	300.00	305.30
11-Jul-25	285.00	313.51
03-Jul-25	315.00	315.35
06-Jun-25	285.00	295.14
12-May-25	295.00	318.38
23-Apr-25	235.00	250.74
10-Apr-25	260.00	252.40
03-Apr-25	275.00	267.28
05-Mar-25	320.00	279.10
10-Dec-24	345.00	400.99
24-Oct-24	250.00	260.48
24-Jul-24	230.00	215.99
10-Jul-24	248.00	263.26
09-Apr-24	175.00	176.88
18-Mar-24	190.00	173.80
25-Jan-24	220.00	182.63
03-Jan-24	255.00	238.45
19-Oct-23	235.00	220.11
02-Oct-23	265.00	251.60

Nvidia Corp. (NVDA)

Date of report	Target price ($)	Closing price ($)
27-Aug-26	300.00	227.98
21-May-26	285.00	219.51
20-Nov-25	250.00	180.64
31-Oct-25	240.00	202.49
06-Oct-25	210.00	185.54
07-Aug-25	200.00	180.77
10-Jul-25	185.00	164.10
21-Nov-24	165.00	146.67
11-Oct-24	150.00	134.80
11-Jun-24	135.00	120.91
23-May-24	1,200.00	103.80
07-May-24	1,100.00	90.55
19-Mar-24	1,000.00	89.40
22-Feb-24	875.00	78.54
05-Feb-24	800.00	69.33
22-Nov-23	625.00	48.72

Hesai Group (H) (2525.HK)

Date of report	Target price (HK$)	Closing price (HK$)
20-Aug-26	30.00	18.19
17-Apr-26	273.00	23.25
13-Nov-25	265.00	21.19
22-Sep-25	281.00	28.88

Walmart Inc. (WMT)

Date of report	Target price ($)	Closing price ($)
21-Aug-26	130.00	103.70
20-Jul-26	141.00	112.20
21-May-26	154.00	121.34
20-Feb-26	138.00	122.99
21-Nov-25	121.00	105.32
21-Aug-25	114.00	97.96
16-May-25	101.00	98.24
16-Apr-25	99.00	91.19
21-Feb-25	106.00	94.78
29-Jan-25	101.00	97.50
19-Nov-24	93.00	86.60
15-Aug-24	81.00	73.18
17-May-24	73.00	64.65

Renesas Electronics (6723.T)

Date of report	Target price (¥)	Closing price (¥)
31-Jul-26	5,500	3,442
08-Jun-26	5,400	4,139
24-Apr-26	3,800	3,141
23-Mar-26	3,600	2,276
05-Feb-26	3,300	2,767
12-Jan-26	2,900	2,380
24-Apr-25	2,500	1,670
31-Mar-25	2,900	1,988
06-Feb-25	2,700	2,306
31-Oct-24	2,600	2,110
01-Oct-24	2,900	2,161
25-Jul-24	3,400	2,584
02-Jul-24	3,800	3,014

Walmart Inc. (WMT)

Date of report	Target price ($)	Closing price ($)
20-Feb-24	193.00	58.62
16-Nov-23	180.00	52.01

Renesas Electronics (6723.T)

Date of report	Target price (¥)	Closing price (¥)
03-Apr-24	3,400	2,650
08-Feb-24	3,200	2,542
27-Nov-23	3,300	2,563
26-Oct-23	2,900	2,106
04-Oct-23	3,000	2,148

MinebeaMitsumi Inc. (6479.T)

Date of report	Target price (¥)	Closing price (¥)
08-Jun-26	5,500	4,546
12-May-26	4,000	3,566
23-Mar-26	3,800	2,541
12-Jan-26	3,700	2,997
06-Nov-25	3,400	3,114
02-Oct-25	3,300	2,764
05-Aug-25	3,000	2,395
09-May-25	2,900	2,177
31-Mar-25	3,000	2,174
05-Feb-25	3,300	2,447
06-Nov-24	3,400	2,858
01-Oct-24	3,500	2,941
02-Jul-24	3,700	3,552
03-Apr-24	3,400	2,907
02-Feb-24	3,200	3,101
06-Dec-23	3,100	2,831
02-Nov-23	2,800	2,504
04-Oct-23	2,700	2,398

Amphenol Corp. (APH)

Date of report	Target price ($)	Closing price ($)
30-Jul-26	204.00	159.82
29-Apr-26	201.00	148.38
29-Jan-26	184.00	149.58
15-Jan-26	173.00	154.22
09-Dec-25	165.00	138.58
25-Nov-25	157.00	137.81
23-Oct-25	154.00	135.31
29-Sep-25	139.00	121.01
24-Jul-25	124.00	104.46
11-Jul-25	115.00	98.76
09-Jun-25	102.00	92.96
12-May-25	90.00	84.46
24-Apr-25	80.00	76.03
10-Apr-25	72.00	64.13
23-Jan-25	89.00	78.55
23-Oct-24	79.00	68.47
25-Jul-24	75.00	61.76
18-Jun-24	74.00	69.73
16-May-24	140.00	65.86
25-Apr-24	131.00	59.51
09-Apr-24	130.00	57.49
24-Jan-24	119.00	50.33
03-Jan-24	107.00	47.54
26-Oct-23	98.00	40.10

XPeng Inc. (H) (9868.HK)

Date of report	Target price (HK$)	Closing price (HK$)
25-Aug-26	69.00	43.30
03-Aug-26	77.00	49.04
01-Jun-26	89.00	67.80
12-Feb-26	85.00	70.05
19-Nov-25	96.00	85.70
17-Jun-25	94.00	73.20
19-Mar-25	64.00	89.55
21-Feb-25	57.00	71.90
21-Jan-25	50.00	59.70
21-Nov-24	49.00	47.35
16-Oct-24	46.00	43.05
21-Aug-24	41.00	26.95
23-May-24	47.00	32.80
22-Apr-24	45.00	26.50
20-Mar-24	67.00	40.55
27-Feb-24	76.00	36.80
15-Nov-23	78.00	67.80
20-Sep-23	80.00	68.10

HL Mando (204320.KS)

Date of report	Target price (W)	Closing price (W)
11-Jun-26	109,000	50,000

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