The DISRUPT Framework

Artificial Intelligence and Humanoid Robots

GLOBAL X
by Mirae Asset

The DISRUPT Framework: Artificial Intelligence and Humanoid Robots

In the rapidly evolving world of artificial intelligence (AI), staying ahead of the curve is crucial. For investors, it is not just about recognising the next trend but about pinpointing where within a theme or industry to allocate resources - whether upstream or downstream, small-cap disruptors or established players, or emerging markets versus mature leaders. The challenge lies in cutting through the noise to distinguish transformative developments from those that may be overhyped. That is why we developed The DISRUPT Framework - a systematic tool designed to evaluate and track the progress of AI and other groundbreaking technologies. By providing a structured, data-driven approach, the framework helps investors identify not only viable themes but also the specific opportunities within those themes that align with long-term, sustainable growth.

Expected Outcome

The DISRUPT Framework evaluates seven key criteria: disruption, innovation, scalability, resilience, uptake, potential, and transformation. Together, these elements combine to create a detailed picture of a specific innovation, offering insights into its lifecycle stage, market dynamics, and optimal investment opportunities. A five-level rating system is applied to assess the maturity of these technologies, ranging from early-stage development (Nascent) to full-scale implementation and maximum impact (Fully Realised). This approach ensures that every innovation is rigorously analysed, helping investors make informed decisions that balance potential risks with opportunities for meaningful returns.

	Component	Objective	Guidelines
D	**D**isruption	Identify and analyse technologies causing major disruptions in various industries.	• Identify Technologies • Assess Impact • Market Dynamics
I	**I**nnovation	Track cutting-edge innovations driving change and breakthroughs.	• Research and Development • Technological Breakthroughs • Recognition and Impact
S	**S**calability	Assess the scalability and growth potential of disruptive technologies.	• Market Size • Barriers to Entry • Adoption Catalysts
R	**R**esilience	Evaluate how technologies contribute to business resilience and adaptability.	• Risk Management • Sustainability • Business Continuity
U	**U**ptake	Monitor the market uptake and adoption rates of disruptive technologies.	• Adoption Curves • User Engagement • Market Penetration
P	**P**otential	Assess the future potential and impact of disruptive technologies.	• Strategic Partnerships • Long-term Forecasts • Investment Opportunities
T	**T**ransformation	Analyse how disruptive technologies are transforming industries and societies.	• Competitor Analysis • Economic Impact • Societal Change

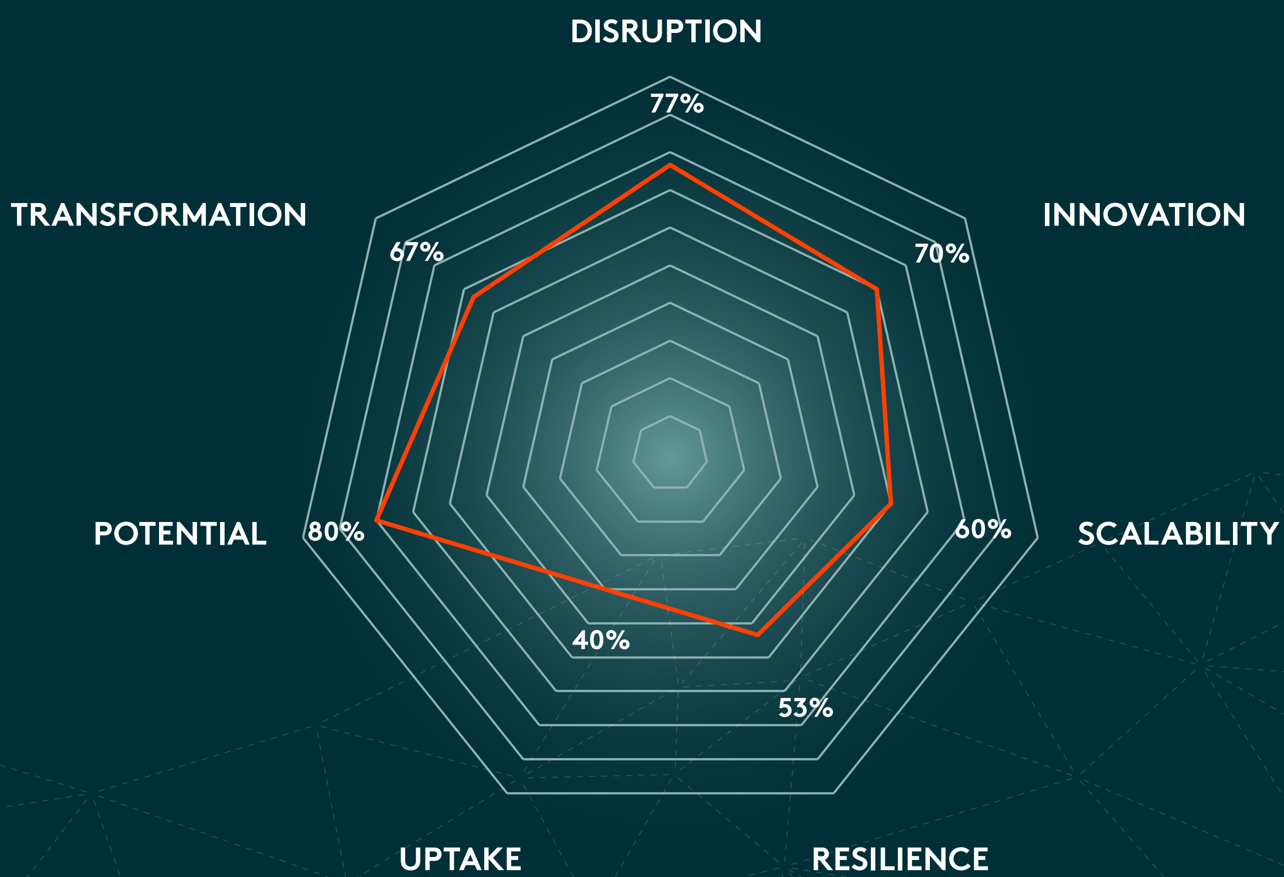
Rating	Description
Nascent	Early stages of development with limited real-world application.
Developing	Progressing, but significant advancements needed before becoming mainstream.
Established	Proven and widely used, though room for further growth and improvements remains.
Advanced	Highly developed, with few obstacles, close to full-scale implementation and monetisation.
Fully Realised	Fully adopted and delivering maximum impact across industries.

We believe humanoid robotics is reaching an inflection point, with advances in AI, actuator design, and embedded compute enabling robots to operate in real-world settings, from logistics centres to aged care.

Our DISRUPT framework analysis shows that disruption and innovation are clearly advanced, and the technology itself is no longer the bottleneck. Strategic partnerships, internal deployments, and venture capital flows particularly across the US and China point to a growing base of enterprise demand and production intent. In China, companies like Fourier and UBTech are beginning to scale. In the US, Tesla, Figure, and Apptronik are entering trials with corporate partners. Cost targets of US$20–30k per unit[1] suggest humanoids are beginning to approach commercial thresholds.

That shift is beginning to open up equity-level opportunities. While most of the direct exposure remains in private markets, listed investors can now position around the midstream of the value chain such as semiconductors, actuators, control systems, and foundational AI infrastructure. These are the components expected to scale first and potentially benefit regardless of which humanoid platform wins.

The theme is becoming investable, not yet through pure-play exposure, but through the enabling layer that is already in market and increasingly linked to real deployment.



Disruption: Humanoids Are Not Just Robots. They're a New Platform

Traditional industrial robots have been highly effective in repetitive, structured environments. They are used extensively across manufacturing, but each machine is purpose-built and often fixed in function. Adjusting them for new tasks typically requires hardware changes and infrastructure redesign, which limits flexibility and scale.

Humanoids break from this model by introducing a general-purpose design that can move through and interact with the same environments as humans. The shape is not cosmetic but allows the robot to use existing tools, navigate stairs and doorways, and integrate into workflows without the need to retrofit the environment.[2]

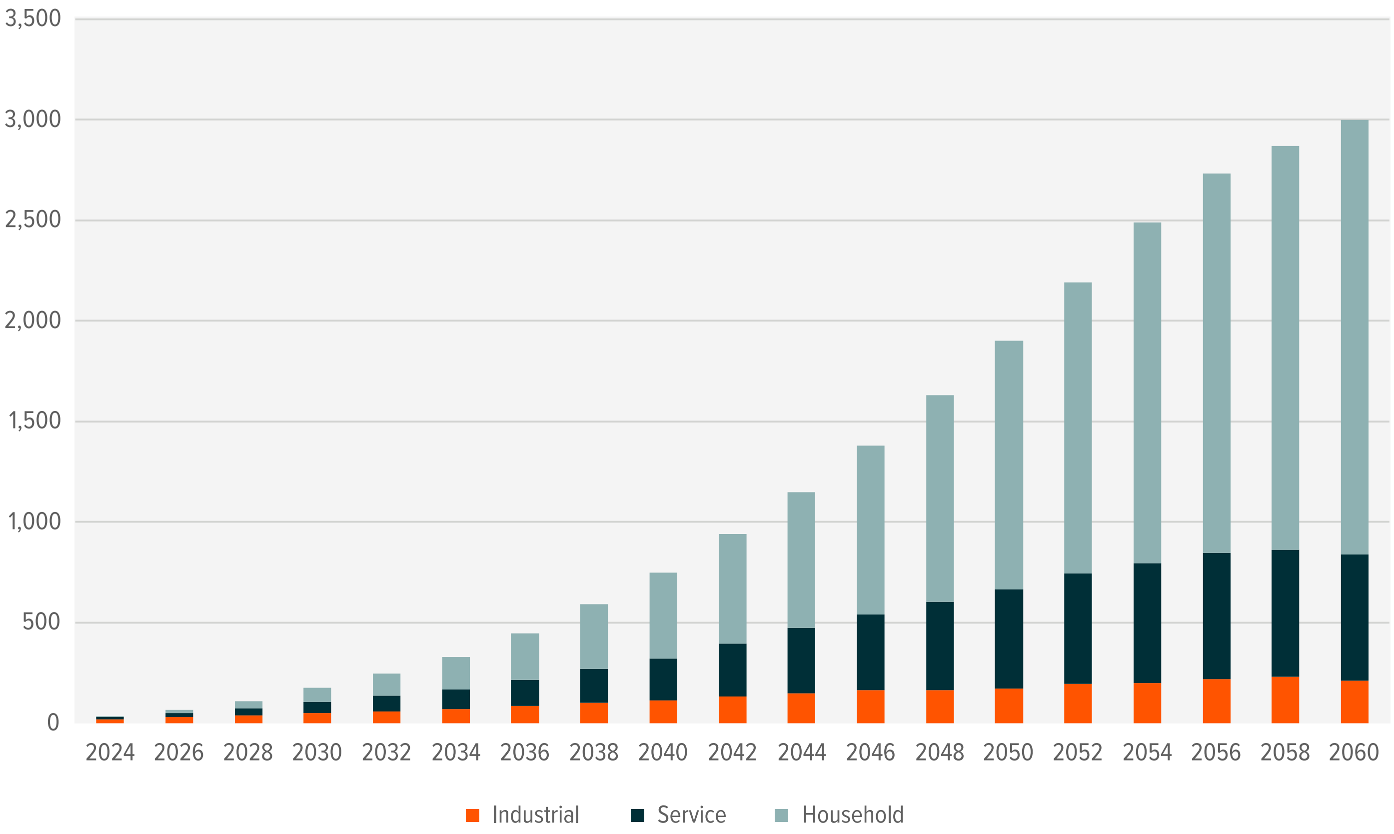
What makes this disruptive is the shift from task-specific automation to a universal interface for physical AI. A humanoid robot can be trained once and adapted to many different roles, reducing the need for bespoke design. This opens the door to scalable deployment across sectors, much like the way smartphones became a platform for diverse applications.

Tesla's plan to mass-produce Optimus units for use across logistics, factories, and homes is built around this principle. Figure, Fourier, and others are following a similar playbook. These are not static machines, but software-defined systems that can evolve through model training and real-world feedback.

The humanoid model displaces the traditional robotics cycle, reframes the automation roadmap, and opens new markets that were previously unreachable. It marks a departure from fixed-function robotics toward an AI-native, general-purpose platform suggesting this is not simply a new product, but a new era for physical automation.

TOTAL UNITS IN OWNERSHIP (MILLION UNITS) COULD REACH 3 BILLION BY 2060

Source: Bofa Global Research.



Innovation: From Mechatronics to Models – The Real Breakthrough Is in AI

The basic form of a humanoid robot is not new. Motors, sensors, joints and actuators have existed for decades. What's changed radically is the intelligence layer that drives them.

Recent advances in AI are allowing humanoids to move beyond scripted behaviours. Instead of executing fixed code, these systems are beginning to interpret, adapt, and make decisions in real time. OpenAI and Figure are working together on a multimodal foundation model that integrates language, vision, and control. The goal is not just object recognition or pathfinding, but the ability to reason through tasks and act autonomously in unstructured settings.

Tesla is applying a similar model to Optimus, using imitation learning from factory footage to train robots on practical workflows.[3] The architecture is tightly integrated with Tesla's own AI stack and compute infrastructure, enabling closed loop learning and deployment without external labelling or pre-programming.

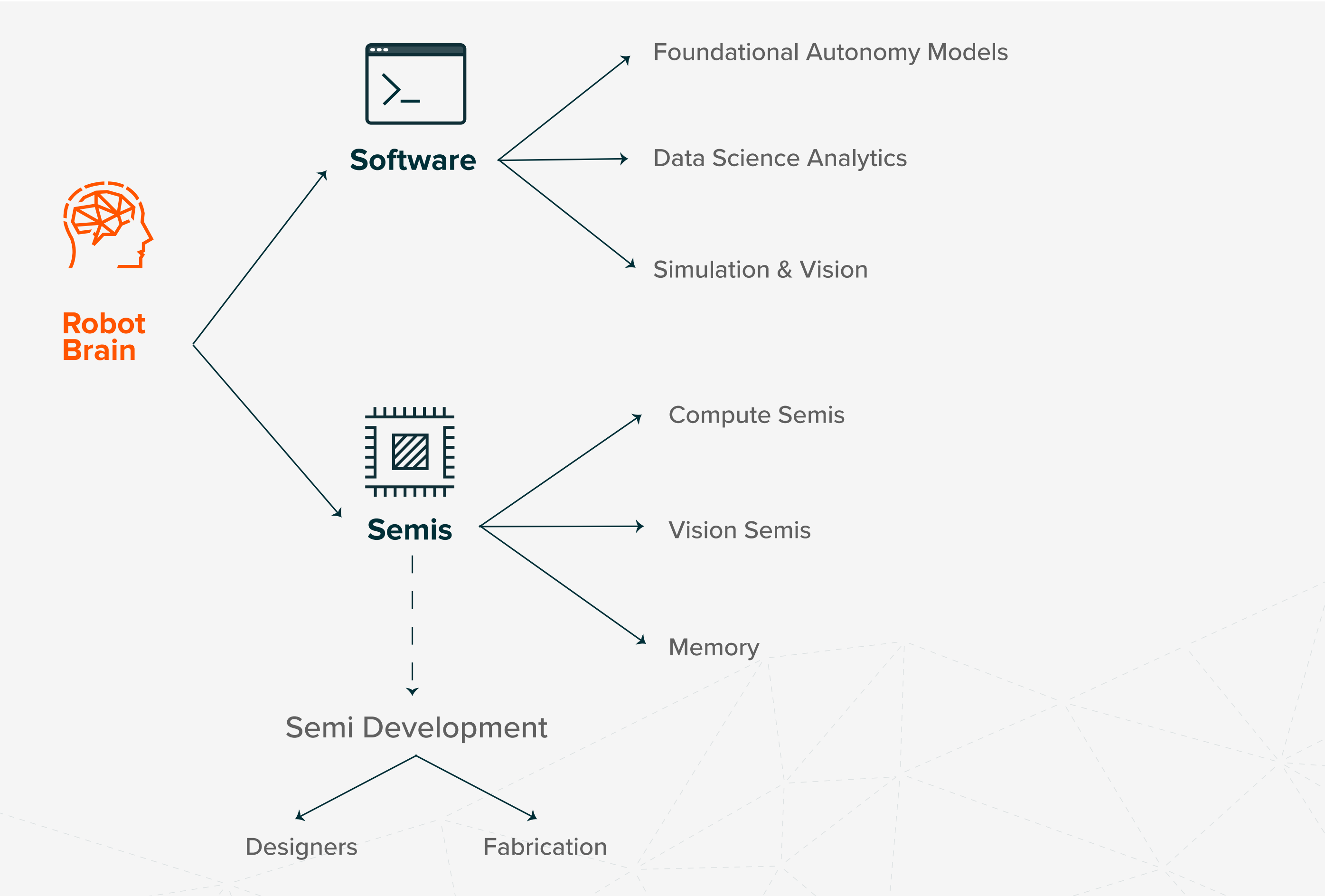
Fourier is taking a generalist approach, combining reinforcement learning and cloud-based simulation to accelerate robotic skill acquisition. Rather than relying on thousands of hours of hand-coded data, their system learns through trial, error, and feedback, compressing the training cycle and improving generalisation across tasks.

What emerges is a new kind of software-defined machine, one that does not require hardware redesign for each new use case. Intelligence is modular and upgradable, which allows continuous improvement after deployment.

Innovation here is not about adding features. The leap in learning, generalisation, and decision-making capacity suggests that humanoids are becoming more than mechanical tools but are starting to act as agents within physical space.

BREAKING DOWN THE AI BRAIN

Source: Morgan Stanley Research.



Scalability: From Factory Showpiece to Mass-Market Platform

Most robots today are built in low volumes, customised for narrow tasks and produced at high cost. The humanoid category has inherited that legacy with prototypes built in labs with bespoke components and run under tightly controlled conditions. The key question now is whether this form factor can scale beyond pilots into meaningful deployment.

Tesla's approach with Optimus suggests it can. The company is embedding humanoid development into its existing manufacturing, using the same supply chain and AI systems as its vehicle business. Tesla recently noted Optimus is performing tasks autonomously at its Fremont plant, with plans for broader internal use by end-2025.[4]

Others are focused on cost. Figure has raised over US$675 million from Microsoft, OpenAI, and Nvidia to push unit costs below a typical worker's salary.[5] Their efforts centre on simplifying actuators, reducing sensors, and building for multi-role reuse.

Fourier is using standardised joints and a modular design to ease manufacturing. It's already producing hundreds of units annually, with ambitions for 10,000-plus.[6]

The similarity between these companies is that humanoids cannot follow the old robotics model. The shift is toward standardised platforms, flexible AI, and integrated production cycles modelled on automotive or electronics supply chains.

LEADING COMPANIES ARE RAMPING UP PRODUCTION OF HUMANOID ROBOTS

Source: JP Morgan Chase, Company reports, Bain Macro Trends Group Analysis.

Company	Headquarters	Planned Unit Production
Tesla	US	10,000 by 2025; 50,000 - 100,000 by 2026; >500,000 by 2027
Figure	US	12,000 by 2025; 10,000 over four years
Agility Robotics	US	10,000 annual capacity
Galbot	China	10,000 by 2028
BYD	China	200,000 deployed in factories by 2026
AgiBot	China	5,000 by 2025
UBTech	China	10,000 by 2027

Resilience: A Gap Between Pace and Policy

The development of humanoid robots is moving faster than the frameworks built to govern them. Most jurisdictions lack any comprehensive regulatory regime specifically for autonomous physical agents. Instead, humanoids are being deployed into environments regulated under legacy industrial, consumer, or workplace laws - none designed for machines that operate semi-independently in human spaces.

There are early signs of movement. China is rolling out sandbox-style guidelines for intelligent robotics, with cities like Shenzhen introducing pilot schemes in logistics, hospitality, and public services. These focus less on restrictions and more on shaping standards like interoperability, data security, and operational transparency. Still, most remain provisional and voluntary.

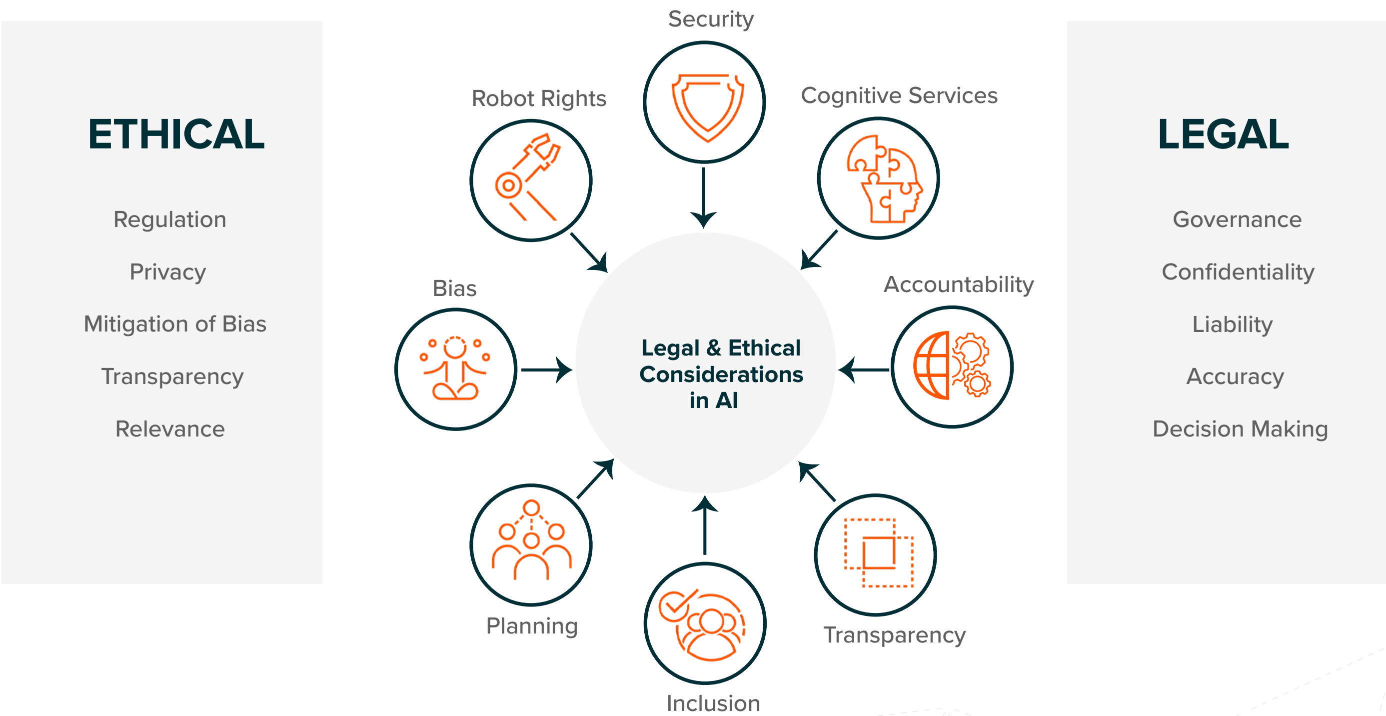
In the US, labour and liability questions loom large. If a humanoid replaces a worker, does it trigger employment protections? If it causes harm, who is responsible, the manufacturer, the software firm, or the operator? These questions are growing more urgent as humanoids move into warehouses and public-facing roles.

Rather than imposing new laws, regulators appear to be waiting for scale. Most are taking a wait-and-see approach while deployment remains limited. In the meantime, companies are moving ahead, guided more by internal compliance and risk teams than formal statute. Safety protocols and override systems are largely self-managed.

This creates both opportunity and risk. It allows fast experimentation but leaves legal and ethical questions open. For now, regulation is not a barrier to early deployment but its absence could quickly become one as the category grows.

BALANCING LEGAL AND ETHICAL CHALLENGES IN AI

Source: Frontiersin.org.



https://www.frontiersin.org/journals/surgery/articles/10.3389/fsurg.2022.862322/full

Uptake: From Novelty to Utility

Humanoids are no longer just research projects or stage demos. Real-world deployments, though early, are beginning to clarify where these systems can add value, how they operate in uncontrolled environments, and what gaps still remain.

Factories have emerged as a proving ground.[7] Fourier Intelligence's GR-1 is already operating in logistics centres, performing pick-and-place tasks and basic handling work. Tesla has trialled Optimus within its Fremont facility for materials transport and part assembly, while UBTech robots are being tested for repetitive inspection and sorting.

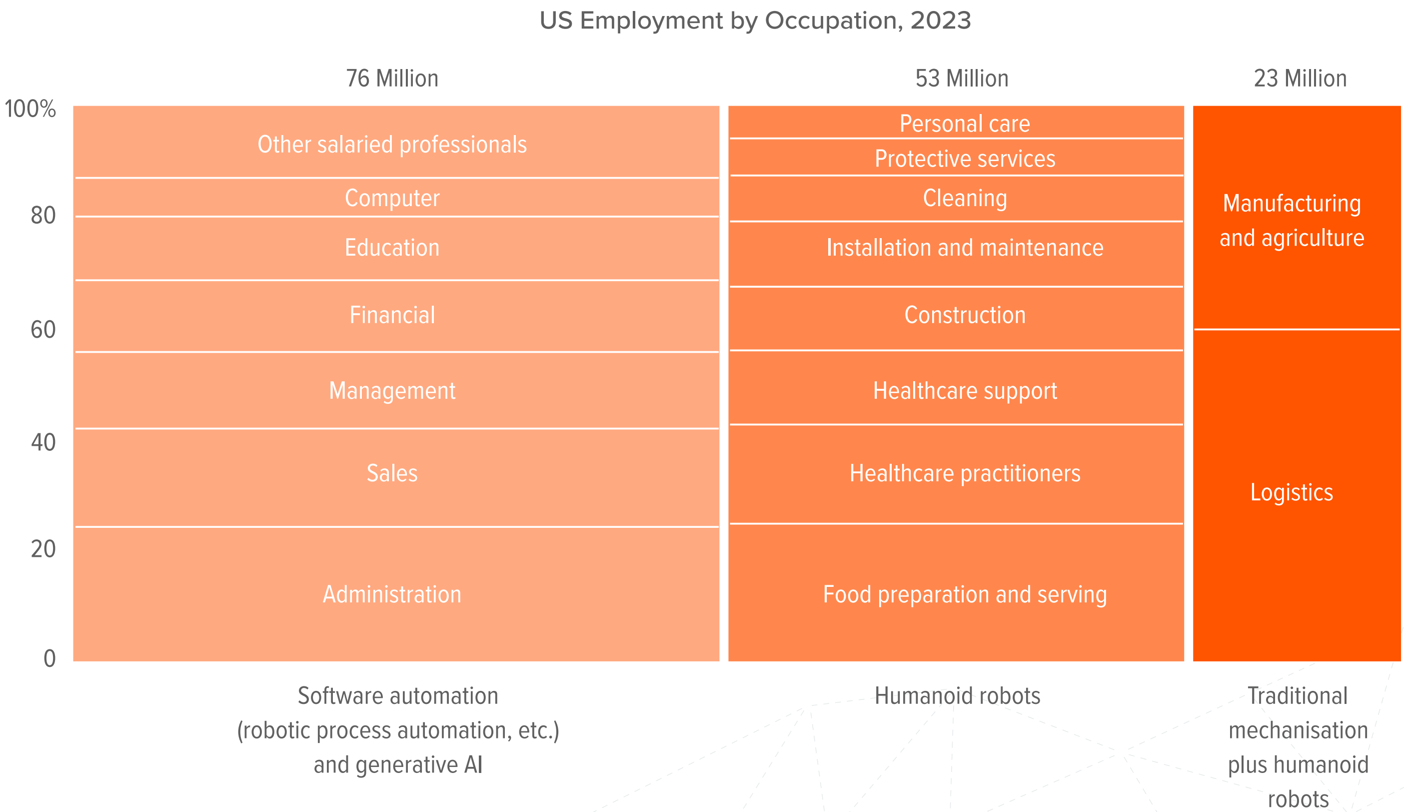
Retail and hospitality settings are also in play. UBTech and Xiaomi have introduced humanoids in concierge and service roles in China, with scripted interactions and integrated voice interfaces. These robots are being used in malls and corporate buildings, primarily as greeters or navigators.

Domestic applications remain further out, but progress is visible. Optimus has been shown folding laundry and picking up household objects[8], while Fourier's roadmap explicitly targets home assistance in later stages. The challenge here is less about hardware, and more about reliable perception, fine-motor dexterity, and environmental understanding.

What's clear is that humanoids are gaining traction in places where wheeled or fixed robots fall short, tight corridors, human-centric layouts, and varied manual tasks. Their general-purpose format allows one unit to be trained and deployed across different roles without redesign.

MANY OCCUPATIONS NOT WELL-SUITED TO SOFTWARE OR GENERATIVE AI COULD BE COMPLETED BY HUMANOID ROBOTS

Source: US Bureau of Labor Statistics Occupational Employment and Wage Statistics survey, May 2023.



Note: The US Bureau of Labor Statistics Occupational Employment and Wage Statistics survey excludes private households and some agricultural workers.

https://www.bain.com/insights/humanoid-robots-at-work-what-executives-need-to-know/

Potential: A Market With Intent, Not Yet Scale

No company is making money from humanoids today but that hasn't stopped enterprise customers from exploring. What's emerging is a pre-commercial phase marked by significant inbound interest, early orders, and a willingness to test.

Figure has signed agreements with BMW and other auto OEMs "Original Equipment Manufacturers" to pilot humanoids on factory floors.[9] Apptronik's Apollo robot is being trialled by logistics firms like GXO and Johnson Controls for warehouse tasks.[10] Tesla has received inbound interest from over a dozen corporates following internal demos of Optimus.

Pricing is still opaque, but targets are converging. Most players are aiming for a cost-to-deploy roughly US$20,000–30,000 per unit[11], assuming scale and hardware maturity. That figure is competitive with full-time labour in many industrial settings, particularly for three-shift operations.

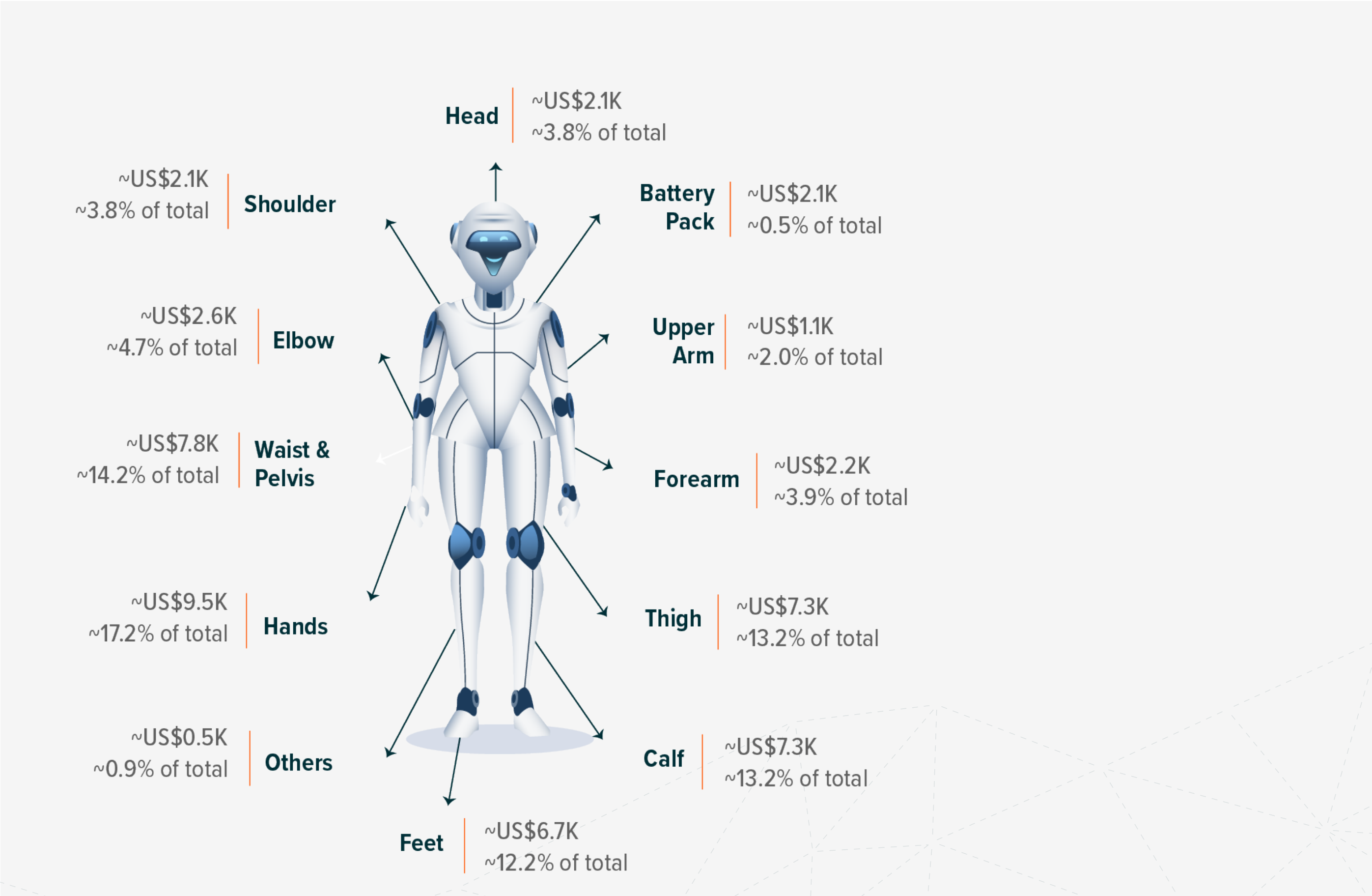
Recurring software and maintenance models are likely to dominate the monetisation structure. Companies expect to layer annual service plans or task-specific subscriptions on top of upfront sales, making humanoids more of a platform than a product. That aligns with the way AI models are now monetised across cloud.

There is also a willingness among enterprise clients to experiment. Unlike consumer markets, which are price-sensitive and brand-driven, industrial buyers are looking for reliability, support, and integration.

In short, profitability isn't here yet. But the building blocks are falling into place. There is enough customer demand, commercial traction, and business model thinking to suggest that monetisation is a 'when,' not an 'if.'

HUMANOID ROBOT COST BY COMPONENT

Source: Goldman Sachs Research, Morgan Stanley Research.



https://www.forbes.com/sites/johnkoetsier/2025/01/25/humanoid-robots-here-are-the-16-leading-manufacturers/

Transformation: The Hardware Finally Catches Up

Until recently, the ambition to build humanoid robots outpaced the tools available to make them. Motors lacked nuance, sensors struggled with variability, and the onboard compute wasn't fast or efficient enough to support complex, real-time movement.

A new generation of actuators is enabling smoother, more humanlike motion. Chinese manufacturers, in particular, have made progress with lightweight, high-torque actuators that reduce bulk without sacrificing strength. These advances are critical as it achieves stability and efficiency in uneven or crowded environments.

Perception and planning are also improving. Multi-modal sensor arrays are allowing humanoids to track, predict, and react to their surroundings with greater fidelity. AI models trained on motion capture and digital twins now underpin decision-making, rather than hard-coded rules. This makes it possible for humanoids to walk, grasp, and recover from disturbances.

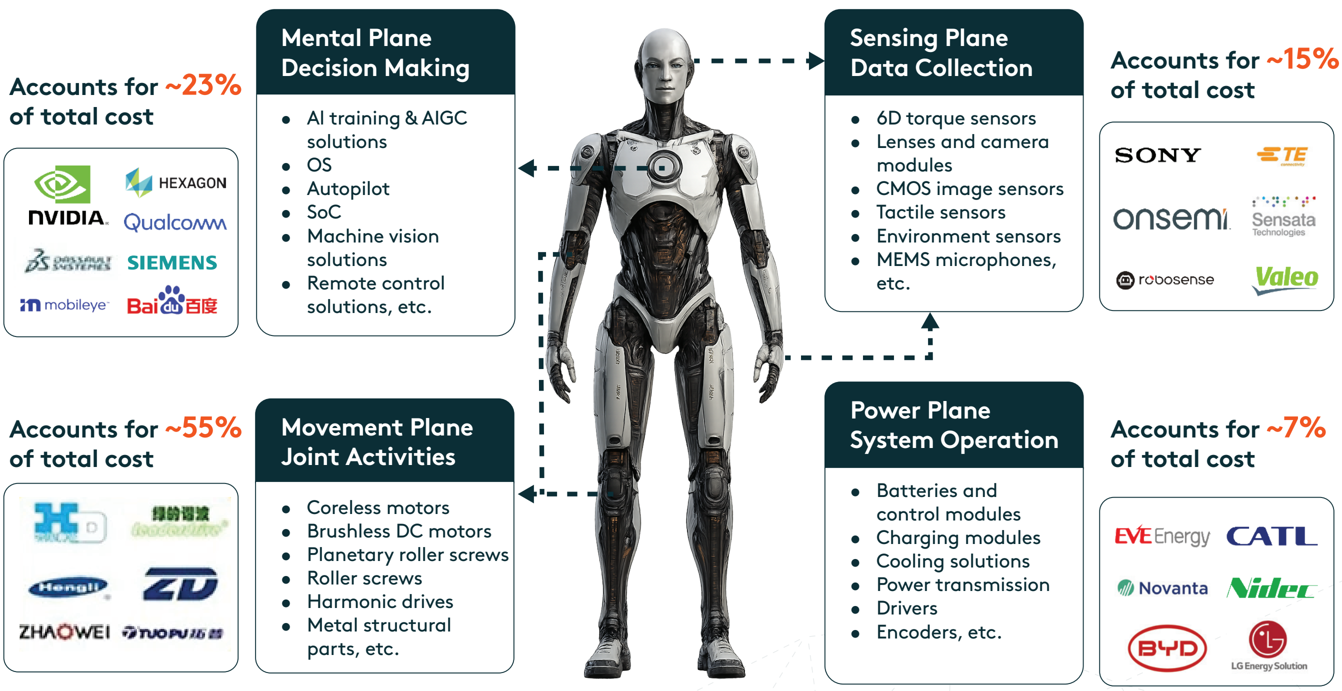
Battery systems have become more compact and power-dense, allowing for untethered operation over several hours. Cooling has improved. So has edge processing, thanks to AI-specific chips optimised for low latency and low power draw.

Perhaps most important is the emergence of foundation models tailored to robotics. These models compress learning from multiple domains such as vision, language, movement and allow robots to generalise across tasks. They bring software scalability to physical systems, enabling humanoids to learn new behaviours without being reprogrammed from scratch.

Together, these breakthroughs remove longstanding barriers to function and reliability. For the first time, the form factor isn't ahead of the tech but is catching up.

HUMANOID ROBOTS - KEY COMPONENTS AND POTENTIAL SUPPLIERS WORLDWIDE

Source: TrendForce, Feb 2025.



https://www.emsnow.com/humanoid-robots-to-become-the-next-us-china-battleground-with-price-differentiation-and-tiered-applications-as-emerging-trends-says-trendforce/

Fund Map

as of August 2025

For more than a decade, our mission has been empowering investors with unexplored and intelligent solutions

THEMATIC GROWTH

Disruptive Technology	
ACDC	Battery Tech & Lithium ETF
BUGG	Cybersecurity ETF
DTEC	Defence Tech ETF
FTEC	Fintech & Blockchain ETF
GXAI	Artificial Intelligence ETF
ROBO	ROBO Global Robotics & Automation ETF
SEMI	Semiconductor ETF
TECH	Morningstar Global Technology ETF
Multi-Theme	
DRGN	China Tech ETF
FANG	FANG+ ETF
FHNG	FANG+ (Currency Hedged) ETF
People & Demographics	
CURE	S&P Biotech ETF
Infrastructure & Environment	
AINF	Artificial Intelligence Infrastructure ETF
HGEN	Hydrogen ETF
PAVE	US Infrastructure Development ETF

COMMODITIES

Miners	
ATOM	Uranium ETF
GMTL	Green Metal Miners ETF
WIRE	Copper Miners ETF
Physical	
ETPMAG	Physical Silver
ETPMPD	Physical Palladium
ETPMPM	Physical Precious Metals Basket
ETPMPT	Physical Platinum
GHLD	Gold Bullion (Currency Hedged) ETF
GOLD	Physical Gold
GXLD	Gold Bullion ETF
Synthetic	
BCOM	Bloomberg Commodity Complex ETF

INCOME

Fixed Income	
BANK	Australian Bank Credit ETF
USTB	US Treasury Bond (Currency Hedged) ETF
USHY	USD High Yield Bond (Currency Hedged) ETF
USIG	USD Corporate Bond (Currency Hedged) ETF
Covered Call	
AYLD	S&P/ASX 200 Covered Call Complex ETF
QYLD	Nasdaq 100 Covered Call Complex ETF
UYLD	S&P 500 Covered Call Complex ETF
Dividend	
ZYAU	S&P/ASX 200 High Dividend ETF
ZYUS	S&P 500 High Yield Low Volatility ETF

INTERNATIONAL ACCESS

Regional	
ESTX	EURO STOXX 50® ETF
Single Country	
NDIA	India Nifty 50 ETF

CORE

A300	Australia 300 ETF
GARP	S&P World ex Australia GARP ETF
OZXX	Australia ex Financials & Resources ETF
RSSL	Russell 2000 ETF
U100	US 100 ETF

DIGITAL ASSETS

EBTC	21Shares Bitcoin ETF
EETH	21Shares Ethereum ETF

LEVERAGED & INVERSE

LNAS	Ultra Long Nasdaq 100 Complex ETF
SNAS	Ultra Short Nasdaq 100 Complex ETF

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About the Author

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Billy joined Global X in 2024 and is responsible for investment research and ETF analysis in the technology sector. Billy has over a decade of experience in financial services, focusing on equities and technology, previously working as Equity Analyst at Optiver in Sydney, and was the Director of Equity Research for China Internet at Haitong International in Hong Kong. Billy has been a top ranked equity analyst for regional software and internet by Asiamoney. Billy holds a Bachelor of Commerce from the University of Melbourne and is a qualified CPA Australia.

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