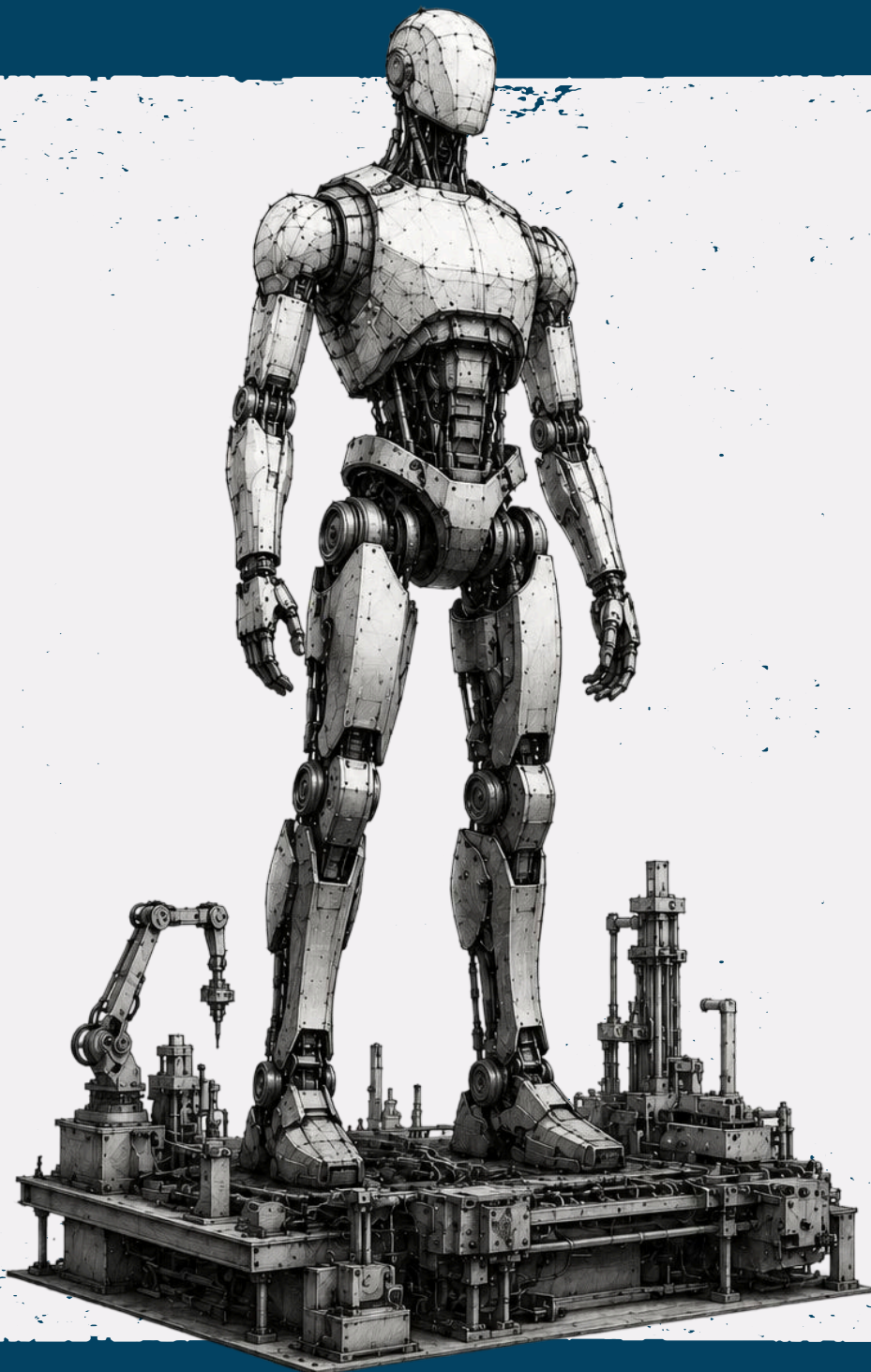


RESEARCH

July 2026

The Humanoid Robot Reality Check



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Who Is Actually Winning the World's Most Important Robotics Race?

Prologue: A Robot Walks Onto a Factory Floor

In November 2025, a Figure 03 humanoid finished an eleven-month posting at BMW's Spartanburg, South Carolina plant. Over that period it worked daily ten-hour shifts, moved more than 90,000 sheet-metal parts across 1,250-plus logged operating hours, and contributed to the assembly of over 30,000 X3 crossovers – figures Figure AI has published and that BMW has not disputed ([Sacra, ifactoryapp case study](#)). It is one of the best-documented pieces of evidence in the entire humanoid robotics industry that a bipedal machine can do sustained, useful, measured work on a real production line.

Eight months later, on July 22, 2026, Tesla held its second-quarter earnings call. Investors had waited a year and a half for a number – any number – of Optimus units built on the company's new dedicated line. They did not get one. Tesla's shareholder deck said only that the company was "installing the first-generation lines for Optimus" at the former Model S/X building in Fremont and would "start production soon" ([CNBC](#)). Elon Musk told analysts that Optimus would be "the hardest product to scale manufacturing that we've ever made," because "everything on the robot is new" and "there is no existing supply chain" for it ([CNBC](#); [Tesla Q2 2026 transcript](#), [Yahoo Finance](#)). As of that call, Tesla had not publicly disclosed a single verified production Optimus unit off the new line, eighteen months after Musk first predicted thousands would be working inside Tesla's own factories by the end of 2025 ([TechTimes](#)).

Meanwhile, on the other side of the Pacific, a company most Western executives had never heard of three years ago quietly became the highest-volume humanoid manufacturer on Earth. Unitree Robotics' initial public offering prospectus, filed with the Shanghai Stock Exchange's STAR Market in March 2026, disclosed that the Hangzhou firm shipped more than 5,500 humanoid units in 2025 alone – more than every Western humanoid company combined, by a wide margin ([Rest of World](#); [TechFlow](#)). Its closest domestic rival, AgiBot, crossed 10,000 cumulative humanoid units produced by the end of March 2026 ([TechTimes](#)). By comparison, Unitree's own prospectus states that Figure AI and Agility Robotics – two of the best-funded humanoid startups in the United States – each shipped approximately 150 units in the same year ([Recode China AI](#)).



A Figure humanoid moves sheet-metal parts on BMW's Spartanburg line during its eleven-month, 1,250-hour deployment — one of the best-documented cases of sustained humanoid labor anywhere in the industry. Credit: Figure AI/BMW Group

These three data points — a genuinely productive robot doing genuinely measured work at BMW, a genuinely absent number from the company whose CEO has done more than anyone to popularize the humanoid robot as a cultural idea, and a genuinely dominant but almost unheralded Chinese manufacturing base — are the spine of this report. The humanoid robotics industry in the summer of 2026 is not one story. It is at least three separate ones, running at different speeds, measured by different yardsticks, and answering different questions. This report tries to keep them separate.

1. How Big Is This Market, Really?

Ask four investment banks how large the humanoid robot market will be and you will get four numbers that do not obviously describe the same industry. Goldman Sachs Research, in a widely cited January 2024 revision, raised its 2035 total addressable market estimate sixfold, from \$6 billion to \$38 billion, and lifted its unit-shipment forecast fourfold to 1.4 million robots a year by 2035, citing faster-than-expected progress in robot foundation models and a roughly 40 percent reduction in the cost of materials ([Goldman Sachs](#)). In a “blue-sky” scenario in which every technical, cost, and public-acceptance obstacle is cleared, the same analysts see a market as large as \$154 billion by 2035 ([Goldman Sachs, “Humanoid Robots: Sooner Than You Might Think”](#)).

Morgan Stanley's research group looks past 2035 entirely and models a \$5 trillion total ecosystem — hardware, supply chains, and services combined — by 2050, with 13 million humanoids in service by 2035 scaling to a billion units globally by mid-century, and perunit costs falling from roughly \$200,000 today to \$50,000 by 2050 ([Morgan Stanley](#)). Citigroup has published an even larger number: \$7 trillion by 2050, with industrial payback periods as short as 36 weeks ([cited via MLQ.ai](#)). At the conservative end, MarketsandMarkets — a market-research firm rather than an investment bank — puts the humanoid robot market at \$2.92 billion in 2025, growing to \$15.26 billion by 2030 at a 39.2 percent compound annual growth rate ([MarketsandMarkets](#)). A compilation of eight separate 2025–2026 forecasts by Robots in Life shows a 2035 range stretching from roughly \$9 billion to \$251 billion, and CAGR estimates spanning 17.5 percent to 69.7 percent — a four-fold spread in the rate of growth, not just the endpoint ([Robots in Life](#)).

These are not simply optimistic-versus-pessimistic readings of the same evidence. They differ because they are answering different questions dressed up as the same question. A forecast that counts only humanoid hardware revenue produces a dramatically smaller number than one that includes robotics-as-a-service subscriptions, maintenance contracts, software licensing, and the “downstream services” Morgan Stanley folds into its \$5 trillion figure. A forecast that assumes humanoids remain confined to structured industrial environments — the only place they have demonstrated sustained, measured productivity as of mid-2026 — produces a smaller number than one that assumes elder care and consumer household adoption at scale by the early 2030s, a assumption for which there is essentially no commercial evidence yet. And a forecast's unit-shipment assumption interacts multiplicatively with its price assumption: Goldman's 1.4 million unit, \$38 billion 2035 figure implies an average selling price in the high five figures to low six figures; a forecast that assumes Tesla or Unitree-style pricing in the \$20,000–\$30,000 range at much higher volumes can produce a similar dollar figure from a very different unit count.

What is not in serious dispute is the order of magnitude of where the market stands today. Independent shipment trackers converge on a 2025 global total in the neighborhood of 13,000 to 18,000 humanoid units shipped worldwide, across every manufacturer, every country, every use case — research, industrial, and consumer combined. Robots in Life's compiled tracker puts the 2025

2025 total near 13,000 units ([Robots in Life](#)); Bank of America Merrill Lynch analysts estimated 18,000 units for 2025, up from 2,500 the year before; and Omdia's estimate, cited by CNBC, was roughly 15,000 ([CNBC](#)). A separate estimate places 2026 sector revenue at \$4–5 billion globally ([AI2Work](#)). These are, in absolute terms, small numbers. Fewer humanoid robots shipped globally in all of 2025 than Toyota builds cars in a single day. The honest 2026 baseline for this industry is not “mass production.” It is early, fragmented, low-volume manufacturing, concentrated overwhelmingly – as Section 3 details – in one country, for one dominant use case: research and demonstration hardware, not deployed industrial labor.

A reasoned forecast, reconciling these sources, would put the market at roughly \$4–6 billion in actual 2026 hardware and service revenue; a plausible path to \$25–45 billion by 2032–2035 if – and only if – humanoid robots achieve reliable general-purpose manipulation in structured industrial settings at the cost curve Unitree and Chinese manufacturers are already demonstrating; and genuine uncertainty, not confident projection, about anything involving consumer or elder-care adoption before the early 2030s. The bull cases north of \$100 billion require assumptions (mass consumer adoption, near-full substitution for manufacturing labor shortages, elder-care deployment at scale) for which there is, as of mid-2026, no commercial precedent anywhere in the world.

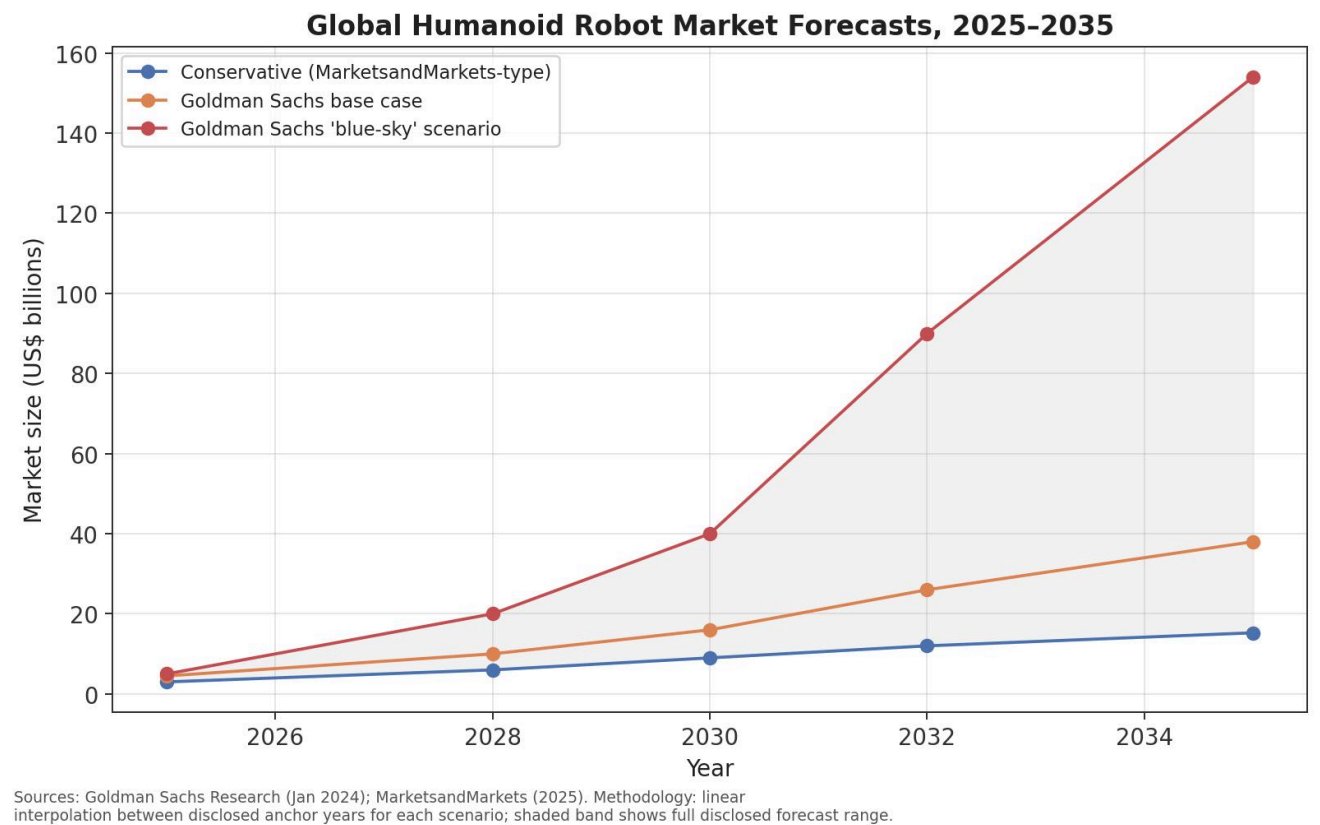


Chart 1 — Global market forecasts, showing the wide disclosed range between conservative hardware-only forecasts and Goldman Sachs' "blue-sky" scenario. Methodology: values plotted at each firm's own disclosed anchor years and interpolated linearly between them; shaded band spans the full disclosed range. Sources: Goldman Sachs, MarketsandMarkets.

What this means for robotics engineers

Treat market-size headlines as scenario planning, not forecasting. The variable that actually matters for a company's near-term prospects is not the 2035 TAM estimate cited in its pitch deck — it is whether its current-generation hardware can complete a defined industrial task at a duty cycle and mean-time-between-failures that beats the fully loaded cost of the human role it targets. Everything else is downstream of that single engineering fact.

2. Who Is Actually Shipping? Separating Production from Promise

This is the question this report treats as central, and the one most coverage of humanoid robotics answers badly — usually by conflating an “order,” a “letter of intent,” a unit that has appeared in a demo video, and a unit that has been manufactured, delivered, and put to sustained use. The table below draws only on figures companies have themselves disclosed (in IPO prospectuses, earnings calls, or on-the-record company statements) or that independent industry trackers (Omdia, TrendForce, Bank of America Merrill Lynch) have published, and assigns each figure a confidence label.

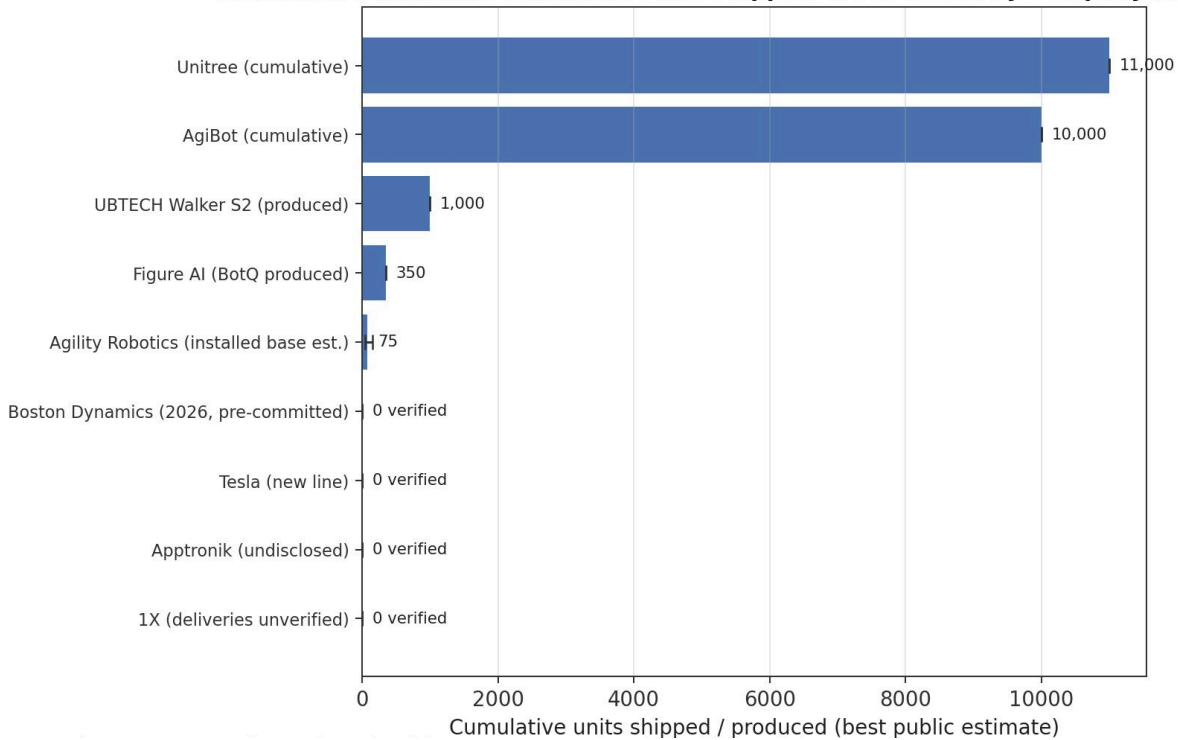
Company	Country	Cumulative units shipped/produced	Best 2025–26 evidence	Confidence
Unitree	China	~11,000 cumulative humanoid units produced; 5,500+ shipped in 2025 alone	IPO prospectus, STAR Market filing (techflowpost ; chinaminutes)	High — audited prospectus disclosure
AgiBot	China	10,000th unit produced by March 30, 2026	Company production milestone reported by TrendForce/Omdia via TechTimes (TechTimes)	Medium-High
UBTECH	China	~1,000th Walker S2 rolled off the line by late Dec. 2025; targeting 5,000/yr capacity in 2026, 10,000/yr in 2027	Guangxi Daily / PRNewswire (Baidu Baike ; PRNewswire)	Medium — company-disclosed, publicly listed
Agility Robotics	US	~40–150 Digit units in commercial/pilot service; best estimate ~75; 65,000+ cumulative operating hours across 9 customer sites	SPAC filing; independent tracker (Roboticsandautomationnews ; New Market Pitch tracker)	Medium — best independently corroborated Western figure
Figure AI	US	~350+ Figure 03 units built at BotQ by April 2026; commercial-vs-research split undisclosed	Company disclosure via industry analysis (RoboZaps)	Medium — production count disclosed, deployment count is not
Apptронik	US	Pilot-scale only; no published unit count; Jabil manufacturing partnership for future scale	Company and press reporting (ifactoryapp)	Low — no disclosed unit figure

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Company	Country	Cumulative units shipped/produced	Best 2025–26 evidence	Confidence
Boston Dynamics	US (Hyundai-owned)	Production just started in 2026; entire 2026 output pre-committed to Hyundai + Google DeepMind, no independent unit count published	Company press release (Boston Dynamics)	Low-Medium – production confirmed, volume not disclosed
Tesla	US	0 verified units from the new dedicated Optimus line as of July 2026; prior-generation builds estimated in the “few hundred” range by The Information	Q2 2026 earnings call; independent reporting (TechTimes)	High confidence that the number is effectively zero on the new line
1X Technologies	US/ Norway	Factory opened May 2026 with ~10,000/year design capacity; over 10,000 pre-orders; customer delivery volume not yet independently verified	Company statement (RoboZaps ; TravTeks)	Low-Medium – capacity disclosed, deliveries not verified

The single most important number in that table is not a shipment count at all – it is the ratio embedded in Unitree’s own prospectus: of the 5,500-plus humanoids it sold in 2025, roughly 70 to 74 percent went to universities and research institutions, and only about 9 percent went into what the company itself classifies as real industrial application ([techflowpost](#); [Rest of World](#)). This is the industry’s own most rigorously disclosed figure, and it says that even the world’s highest-volume humanoid manufacturer is still overwhelmingly selling research and demonstration hardware, not industrial labor substitutes. That single data point should recalibrate almost every other claim in this sector.

Estimated Cumulative Humanoid Units Shipped or Produced, by Company (mid-2026)



Sources: Unitree IPO prospectus; AgiBot/TrendForce via TechTimes; UBTECH/PRNewswire; RoboZaps (Figure, Agility); Boston Dynamics; Tesla Q2 2026 earnings call. Figures are cumulative production/shipment, not necessarily field-deployed. Tesla and Boston Dynamics show zero because no independently verified unit count exists as of July 2026.

Chart 2 — Cumulative humanoid units shipped or produced, by company, as of mid-2026. Note the roughly two-order-of-magnitude gap between the two Chinese volume leaders and every Western competitor, and that Tesla and Boston Dynamics both show zero verified units because neither has disclosed an independently confirmed production count as of this report's research date. Sources as cited in Sections 2 and 8.

What this means for robotics engineers

If you are evaluating a humanoid platform as an engineering customer, ask for three numbers no company likes to volunteer: cumulative fielded (not manufactured) units, mean hours between unplanned interventions in a specific deployed task, and the fraction of a shift completed without human teleoperation assistance. Everything else — DoF counts, payload specs, dexterity demo reels — is necessary but not sufficient information.

3. China vs. the United States: Why the Volume Gap Is So Wide

The clearest single number in this entire investigation is also the least ambiguous: independent industry estimates converge on China accounting for roughly 90 percent of commercial humanoid robot production volume in 2025–2026 ([Gerra supply chain analysis](#)). That is not a forecast. It is close to a present-tense description of where the metal is actually being bent.

The reasons are structural, not incidental, and they compound rather than operate independently.

Actuators and reducers. A modern humanoid uses somewhere between 20 and 40 harmonic reducers plus a comparable number of planetary reducers to achieve human-like joint compliance and torque density — together, actuator systems make up 40 to 60 percent of a humanoid's total bill of materials ([Rockingrobots/McKinsey](#)). Japan's Harmonic Drive Systems still holds an estimated 80 to 85 percent of the global harmonic-reducer market, and Nabtesco supplies roughly 60 percent of reducers for medium-to-large robot joints ([Jamestown Foundation](#)). But Chinese domestic suppliers — Leaderdrive foremost among them — have moved from a standing start to roughly 10 percent global market share in harmonic reducers within a few years, with 2025 revenue of 570 million yuan, up 47 percent year on year, and new capacity investment targeting a further one million units of annual harmonic-reducer output ([Tianxia Gongchang](#)). China's advantage is not that it invented a better reducer. It is that a Chinese humanoid manufacturer can qualify a domestic reducer supplier, a domestic motor winder, a domestic battery cell maker, and a domestic contract assembler all within a few hundred kilometers, with government-backed capital available at each stage, while a US manufacturer typically imports several of those components from Japan, Taiwan, and China itself.

Rare earths and magnets. High-torque actuators depend on neodymium-iron-boron magnets. China controls an estimated 69 percent of global rare-earth mining and roughly 90 percent of global magnet-processing capacity ([Rockingrobots](#)). This is arguably the single most acute chokepoint in the entire supply chain, and it sits entirely outside any individual robotics company's control.

Batteries. China's battery manufacturing base — anchored by CATL and BYD, both of which built their scale in electric vehicles before humanoid robotics existed as a commercial category — gives Chinese humanoid makers access to cell chemistries, energy densities, and unit costs that took a decade of EV-driven capital investment to build. A separate estimate places China's share of global battery production capacity at roughly 77 percent ([Gerra](#)).



A view of BYD's Zhengzhou factory. A decade of EV-driven capital investment now underwrites the cell chemistries and unit costs humanoid manufacturers depend on. Credit: BYD

Contract manufacturing and assembly labor. Foxconn, Luxshare, and a dense ecosystem of Shenzhen- and Suzhou-area contract manufacturers already run the precision-electronics assembly lines that produce smartphones and EVs at global scale. Retooling a fraction of that capacity for humanoid final assembly is a marginal cost; building an equivalent greenfield capability in the United States, as Tesla is now attempting at Fremont, is a from-scratch undertaking. Musk's own description of Optimus – “no existing supply chain,” “everything on the robot is new” ([Yahoo Finance transcript](#)) – is in effect an admission that Tesla is trying to build, from a standing start, the kind of dense component ecosystem that already exists in the Yangtze and Pearl River delta industrial clusters.

Government policy and capital. Beijing has designated humanoid robotics a strategic priority sector, and provincial and municipal governments have layered subsidies, cheap land, and state-linked investment funds on top of that designation. China's Ministry of Industry and Information Technology has explicitly flagged reducers as a target technology for domestic substitution ([Jamestown Foundation](#)), precisely the kind of top-down component-level industrial policy a market-driven Western startup ecosystem rarely attempts.

Pricing discipline as a byproduct of scale. Unitree's own numbers illustrate the outcome: the average price of its humanoid robots fell from about 593,400 yuan (~\$85,000) in 2023 to 167,600 yuan (~\$25,000) in 2025 – a 70 percent price decline in two years – while gross margin improved to nearly 60 percent ([Rest of World](#)). That combination – falling price, rising margin – is only possible when a company controls its own component supply chain, which Unitree's prospectus says it deliberately does.

Where the United States still leads is narrower but real. American and allied companies hold a clear edge in the two layers of the stack that sit above the mechanical bill of materials: advanced AI compute – NVIDIA’s Jetson Thor and Isaac GR00T platform is the reference architecture that Chinese manufacturers are themselves building around (Unitree’s own H2 Plus chassis is the hardware for NVIDIA’s academic reference design, and Chinese firms are early adopters of Jetson AGX Thor) ([CNBC](#); [qz.com](#)); leading-edge semiconductor fabrication, where TSMC’s Taiwan facilities produce an estimated 90 percent of the world’s most advanced sub-5nm chips ([Gerra](#)); and foundation-model research talent, where US labs and the open frontier ecosystem (OpenVLA, RT-2, Physical Intelligence’s OpenPI) still set the pace for generalizable robot learning.

The uncomfortable synthesis: China’s edge sits almost entirely in the mechanical, electrical, and manufacturing layers – the hardest parts of a humanoid to replicate quickly. The US edge is concentrated in compute and AI software, which is, ironically, the layer most easily licensed, open-sourced, or purchased off a cloud platform by a well-capitalized competitor anywhere in the world. That asymmetry should worry Western manufacturing strategists more than any individual company’s valuation does.

What this means for robotics engineers

Supply-chain due diligence is now a core competency for anyone specifying humanoid hardware, not an afterthought. If your actuator, reducer, or battery-cell supplier sits in a single-source Chinese or Japanese cluster, your production timeline is hostage to export-control policy as much as to your own engineering roadmap – a risk that is no longer hypothetical, given the U.S. legislative activity around Chinese-made robots discussed in Section 7.

4. The Real Engineering Bottlenecks

Mechanical: the actuator is still the whole problem

Every serious cost and reliability analysis of humanoid robotics converges on the same conclusion: the actuator – the integrated motor, gearbox, encoder, and drive electronics that moves a single joint – is the bottleneck, not a bottleneck. Interact Analysis’s 2025 humanoid robot report found that joint actuators account for over 30 percent of total bill-of-materials cost in high-configuration humanoids, and more than 50 percent in simpler models lacking dexterous hands ([TheHumanoid.ai](#)). A representative full-size humanoid carries on the order of 20 to 40 harmonic reducers alone ([Tianxia Gongchang](#)), each a precision-ground, capital-intensive component that – unlike a battery cell or a camera module – cannot simply have capacity “added” the way a semiconductor fab line can. McKinsey’s supply-chain analysis is explicit that harmonic and strain-wave drives are “structurally harder to scale” than electronics because of tight tolerances, dedicated tooling, and long qualification cycles ([McKinsey](#)).

The engineering trade-off inside the actuator is backdrivability versus torque density versus cost. Harmonic (strain-wave) drives give smooth, low-backlash, backdrivable motion ideal for compliant lower-body joints, but they are expensive and precision-bound. Planetary and cycloidal reducers offer higher stiffness and load capacity for high-impact joints but sacrifice some of that natural compliance. A typical humanoid mixes both: roughly 14–15 harmonic reducers and a similar number of planetary units allocated by joint role, according to industry teardown estimates ([TechBuzzChina Tracker](#)). Every one of these choices propagates into thermal management (motor windings generate heat that must be dissipated inside a sealed, human-scale limb), weight budget (every gram of actuator mass at the extremities disproportionately taxes dynamic balance), and long-run wear characteristics that no manufacturer has yet published multi-year field data on, because no humanoid has been in continuous field service for multiple years.

Electrical: batteries define the duty cycle, not the marketing copy

Goldman Sachs’ own 2022 analysis noted that contemporary humanoids could work only one to two hours before recharging, and that reaching viable economics requires roughly 20 hours of continuous operation, or a fast-charge cycle of one hour of charging to four to five hours of work, repeated through a shift ([Goldman Sachs](#)). 1X’s NEO carries a 0.75 kWh internal pack rated for about four hours of use before automatic docking ([Notebookcheck](#)). Apptronik’s Apollo uses swappable four-hour battery packs specifically to work around the same limitation rather than solve it ([TSG Invest](#)). Battery thermal management, cell chemistry selection, and hot-swap mechanical design are not secondary concerns; they are, alongside actuators, the second-largest line item in the bill of materials, estimated at 15 to 20 percent of total BOM cost ([Robotomated](#)).

Perception, manipulation, and the dexterity gap

The most consistent unglamorous truth from every deployment case study in this report is that current humanoids are performing narrow, defined, repeatable tasks — sheet-metal loading, tote transport, part sequencing — not general open-world manipulation. Figure's own description of its BMW deployment is explicit that the task was “defined, repeatable, and measurable,” not general assembly help ([ifactoryapp](#)). Bimanual manipulation of deformable objects (fabric, cables, food), fine motor control comparable to a human hand, and robust tool use under visual and force-sensing feedback remain open research problems, not solved engineering ones — which is precisely why every credible company in this space (Figure, Boston Dynamics, NVIDIA, Tesla) is racing to build and train vision-language-action foundation models rather than hand-coded controllers.

AI: robot foundation models are where the real competition now lives

The software stack has consolidated around a common architecture pattern — a vision-language-action (VLA) model that fuses semantic reasoning with real-time motor control — even as companies diverge sharply on how they build it. Figure's Helix, trained fully in-house after Figure exited its OpenAI partnership in February 2025 (in founder Brett Adcock's words, because “to solve embodied AI at scale in the real world, you have to vertically integrate robot AI”) ([TechMarketBriefs](#)), runs onboard at 200Hz for whole-body control ([Silicon Valley Investclub](#)). NVIDIA's Isaac GR00T is explicitly an open, licensable alternative: a stack spanning teleoperation data capture, the GR00T N open foundation model, Isaac Sim/Isaac Lab simulation, Cosmos world models for synthetic data generation, and Jetson Thor for onboard inference, deployed on hardware from Unitree, Hugging Face's Reachy, and other partners ([NVIDIA Developer](#); [TechCrunch](#)). Boston Dynamics has taken a third path, partnering with Google DeepMind to bring Gemini Robotics foundation models to Atlas rather than building its own from scratch ([Boston Dynamics](#)).



NVIDIA's open Isaac GRoot reference platform, demonstrated on Unitree hardware — a visible example of the US-compute/China-hardware interdependence running through this industry. Credit: NVIDIA

The industry-wide bet is that imitation learning from teleoperated demonstrations, reinforcement learning in simulation, and increasingly synthetic and internet-scale video data (Figure's "Project Go-Big," which uses human video captured across 100,000 Brookfield residential units, is one concrete example) can close the gap between narrow-task competence and general-purpose dexterity faster than hand-engineered control ever could ([TechMarketBriefs](#)). Whether that bet pays off before 2030 is the single largest open technical question in the industry, and no company has yet published independently verifiable evidence of a foundation-model-driven humanoid completing open-world tasks at production reliability outside a curated demo.

Manufacturing: yield, testing, and the "S-curve" problem

Musk's own framing on the July 2026 earnings call is the clearest public articulation of the manufacturing bottleneck from anyone in the industry: Optimus will follow a normal manufacturing S-curve, but "the initial portion of the S-curve will be quite flat and long because of the newness of the parts in the robot" ([Yahoo Finance](#)). This is not a Tesla-specific problem. Every humanoid manufacturer faces the same sequence: qualify novel precision components at low volume, discover failure modes that only appear at scale (Figure has publicly attributed reliability issues in its Figure 02 forearm and wrist electronics to lessons learned at BMW, which were then redesigned into Figure 03 for improved thermal management and robustness ([Sacra](#))), then re-tool for volume production. Boston Dynamics has explicitly designed the production Atlas to reduce unique part count and align with automotive supply chains for exactly this reason ([Medium/Daniel Ikechukwu](#)). Unitree's advantage here is not a manufacturing secret; it is simply that it started this qualification cycle years earlier, at lower cost, building on its existing quadruped-robot manufacturing base.

What this means for robotics engineers

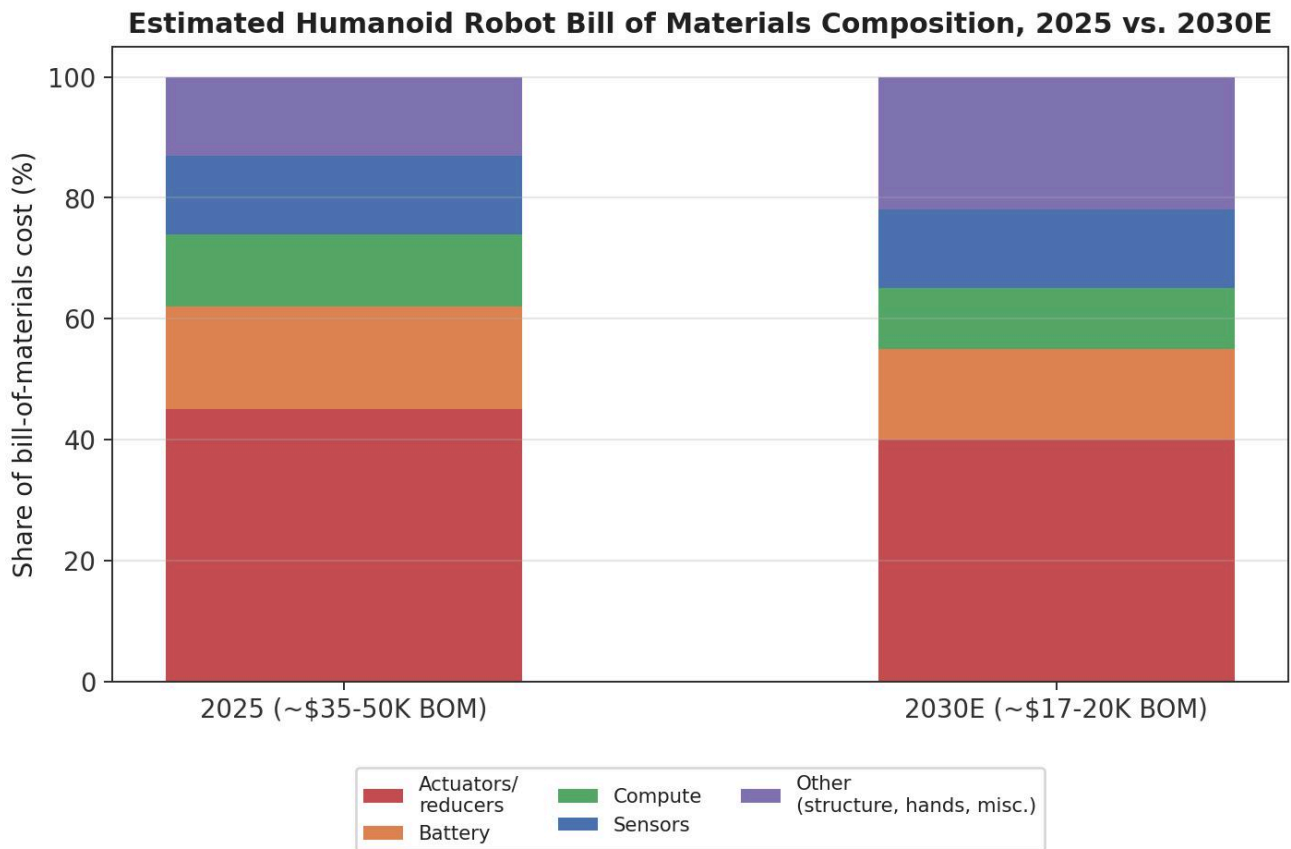
If you are designing or specifying humanoid hardware, treat the actuator and battery bill of materials as the primary cost and reliability lever, not the AI stack. The foundation model determines what a robot can eventually be taught to do; the actuator and thermal design determine whether it survives being taught. Companies that vertically integrate actuator and reducer manufacture (Unitree, and increasingly Hyundai Mobis for Boston Dynamics) have a structural cost and iteration-speed advantage over those that source them externally.

5. Cost Reality: What a Humanoid Actually Costs to Build

Every credible engineering-grounded estimate places 2025–2026 humanoid bill-of-materials cost in a wide band, and the width of that band is itself informative – it reflects how differently configured “humanoid robots” actually are. Bank of America Global Research estimates a China-built humanoid’s BOM cost was about \$35,000 in 2025, projected to roughly halve to below \$17,000 by 2030 on scale effects and component redesign ([Bank of America Institute](#)). The same report puts pilot-stage development cost (not mass-production BOM) at \$90,000–\$100,000 per unit. Bain & Company’s Global Humanoid Robot Industry Trends report estimates current BOM cost at roughly \$40,000–\$50,000, falling 60–70 percent to \$10,000–\$20,000 by 2035 ([Airobot Seidos](#)). McKinsey’s breakdown attributes 40–60 percent of BOM to actuators, 10–20 percent to sensing/perception, and states that five component domains together account for 85–90 percent of total unit cost, with the widely cited industry threshold for mass-market viability sitting under \$20,000 ([Rockingrobots](#)).

Retail and quoted prices in mid-2026 span an unusually wide range because they reflect radically different levels of finish, dexterity, and support: Unitree’s G1 sells in the US for roughly \$70,000 including tax in fully specified configuration ([ZMProbots](#)), though base configurations have listed as low as \$13,500–\$16,000 in China-market pricing ([RoboZaps company hub](#)); UBTECH’s new consumer-oriented UWORLD U1 companion robot starts at 119,800 yuan (~\$17,700) and rises to 990,000 yuan (~\$146,000) for the full-body Ultra model ([BigGo Finance](#)); 1X’s NEO is priced at \$20,000 outright or \$499/month ([1X](#)); and neither Tesla’s Optimus, Boston Dynamics’ Atlas, Figure’s Figure 03, nor Apptронik’s Apollo has a public list price at all, because none is available for open commercial purchase – Boston Dynamics’ entire 2026 output is contractually committed to Hyundai and Google DeepMind ([Boston Dynamics](#)), and Apptронik sells Apollo only through enterprise pilot agreements on a quote basis ([RoboZaps](#)).

Gross margin evidence is scarcer, but Unitree’s disclosed prospectus figures are the most reliable data point in the industry: 60.27 percent gross margin on 2025 revenue, achieved specifically because the company self-manufactures core components rather than buying them from third parties ([TechMarketBriefs](#)). That is a rare, audited example of a humanoid manufacturer that is not simply burning venture capital to subsidize unit economics.



Sources: McKinsey (2026); Bank of America Global Research (Mar 2026); Bain & Company; Interact Analysis (2025). Composition percentages reconciled across sources; absolute BOM figures per BofA (35K, 2025→ < 17K, 2030) and Bain (40 – 50K→10-20K by 2035, interpolated to 2030 here).

Chart 3 — Estimated BOM composition, 2025 vs. a 2030 projection. Actuators and reducers remain the largest cost category throughout the forecast period even as absolute BOM cost roughly halves. Sources: McKinsey, Bank of America Global Research, Bain & Company via Airobot Seidos.

Costs will fall first, and fastest, in the components that already benefit from adjacent-industry scale: battery cells (piggybacking on EV-driven capacity from CATL, BYD, LG, Panasonic, and Samsung SDI), commodity brushless DC motors, and camera/LiDAR sensing hardware, all of which McKinsey classifies as “low risk” from a supply standpoint ([Rockingrobots](#)). Costs will fall last, and most slowly, in the precision-bound actuator and reducer layer, and in planetary roller screws specifically – which McKinsey flags as possibly the single most acute supply risk in the entire stack because of a narrow supplier base, long qualification lead times, and essentially no substitution path.

What this means for robotics engineers

If your organization is modeling total cost of ownership for a humanoid deployment, do not anchor on a manufacturer’s headline sticker price. Anchor on BOM composition: a robot whose price advantage comes from a thinner sensor suite or fewer actuated degrees of freedom in the hand may be cheaper to buy and much more expensive to integrate for any task requiring genuine dexterity.

6. Deployment Reality: Separating Paid Production Work from Proofs of Concept

This report classifies every publicly documented humanoid deployment into one of four tiers: **announced partnership** (a press release with no operational evidence), **pilot** (robots physically present and running, but in a bounded test area, often behind light curtains, with no disclosed continuous-operation metric), **paid production deployment** (a commercial contract under which the robot is doing measured, sustained work as part of a real workflow), and **proof of research concept** (a robot operating in a controlled demonstration, at a trade show, or in a lab setting).

Judged by that standard, only a handful of deployments worldwide currently qualify as paid production deployments with independently corroborated metrics:

Figure AI at BMW Spartanburg. Figure 02 ran daily ten-hour shifts across eleven months, moving over 90,000 parts across 1,250-plus logged hours, contributing to more than 30,000 X3 vehicles, before the pilot was formally completed in November 2025 and evaluation of Figure 03 use cases began ([Sacra](#); [TechMarketBriefs](#)). Figure 03 has since been redeployed at the same facility with roughly 40 units ([Sacra](#)). This is the best-documented Western humanoid deployment by volume of measured work, though it remains task-narrow (sheet-metal loading) and single-customer.

Agility Robotics' Digit at GXO Logistics. GXO's Flowery Branch, Georgia facility is recognized industry-wide as the first formal commercial Robots-as-a-Service humanoid contract, signed in 2024; as of late 2025 GXO reported Digit units had moved more than 100,000 totes ([Agility Robotics](#); [EmbodimentVC](#)). Digit has also run daily eight-hour factory shifts at Schaeffler's Cheraw, South Carolina plant continuously since early 2025 — independently confirmed by The Wall Street Journal in March 2026 — making it the earliest verified factory-floor (as opposed to warehouse) humanoid deployment in the West ([New Market Pitch tracker](#)). Across nine customer facilities, Agility discloses more than 65,000 cumulative operating hours ([Roboticsandautomationnews](#)). A February 2026 agreement added Toyota Motor Manufacturing Canada, deploying seven Digit units at its Woodstock, Ontario RAV4 plant ([Agility Robotics](#)). Independent analysis places Agility's total global installed base at roughly 40–150 units, with a best estimate near 75 ([New Market Pitch](#)) — meaning even the most operationally mature Western humanoid program in the world remains a two-digit-to-low-three-digit fleet.

UBTECH's Walker S2 in Chinese manufacturing. UBTECH began mass production and delivery of Walker S2 in November 2025, targeting 500 units delivered within the year and an annual capacity of 5,000 units by 2026, rising to 10,000 by 2027 ([PRNewswire](#)). The company disclosed order commitments exceeding 800 million yuan (~\$112 million) by November 2025, including a single 250-million-yuan order from an undisclosed major Chinese manufacturer ([SCMP](#)) and its 1,000th Walker S2 rolled off the Liuzhou production line by late December 2025 ([Baidu Baike](#)). These are order and production figures rather than independently verified operational-hours metrics, but they represent real revenue booked by a publicly listed company, not a demo.

Appttronik's Apollo at Mercedes-Benz, GXO, and Jabil. All three relationships are, by Appttronik's own account and industry analysis, pilot or R&D-stage programs rather than sustained paid production work — Apollo operates within light-curtain-bounded areas, and no customer has published performance metrics ([RoboZaps](#)).

Boston Dynamics' Atlas at Hyundai and Google DeepMind. As of mid-2026, production has only just begun, with initial fleets shipping to Hyundai's Robotics Metaplant Application Center and Google DeepMind through the remainder of the year; there is not yet a public operational-hours or task-completion metric to evaluate, and Hyundai's factory-floor deployment plan is explicitly targeted for 2028, not 2026 ([Medium/Daniel Ikechukwu](#)).

Tesla's Optimus inside Tesla's own factories. Musk himself, on the January 2026 earnings call, characterized existing Optimus units as being used “primarily for learning, not productive tasks” — a direct contradiction of earlier claims and social-media suggestions that thousands were already working productively on the line ([TechTimes](#)). This is Tesla's own on-the-record characterization, not third-party skepticism.

Two conclusions follow directly from this evidence. First, the most operationally mature, best-measured humanoid deployments in the world today are narrow-task, single- or few-customer programs: Figure at BMW, Agility at GXO and Schaeffler. Neither has scaled beyond roughly a few dozen to a couple hundred units in the field. Second, China's deployment story is different in kind, not just degree: UBTECH and its peers are converting large order books into hundreds and low thousands of delivered units, even though the operational-hours evidence behind those deployments is thinner than what Figure and Agility have published. The West has better-documented quality of evidence at very low volume; China has much higher volume with thinner public operational evidence. Both facts are true simultaneously, and most coverage of this industry picks one and ignores the other.

What this means for robotics engineers

When evaluating a vendor's deployment claims, insist on the difference between an “agreement,” a “pilot,” and an operating-hours figure with a named facility and date range. Only the last category is falsifiable. Treat order-book figures (UBTECH's 800-million-yuan bookings, 1X's 10,000-plus pre-orders) as demand signals, not delivery evidence — they say a customer is willing to pay, not that the robot has performed the job.

7. Credible vs. Hype

Millions of humanoid robots in service by 2030. — Red. No manufacturer's disclosed current capacity supports this. Even Unitree's aggressive five-year target — 75,000 humanoids and 115,000 quadrupeds annually — is roughly 14 times its 2025 humanoid shipment volume, and is a target, not a delivered figure ([TechFlow](#)). Global 2025 shipments across every manufacturer worldwide were on the order of 13,000–18,000 units ([Robots in Life](#); [CNBC](#)).

A sub-\$20,000 humanoid robot. — Amber. 1X's NEO is priced at exactly \$20,000 today ([1X](#)), and Unitree's average selling price has already fallen below that level in China (\$25,000 in 2025, down from \$85,000 two years earlier) ([Rest of World](#)). The claim is achievable and partly achieved for stripped-down or subsidized configurations, but a fully dexterous, general-purpose \$20,000 humanoid at the capability level BMW or Mercedes are piloting does not yet exist at that price.

Consumer home robots in meaningful numbers by 2027. — Amber-to-Red. 1X has a real factory, real pricing, and real pre-orders, but its own rollout explicitly depends on human teleoperators covering tasks the robot cannot yet do autonomously — the company's language is "some this year, some later" against a stated 10,000-unit annual factory capacity ([RoboZaps](#)). No customer deliveries had been independently verified as of mid-July 2026. This is a genuine product with a genuine shipping date, but the underlying autonomy claim is unproven at scale.

Factory automation replacing meaningful manufacturing labor by 2028. — Amber. BMW, Schaeffler, Toyota, Mercedes, and Hyundai are all running real, named, dated pilots — this is not vaporware. But every one of them remains narrow-task and low-volume. Hyundai's own roadmap targets 2028 for factory-floor deployment at scale, not 2026 ([Medium/Daniel Ikechukwu](#)); Schaeffler's own public target is "a significant number of humanoids" across its 100-plant network by 2030 ([Agility Robotics](#)).

Elder care and healthcare humanoids at scale. — Red. No company reviewed in this report has a paid, measured elder-care deployment. Figure's marketing references healthcare and eldercare applications leveraging Helix's language and vision capabilities ([Sacra](#)), but this is a stated intention, not a demonstrated deployment.

Tesla shipping "thousands" of Optimus units in 2026, en route to a million-unit annual Fremont line. — Red for the near-term volume claim, Amber for the long-term factory capacity claim. The 1-million-unit design capacity of the converted Fremont line is a real, confirmed engineering fact, stated by Musk on the record ([RoboZaps](#)). But it is explicitly a design capacity, not a production forecast, and as of the July 2026 earnings call, zero verified units had shipped from that line ([TechTimes](#)).

Boston Dynamics/Hyundai’s 30,000-unit-per-year factory. – Amber. The factory investment and target are real and disclosed as part of Hyundai’s broader \$26 billion US manufacturing commitment ([AI2Work](#)), but the 30,000-unit figure explicitly spans Atlas, Spot, and other Boston Dynamics platforms combined, is targeted for 2028, and current 2026 Atlas output is entirely pre-committed to two customers with no independent unit count disclosed.

China’s ~90% share of commercial humanoid production. – Green. This is the most solidly evidenced claim in the report, supported by converging independent estimates from supply-chain analysts and corroborated by the raw shipment gap between Unitree/AgiBot (thousands to tens of thousands of units) and every Western competitor (tens to low hundreds) ([Gerra](#); [Recode China AI](#)).

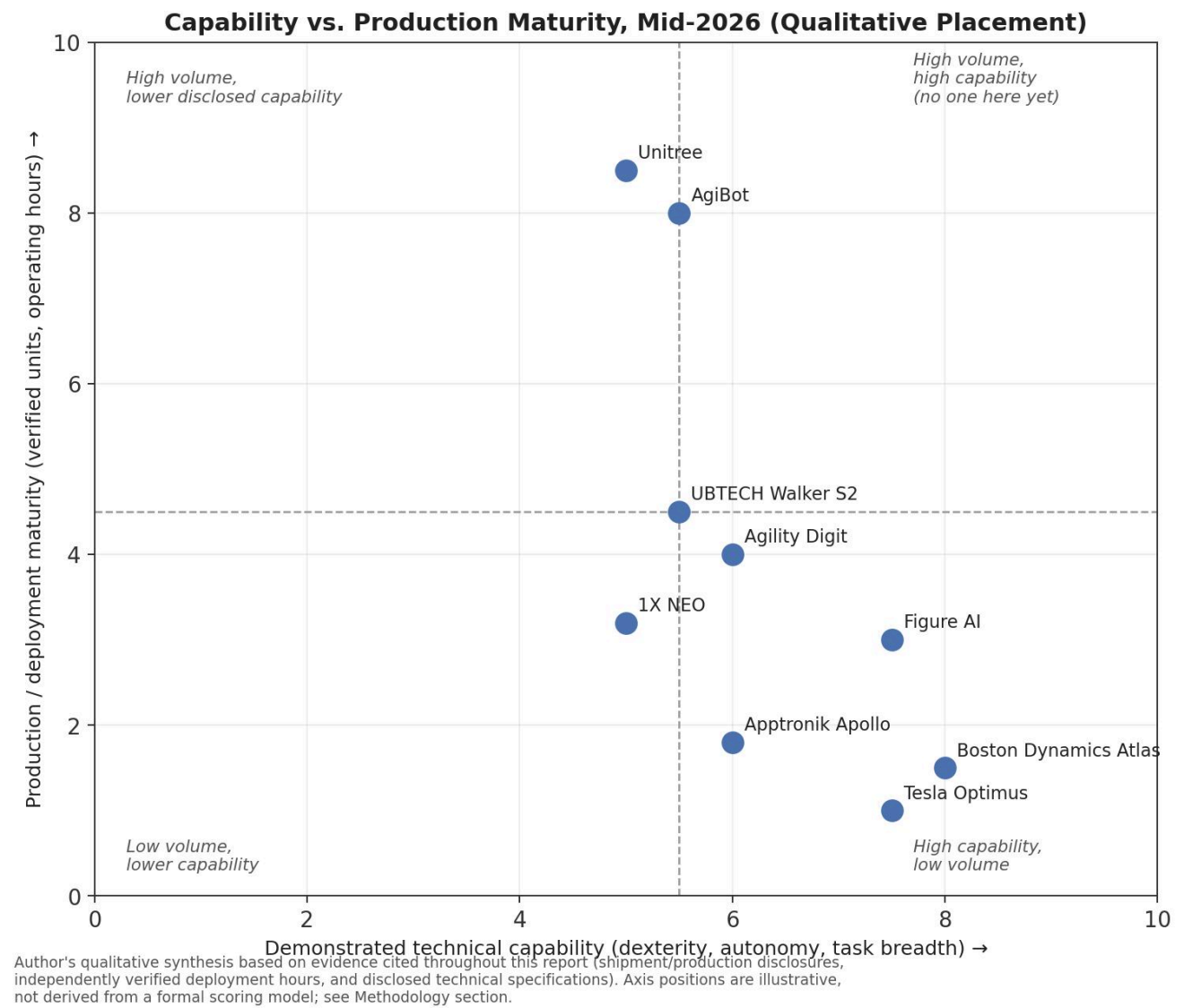


Chart 4 — A qualitative synthesis plotting demonstrated technical capability against production/deployment maturity for every Tier One company profiled in this report. No company currently occupies the “high capability, high volume” quadrant — which is, in a single image, the central finding of this report. Author’s synthesis; see Methodology.

8. Company Profiles

What this means for robotics engineers

Tesla's Optimus program is, by capital committed and public attention generated, the most important single humanoid effort in the world – and, as of July 2026, the least evidenced by actual shipped units. The company converted its Fremont Model S/X production line – a real, physical, photographed transformation, with the last legacy vehicle built in early May 2026 and the line torn down in roughly 46 days ([RoboZaps](#)) – to build Optimus V3, targeting a design capacity of one million units annually. Optimus V4 is slated for Gigafactory Texas, with Musk citing an “aspirational” 10-million-unit annual target with no date attached. On the Q2 2026 call, Musk was unusually candid: “there is no humanoid robot that is actually able to do generalized tasks... the demonstrations you’re seeing are pre-programmed or remote controlled,” a direct swipe at the state of the entire industry including, implicitly, his own prior public statements ([Yahoo Finance transcript](#)). Tesla's structural strengths are real: in-house actuator and power-electronics design, an enormous balance sheet, an existing high-volume automotive manufacturing discipline, and a training-data pipeline that can in principle borrow from the company's Full Self-Driving program. Its weaknesses are equally real: Musk's own admission that Optimus uses roughly 10,000 unique components with “no existing supply chain,” a track record of missed humanoid timelines dating back to the “thousands of robots by end of 2025” prediction that did not materialize, and – as of the most recent earnings call – a Q2 free cash flow deficit of \$1.1 billion, in a period when capex more than doubled to fund Robotaxi, Optimus, and AI infrastructure simultaneously ([CNBC](#)). Tesla is, on the evidence, a company that has built impressive manufacturing infrastructure for a robot it has not yet proven it can build.

Unitree: The Volume Leader Nobody in the West Saw Coming

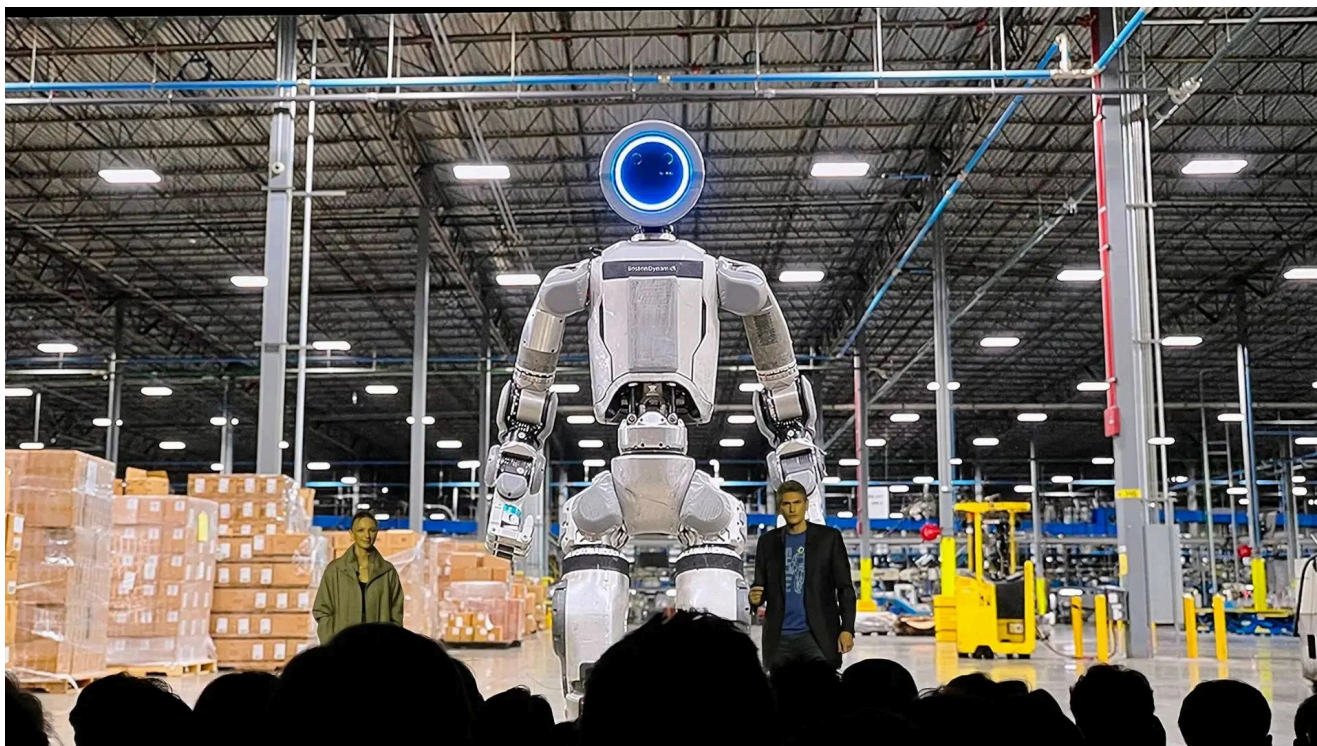
Founded in Hangzhou in 2016 by Wang Xingxing, Unitree spent its first eight years as a quadruped-robot company, entering humanoids only in the last two to three years – yet its March 2026 STAR Market IPO prospectus discloses it shipped more than 5,500 humanoid units in 2025, the highest volume of any manufacturer worldwide, on revenue that grew 335 percent year-over-year to 1.71 billion yuan (~\$235 million), with a net profit of 278 million yuan and gross margin of 60.27 percent ([TechMarketBriefs](#); [Gasgoo](#)). Unitree is, on the numbers, the only humanoid robotics company on Earth that is both large by shipment volume and reliably profitable – a combination no Western competitor has come close to. Its five-year target of 75,000 humanoids and 115,000 quadrupeds annually would represent roughly 14 times its 2025 volume ([TechFlow](#)). Its core strength is vertical integration: the company self-develops and manufactures its own actuators and reducers rather than sourcing them externally, which is the direct cause of both its falling prices (average selling price down from ~\$85,000 to ~\$25,000 in two years) and its improving margins ([Rest of World](#)). Its principal weakness, by its own disclosure, is commercial maturity: roughly 70–74 percent of 2025 humanoid sales went to universities and research buyers, and only about 9 percent into genuine industrial application – meaning Unitree's volume lead reflects dominance of the research and

education humanoid market more than the industrial labor market ([techflowpost](#)). The company also faces mounting Western scrutiny: security researchers disclosed a wormable Bluetooth vulnerability (“UniPwn”) in Unitree hardware in September 2025, and in March 2026 U.S. senators introduced the American Security Robotics Act aimed at Chinese-made robots, partly in response to reporting on Unitree’s ties to PLA-linked funding programs ([TechTimes](#)).

Figure AI: The Best-Evidenced Western Deployment, Wrapped in the Industry’s Highest Valuation

Figure AI’s \$39 billion valuation, set in its September 2025 Series C round (over \$1 billion raised at that close alone, bringing total funding to roughly \$1.9 billion), is difficult to reconcile with any conventional revenue multiple – but its underlying deployment evidence is genuinely the strongest of any Western humanoid company ([TSG Invest](#); [TechMarketBriefs](#)). The eleven-month BMW Spartanburg run is the most thoroughly measured humanoid deployment in the West by hours and units of output. Figure’s decision to exit its OpenAI partnership in February 2025 and build Helix fully in-house is a defensible long-term strategic bet – vertical integration of the AI stack mirrors what Unitree has done on the hardware side – but it also means Figure now owns 100 percent of the execution risk on both hardware and AI simultaneously. BotQ, Figure’s own manufacturing facility, had produced more than 350 Figure 03 units by April 2026, though the company has not disclosed what fraction were sold to paying customers versus retained for internal data collection and R&D ([RoboZaps](#)). Figure has also expanded beyond BMW, with a Catalyst Brands logistics agreement targeting a Reno facility announced in May 2026, and reported interest from UPS ([TSG Invest](#)). Risks include an active safety-related employment lawsuit, limited public governance disclosure since its 2024 securities filing, and a valuation built almost entirely on forward-looking narrative rather than current audited revenue.

Boston Dynamics: Deep Engineering Pedigree, Now a Captive Supplier to Its Own Parent



The production version of Atlas, redesigned for automotive-supply-chain manufacturability — Boston Dynamics' entire 2026 output is pre-committed to Hyundai and Google DeepMind. Credit: Boston Dynamics

Boston Dynamics brings the longest continuous engineering track record in legged robotics of any company in this report, dating to its hydraulic Atlas research platform. The January 2026 CES unveiling of the production, fully electric Atlas — explicitly redesigned to reduce unique part count and align with automotive supply chains — is a genuine manufacturing-maturity milestone (Automate.org). But the company's entire 2026 production output is contractually committed to just two customers: majority owner Hyundai Motor Group (for its Robotics Metaplant Application Center) and research partner Google DeepMind — meaning Boston Dynamics is not, in 2026, selling humanoids on the open market to anyone ([Boston Dynamics](#); [The Register](#)). Hyundai's planned 30,000-unit-per-year robotics factory, backed by a \$26 billion US investment commitment, is real and disclosed, but targets 2028, spans multiple Boston Dynamics platforms rather than Atlas alone, and Hyundai Mobis — not Boston Dynamics itself — will manufacture the actuators, giving Hyundai effective control of the platform's most cost-critical component ([AI2Work](#)). Notably, Boston Dynamics is partnering with Google DeepMind rather than building its own foundation model in-house, a strategic choice that trades AI independence for speed. As of July 2026, Hyundai workers had staged what is reported to be the first strike explicitly over humanoid deployment, and Hyundai was reportedly moving to buy out SoftBank's remaining stake in the company ([RoboZaps](#)) — both signs of the social and ownership friction that accompanies even a technically credible rollout.

Agility Robotics: The Quiet Operational Leader

Agility Robotics has, by a meaningful margin, the most independently corroborated record of sustained, paid, real-workflow humanoid operation of any company in this report – a claim its SPAC-merger filing (a \$2.5 billion pre-money valuation deal with Churchill Capital Corp XI, announced July 2026) is built on ([Roboticsandautomationnews](#)). Digit's GXO deployment was recognized industry-wide as the first formal commercial humanoid Robots-as-a-Service contract, and its Schaeffler deployment at Cheraw, South Carolina represents the earliest verified continuous factory-floor (not warehouse) humanoid operation in the West, independently confirmed by The Wall Street Journal. Agility's installed base remains small in absolute terms – an estimated 40 to 150 units globally – but its per-unit evidentiary quality is the highest in the Western field. Weaknesses include a payload ceiling (16 kilograms per cycle on current-generation Digit, with a next-generation unit targeting roughly 43 percent more) that limits task scope relative to competitors, and a slower funding pace than Figure or Appttronik, which the SPAC transaction is explicitly designed to address.

Appttronik: Well-Capitalized, Still Pre-Commercial

Appttronik's Apollo has attracted serious industrial partners – Mercedes-Benz, GXO Logistics, and manufacturing partner Jabil – and serious capital, with a \$520 million Series A extension in February 2026 bringing total funding to roughly \$935 million–\$1 billion at an approximately \$5–5.5 billion valuation, backed by Google, Mercedes-Benz, and, notably, John Deere and the Qatar Investment Authority ([CNBC](#); [Sacra](#)). But by the company's own account, every one of its named deployments remains a pilot or R&D program operating behind light curtains, with no customer having published performance metrics, and Appttronik itself describing Apollo 3 – not the current Apollo 2 – as its first true commercial product, targeted for 2027 ([RoboZaps](#)). Appttronik's Jabil manufacturing partnership is a credible signal that the company understands it needs contract-manufacturing scale it does not have in-house, but as of mid-2026 it has not disclosed a single unit-shipment or operating-hours figure comparable to what Figure or Agility have published.

UBTECH: China's First Public Humanoid Company, Betting on Both Factories and Living Rooms

UBTECH holds a genuine historical distinction – the first humanoid robotics company to list publicly, on the Hong Kong Stock Exchange in December 2023 – and has since raised additional capital through four further HKEX offerings totaling roughly HKD 4.5 billion (~\$570 million) ([TechBuzzChina](#)). Its Walker S2 industrial humanoid entered genuine mass production and delivery in November 2025, and by the time of this report's research, cumulative Walker S2 production had passed roughly 1,000 units, with disclosed order commitments exceeding 800 million yuan and a production-capacity target of 5,000 units in 2026 rising to 10,000 in 2027 ([PRNewswire](#); [Baidu Baike](#)). UBTECH is simultaneously pursuing a consumer companion-robot strategy through its new UWORLD U1 line, which had logged over 13,300 orders by its June 30, 2026 launch, with CEO James Zhou stating humanoid revenue is expected to exceed 80 percent of total company income in 2026 ([BigGo Finance](#)). The company remains loss-making overall – first-half 2025 revenue of 621 million

yuan against a narrowed loss of 440 million yuan ([itiger](#)) – meaning its order-book growth has not yet translated into profitability, unlike Unitree's.

AgiBot (Zhiyuan Robotics): The Volume Rival Racing Toward Its Own IPO

Appttronik's Apollo has attracted serious industrial partners – Mercedes-Benz, GXO Logistics, and manufacturing partner Jabil – and serious capital, with a \$520 million Series A extension in February 2026 bringing total funding to roughly \$935 million–\$1 billion at an approximately \$5–5.5 billion valuation, backed by Google, Mercedes-Benz, and, notably, John Deere and the Qatar Investment Authority ([CNBC](#); [Sacra](#)). But by the company's own account, every one of its named deployments remains a pilot or R&D program operating behind light curtains, with no customer having published performance metrics, and Appttronik itself describing Apollo 3 – not the current Apollo 2 – as its first true commercial product, targeted for 2027 ([RoboZaps](#)). Appttronik's Jabil manufacturing partnership is a credible signal that the company understands it needs contract-manufacturing scale it does not have in-house, but as of mid-2026 it has not disclosed a single unit-shipment or operating-hours figure comparable to what Figure or Agility have published.

UBTECH: China's First Public Humanoid Company, Betting on Both Factories and Living Rooms

Founded in Shanghai in February 2023 by Deng Taihua and Peng Zhihui, AgiBot (operating under parent entity Zhiyuan Robotics) has compressed an unusually fast funding trajectory – at least eight rounds in two years, taking its valuation from angel stage to more than \$1 billion by mid-2025 – into becoming Unitree's closest domestic rival, producing its 10,000th cumulative humanoid unit by March 30, 2026 and, per Omdia, leading 2025 shipments outright, ahead of Unitree ([TechTimes](#); [Mike Kalil](#)). Backers include Tencent, HongShan Capital (formerly Sequoia China), LG Electronics, BYD, and Hillhouse Investment, and AgiBot is now targeting a Hong Kong IPO in 2026 at a reported valuation of HK\$40–50 billion (~\$5.1–6.4 billion) ([Capital.com](#)) – though some more recent reporting suggests a considerably higher target range under discussion. AgiBot's flagship A2 humanoid has generated unusually high public visibility, including a branded partnership with Pepsi. Together, Unitree and AgiBot are projected by TrendForce to capture nearly 80 percent of all Chinese humanoid shipments in 2026 ([TechTimes](#)) – meaning the “China vs. US” framing understates how concentrated the race has already become within China itself.

1X Technologies: The First Real Consumer Humanoid, With an Honest Asterisk

1X occupies a distinct niche: it is the only company in this report with a purpose-built home humanoid, a fixed consumer price (\$20,000 outright or \$499/month), an open order flow, and an operating factory — opened in Hayward, California on May 1, 2026, with a stated design capacity of roughly 10,000 units per year against more than 10,000 pre-orders already on the books ([TravTeks](#); [RoboZaps](#)). NEO's core design — a soft-bodied, 66-pound, 22-degree-of-freedom-handed robot built around an NVIDIA Jetson Thor "Cortex" — is genuinely aimed at the consumer environment other companies only discuss ([Livium](#)). The company's own candor is worth noting: NEO's early autonomy explicitly depends on a human teleoperator remotely completing tasks the robot cannot yet do itself, a model 1X has compared publicly to how Waymo and Cruise began autonomous-vehicle deployment with remote human backup ([TravTeks](#)). As of mid-July 2026, no customer delivery had been independently verified, despite the company's own May 2026 statement that shipments were beginning.

9. Comparison Tables

Market Forecast Comparison

Firm	Base year est.	Target year	Forecast	Implied CAGR	What it counts	Source
Goldman Sachs Research	\$6B (2035, prior est.)	2035	\$38B (base), \$154B (blue-sky)	~70% (unit shipment growth)	Hardware TAM; 1.4M units/yr by 2035	Goldman Sachs
Morgan Stanley	-	2050	\$5 trillion	Multi-decade	Hardware + supply chain + services ecosystem; 13M units by 2035, 1B by 2050	Morgan Stanley
Citigroup	-	2050	\$7 trillion	Multi-decade	Broad ecosystem incl. services	MLQ.ai
Marketsand-Markets	\$2.92B	2030	\$15.26B	39.2%	Hardware market	Marketsand Markets
BofA Global Research	~\$4-6B (2026)	2028	\$13.8B (cited via Marketsand-Markets figure)	~50%+	Hardware, near-term	Standard Bots
Compiled range (8 firms)	-	2035	\$9B–\$251B	17.5%–69.7%	Varies by inclusion criteria	Robots in Life

Methodology note: Forecasts diverge primarily on three variables – (1) whether software/services/RaaS revenue is included alongside hardware, (2) whether the model assumes consumer/elder-care adoption in the 2030s (which the bull cases require and which has zero commercial precedent as of 2026), and (3) unit price trajectory assumptions, which range from today's \$30,000–\$150,000 BOM-driven pricing down to a \$10,000–\$20,000 long-run target.

Company Comparison (Tier One)

Company	Country	Cumulative units shipped (best estimate)	2026 production rate/capacity	Flagship model	Payload	Price	Key customers	Funding/valuation	Commercial maturity
Unitree	China	~11,000 cumulative; 5,500+ in 2025	Targeting 75,000/yr within 5 yrs	H1 / H2 / G1	Model-dependent	\$13.5K–\$90K (listed)	Universities (majority); BYD, Geely (reported)	~\$5.9B implied IPO valuation	Highest volume; mostly research/EDU sales
AgiBot	China	10,000 cumulative (as of Mar 2026)	Rapid scale-up; IPO-track	A2, Lingxi X2	Model-dependent	Not fully public	Pepsi (brand), various pilots	~\$1B+ private; IPO target \$5.1-6.4B+	High volume, early commercial
UBTECH	China (HKEX-listed)	~1,000 Walker S2 by Dec 2025	5,000/yr (2026) → 10,000/yr (2027)	Walker S2	Not fully disclosed	N/A (contract-based)	Multiple automakers (undisclosed)	Publicly listed, ~HK\$48.8B market cap	Mass production started Nov 2025; loss-making
Tesla	US	~0 verified from new line; “few hundred” prior-gen (unverified, third-party)	Design capacity 1M/yr (Fremont), not yet realized	Optimus V3	Not disclosed	No price; \$20-30K aspirational	Internal only	N/A (part of TSLA)	Internal training only; no shipments
Figure AI	US	~350+ built at BotQ (customer split undisclosed)	Targeting 12,000/yr capacity	Figure 03	Not fully disclosed	No public price	BMW, reportedly UPS, Catalyst Brands	\$39B (Sept 2025)	Most-measured Western industrial deployment
Boston Dynamics	US (Hyundai-owned)	Production just begun 2026	2026 output pre-committed; 30,000/yr factory target	Atlas (electric)	Not disclosed	No price (not for sale)	Hyundai, Google DeepMind	Part of Hyundai Motor Group	Pre-commercial; captive customer base
Agility Robotics	US	~40-150 units in field (best est. ~75)	Not disclosed	Digit	16 kg (next-gen ~50 lb target)	Not public (RaaS)	GXO, Schaeffler, Toyota (Canada), Mercado Libre	\$2.5B pre-money (SPAC, 2026)	Most independently verified operating hours in the West
Apptronik	US	Not disclosed	Not disclosed	Apollo 2	55 lb (25 kg)	No public price	Mercedes-Benz, GXO, Jabil	~\$5-5.5B (Feb 2026)	Pilot/R&D stage only
IX Technologies	US/Norway	Factory opened May 2026; deliveries unverified	~10,000/yr design capacity	NEO	Not primary spec	\$20,000 or \$499/mo	Consumer pre-order (10,000+)	Not fully disclosed	First open consumer order flow; teleop-assisted

Technology Comparison

Domain	Leading approach	Notable players	Source
Actuators	In-house vertical integration (lowest cost) vs. external sourcing	Unitree (in-house), Hyundai Mobis (for Atlas)	Rest of World; AI2Work
Reducers	Harmonic (compliant, expensive) + planetary (stiff, load-bearing) mix	Harmonic Drive Systems, Nabtesco (Japan, ~80-85% harmonic share); Leaderdrive (China, ~10% and rising)	Jamestown; Tianxia Gongchang
AI/Foundation model	Vertically integrated in-house VLA vs. open platform vs. partner model	Figure (Helix, in-house); NVIDIA (Isaac GR00T, open); Boston Dynamics (Google DeepMind Gemini Robotics, partnered)	TechMarketBriefs; NVIDIA
Compute	Dedicated humanoid SoC	NVIDIA Jetson Thor (800 TFLOPS FP8 / 2,070 TFLOPS FP4 variants)	NVIDIA Newsroom; qz.com
Battery	Swappable packs vs. fixed internal pack	Apptronik (swappable, 4hr packs); UBTECH Walker S2 (hot-swap); IX NEO (fixed 0.75kWh, ~4hr)	TSG Invest; Notebookcheck

Supply Chain Comparison

Layer	Country of leadership	Key suppliers	Est. share of BOM
Actuators/motors	China (assembly & scale), Japan/Germany (precision)	Various; Sanhua Controls (rumored Tesla supplier)	40-60% (Rockingrobots)
Harmonic/strain-wave reducers	Japan (dominant), China (rising)	Harmonic Drive Systems, Nabtesco, Leaderdrive, Suzhou Green Harmonic	Embedded in actuator cost above
Batteries	China (dominant)	CATL, BYD, LG Energy Solution, Panasonic, Samsung SDI	15-20% (Robotomated)
AI compute/chips	US (design), Taiwan (fabrication)	NVIDIA, TSMC	10-15%
Rare-earth magnets	China (dominant, ~69% mining / ~90% processing)	Various Chinese processors	Embedded in actuator cost
Final assembly	China (dominant), US (emerging)	Foxconn, Luxshare; Tesla (Fremont, in-house)	N/A

10. Charts

Global humanoid robot market forecasts, 2025-2035

Chart 1 – Global market forecasts, showing the wide disclosed range between conservative hardware-only forecasts and Goldman Sachs’ “blue-sky” scenario. Methodology: values plotted at each firm’s own disclosed anchor years and interpolated linearly between them; shaded band spans the full disclosed range. Sources: [Goldman Sachs](#), [MarketsandMarkets](#).

Estimated cumulative units shipped or produced by company

Chart 2 – Cumulative humanoid units shipped or produced, by company, as of mid-2026. Note the roughly two-order-of-magnitude gap between the two Chinese volume leaders and every Western competitor, and that Tesla and Boston Dynamics both show zero verified units because neither has disclosed an independently confirmed production count as of this report’s research date. Sources as cited in Sections 2 and 8.

Estimated humanoid robot bill of materials composition

Chart 3 – Estimated BOM composition, 2025 vs. a 2030 projection. Actuators and reducers remain the largest cost category throughout the forecast period even as absolute BOM cost roughly halves. Sources: [McKinsey](#), [Bank of America Global Research](#), [Bain & Company via Airobot Seidos](#).

Capability vs production maturity quadrant

Chart 4 – A qualitative synthesis plotting demonstrated technical capability against production/deployment maturity. No company currently occupies the “high capability, high volume” quadrant – which is, in a single image, the central finding of this report. Author’s synthesis; see Methodology.

11. Technical Sidebars

How harmonic drives work. A harmonic (strain-wave) drive uses a flexible, slightly elliptical “flexspline” that meshes with a rigid, internally toothed “circular spline” as a rotating wave generator flexes it. Because the flexspline has slightly fewer teeth than the circular spline, one full rotation of the wave generator produces a tiny relative rotation between the two splines – giving very high reduction ratios (often 50:1 to 160:1) in a compact, low-backlash package, which is exactly the compliance and precision profile a robot’s lower-body joints need for natural, backdrivable walking.

Whole-body control. Rather than controlling each limb independently, modern humanoid controllers solve for coordinated torques across the entire kinematic chain simultaneously – balancing center-of-mass dynamics, contact forces at the feet, and manipulation forces at the hands in one optimization problem, typically running as a model-predictive or quadratic-programming controller at 100Hz–1kHz. Figure’s Helix and NVIDIA’s GR00T N models both increasingly fold this whole-body coordination into the learned policy itself rather than a separately hand-engineered layer.

Sim-to-real transfer. Because collecting real-world robot interaction data is slow and physically risky, most foundation-model training now happens substantially in simulation (NVIDIA’s Isaac Sim/Isaac Lab, or equivalent internal tools), with domain randomization and increasingly generative “world models” (NVIDIA’s Cosmos Transfer/Predict) used to close the gap between simulated and real-world sensor statistics and dynamics before a policy is deployed on physical hardware.

Teleoperation pipelines. Most current-generation humanoids – including 1X’s NEO and every company’s public demo reels – rely on some blend of autonomous policy execution and remote human teleoperation, either to complete tasks the autonomous stack cannot yet handle, or to generate the labeled demonstration data used to train the next version of that stack. This is not a temporary embarrassment; it is the industry’s actual data flywheel in 2026, and any company’s public claims of “autonomy” should be read against how much of that autonomy is teleoperation-assisted.

ISO 10218 and ISO/TS 15066. ISO 10218 is the base industrial-robot safety standard (design, risk assessment, integration requirements), while ISO/TS 15066 provides the technical specification for collaborative robot operation – the biomechanical force and pressure limits that govern how close, and how forcefully, a robot may safely operate near an unprotected human. Every industrial humanoid pilot referenced in this report (BMW/Figure, Mercedes/Appttronik, GXO/Agility) currently operates with supplementary engineering controls – light curtains, defined exclusion zones, reduced-speed zones – precisely because full ISO/TS 15066-compliant collaborative operation at humanoid scale and payload remains an unresolved certification challenge industry-wide, not a solved one.

12. Case Studies: Distinguishing the Announcement from the Deployment

Case	Status	Evidence
BMW + Figure AI	Completed paid production pilot (Nov. 2025), now evaluating Figure 03 expansion	90,000+ parts, 1,250+ hours, 30,000+ vehicles, 11-month run, independently reported (Sacra)
Tesla internal factory deployment	Training/data-collection only, by Tesla's own characterization	Musk: units used "primarily for learning, not productive tasks" (TechTimes)
UBTECH manufacturing (Walker S2)	Paid production deployment, order-book confirmed	800M+ yuan in disclosed orders; 1,000+ units produced; mass delivery started Nov. 2025 (PRNewswire)
Unitree commercial customers	Mixed — mostly research/EDU (70-74%), minority (~9%) genuine industrial	Company's own IPO prospectus disclosure (techflowpost)
Amazon robotics strategy (Digit)	Pilot, ongoing since Oct. 2023, no disclosed scaled commercial deployment	EmbodimentVC
Foxconn automation	Contract manufacturer for humanoid component and device assembly (electronics), not itself a deployer of humanoids at scale in this dataset	Industry-wide contract manufacturing role, referenced throughout supply-chain sourcing
Mercedes-Benz + Apptronik	Pilot, light-curtain bounded, no published performance metrics	RoboZaps
Hyundai + Boston Dynamics	Announced partnership transitioning to initial deployment; factory-floor scale targeted 2028	Boston Dynamics ; Medium/Ikechukwu
NVIDIA Isaac ecosystem	Enabling platform, not itself a deployer; adopted across both US and Chinese hardware (Unitree chassis for its own reference design)	NVIDIA Newsroom

13. Future Outlook

Near-term (2026–2028). Expect continued narrow-task industrial deployment growth from the companies already demonstrating it – Figure, Agility, UBTECH, and Chinese automakers integrating Unitree/AgiBot hardware – measured in low hundreds to low thousands of units per company, not tens of thousands. Tesla’s Fremont line either produces its first verified units in this window or the company’s credibility on humanoid timelines takes a further hit; Boston Dynamics’ Hyundai deployment begins in earnest but stays inside Hyundai’s own facilities. 1X’s NEO is the best-positioned candidate for the first real (if teleoperation-assisted) consumer humanoid shipments at scale. Warehouse and logistics adoption (GXO, Amazon, Mercado Libre) continues to lead factory-floor adoption because the task structure (tote and material transport) is more tractable than general assembly work.

Medium-term (2028–2031). This is the window in which Hyundai’s 30,000-unit factory and Unitree’s 75,000-unit five-year target are both due to mature – if either comes close to its stated target, the industry crosses from “early production” into genuine mass manufacturing for the first time. Construction and defense applications remain speculative; neither has a documented commercial pilot in this report’s evidence base. Elder-care and healthcare deployment, if it appears at all in this window, is likely to be pilot-scale only, gated by regulatory certification (medical-device-adjacent standards, not just ISO/TS 15066) that no company has yet navigated for a humanoid platform.

Long-term (2031–2035). This is the window Goldman Sachs’ base case and Morgan Stanley’s early-adoption curve both target for meaningful consumer and elder-care volume. It is also the window in which the current cost curve (BOM cost potentially below \$20,000 per the Bain and BofA estimates) would need to be realized for the bull-case unit-shipment forecasts to be economically plausible. Nothing in the evidence gathered for this report either confirms or forecloses that outcome; it remains, honestly, the most uncertain window in the entire forecast horizon.

14. Methodology

This report was compiled through targeted research across primary sources — company press releases, SEC/HKEX/STAR Market filings and prospectuses, earnings-call transcripts, and official product documentation — supplemented by reputable financial and trade press reporting (CNBC, Reuters-sourced coverage, Rest of World, SCMP, TechCrunch) and specialist industry-tracking outlets (RoboZaps, Sacra, EmbodyVC, New Market Pitch) whose figures were, wherever possible, cross-checked against a company's own disclosures. Market-research-firm forecasts (Goldman Sachs, Morgan Stanley, Citigroup, MarketsandMarkets, McKinsey, Bain, Bank of America) were used strictly for forecast comparison and cost-structure analysis, not treated as authoritative production figures — actual shipment and deployment figures were sourced from company disclosures and independent operational verification (e.g., The Wall Street Journal's confirmation of the Schaeffler-Digit deployment) wherever available.

Confidence scoring, used throughout Sections 2 and 8, follows three tiers: High — figure appears in an audited regulatory filing (e.g., Unitree's STAR Market prospectus) or is independently corroborated by a named third party; Medium — figure is company-disclosed but not independently audited or corroborated; Low — figure is estimated by a third-party tracker without company confirmation, or a company has declined to disclose a directly comparable number.

Shipment estimation methodology. Where a precise company figure was unavailable, this report used the tightest publicly available range from independent trackers (e.g., Agility Robotics' estimated 40–150 installed Digit units) rather than constructing an original bottom-up estimate, and flagged the estimate's confidence accordingly.

Limitations. This report reflects publicly available information as of late July 2026. Several companies (Tesla, Boston Dynamics, Apptроник) have disclosed production capacity targets without disclosing actual output, which this report treats as a structural transparency gap rather than filling with modeled estimates. Chinese company disclosures (Unitree, UBTECH) benefit from the unusually rich transparency requirement of a public listing process; equivalent private US competitors (Figure, Apptроник) are under no comparable disclosure obligation, which likely understates the completeness of the Western evidence base relative to the Chinese one, independent of the underlying operational reality. The market-size reconciliation in Section 1 is this report's own synthesis of disclosed third-party forecasts, not an independently constructed bottom-up model, and should be read as an informed range rather than a forecast in its own right.

Epilogue

The humanoid robotics race will not be won by the company with the boldest vision or the highest valuation, but by the one that consistently transforms ambitious prototypes into economically viable, manufacturable, and widely deployed machines. Judged against that standard in mid-2026: Unitree and AgiBot are winning the volume race, decisively, but against a customer base that is still mostly research institutions rather than industrial buyers. Figure AI and Agility Robotics are winning the evidentiary-quality race in the West, with real, measured, sustained production work — at a scale that remains, by any honest reading, tiny. Tesla is winning the attention race by a wide margin, and as of this report's research date has yet to convert that attention into a single verified shipped unit from its new production line. Boston Dynamics has the deepest engineering pedigree in the field and the least commercial freedom, having sold its entire near-term output to its own parent company. And NVIDIA, without building a single humanoid of its own, may end up the most consequential company in this industry regardless of who wins the hardware race — because Jetson Thor and Isaac GR00T are becoming the common substrate that Chinese and Western humanoids alike are increasingly built on top of.

None of that is the story investors were told in 2024. It is, on the evidence gathered here, closer to the truth in 2026.

This report was compiled in July 2026 from publicly available sources. Given the pace of disclosure in this sector — several of the production and shipment figures cited here changed materially within the research window itself — readers evaluating time-sensitive investment or engineering decisions should verify current figures directly against the linked primary sources rather than treating any number in this report as static.