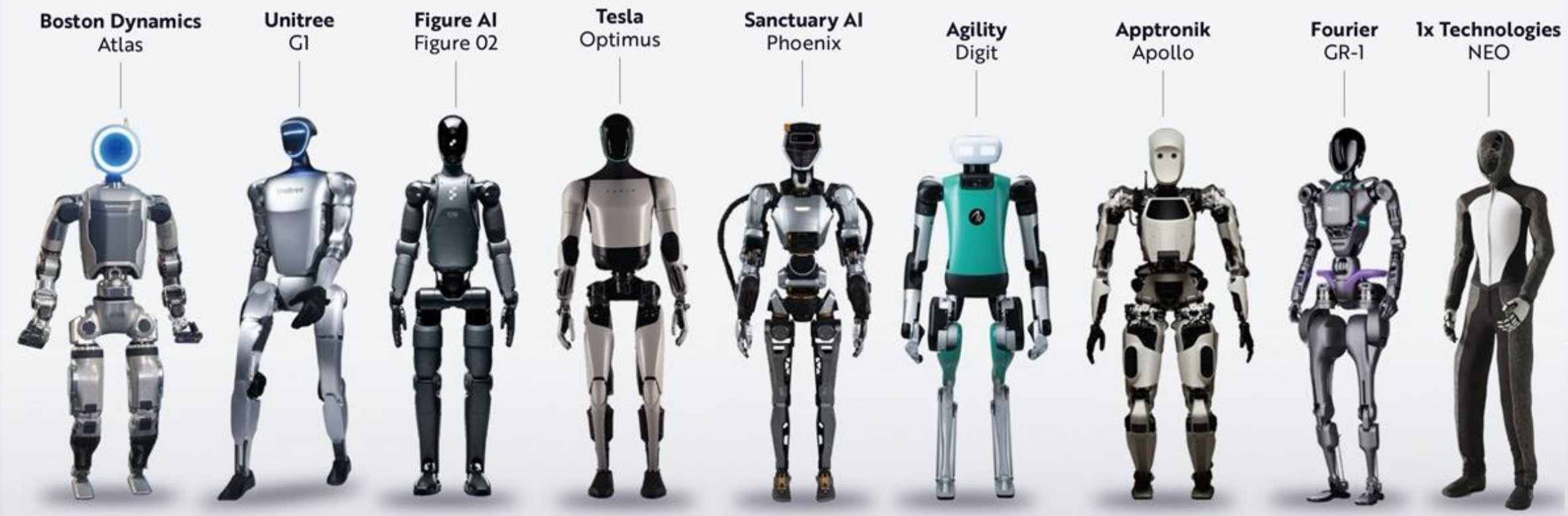
Humanoid Service Robots & AI to Redefine Customer Engagement

By Asst.Prof. Supachai Vongbunyong, PhD - Director of FIBO@KMUTT



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Agenda

1. Overview of Humanoid & Trend
2. Technical Overview of Humanoid
3. User Experience & Standard
4. When to use or not to use ?
5. Humanoid and MAR Tech Ideas

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1.1 Humanoids – Adoption Trend

"Futuristic humanoids working in homes, businesses, and public spaces fuel people's interest. Since our environment is *optimized for the human body*, the idea of a quick, universal helper to maintain manufacturing and services is evident."

"If and when a mass adoption of humanoids will take place remains uncertain, in any case, *humanoids are not expected to replace the types of robots currently on the market in the future*. Instead, they will complement and expand upon existing technology."

Takayuki Ito, president of IFR (International Federation of Robotics)

Trend around the glove https://www.therobotreport.com/ifr-examines-humanoid-adoption-trends-around-globe/

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1.2 Humanoids – Adoption Trend by Regions

US United States

- **Tech giants and startups** (e.g., NVIDIA, Amazon, Tesla) are heavily investing in humanoids.
- Focus: enhancing productivity in logistics and manufacturing—not social companionship

CN China

- Humanoids are a **national strategic priority**, supported by industrial policy and scalable supply chain initiatives.
- Emphasis: service industries like customer-facing roles, with manufacturing automation as a secondary goal

JP Japan

- **Pioneering history**: Honda's ASIMO in 2000 paved the way.
- Current humanoids (e.g. Pepper, Palro) serve primarily as **social companions** (education, retail, and elderly care).
- Cultural acceptance is higher due to demographic needs and societal attitudes toward robot companionship

EU Europe

- **Ethics and human-centric design** dominate.
- Preference for collaborative robots (cobots) in industrial environments over full humanoid deployment.
- Humanoids are seen more as a complement than a core automation tool

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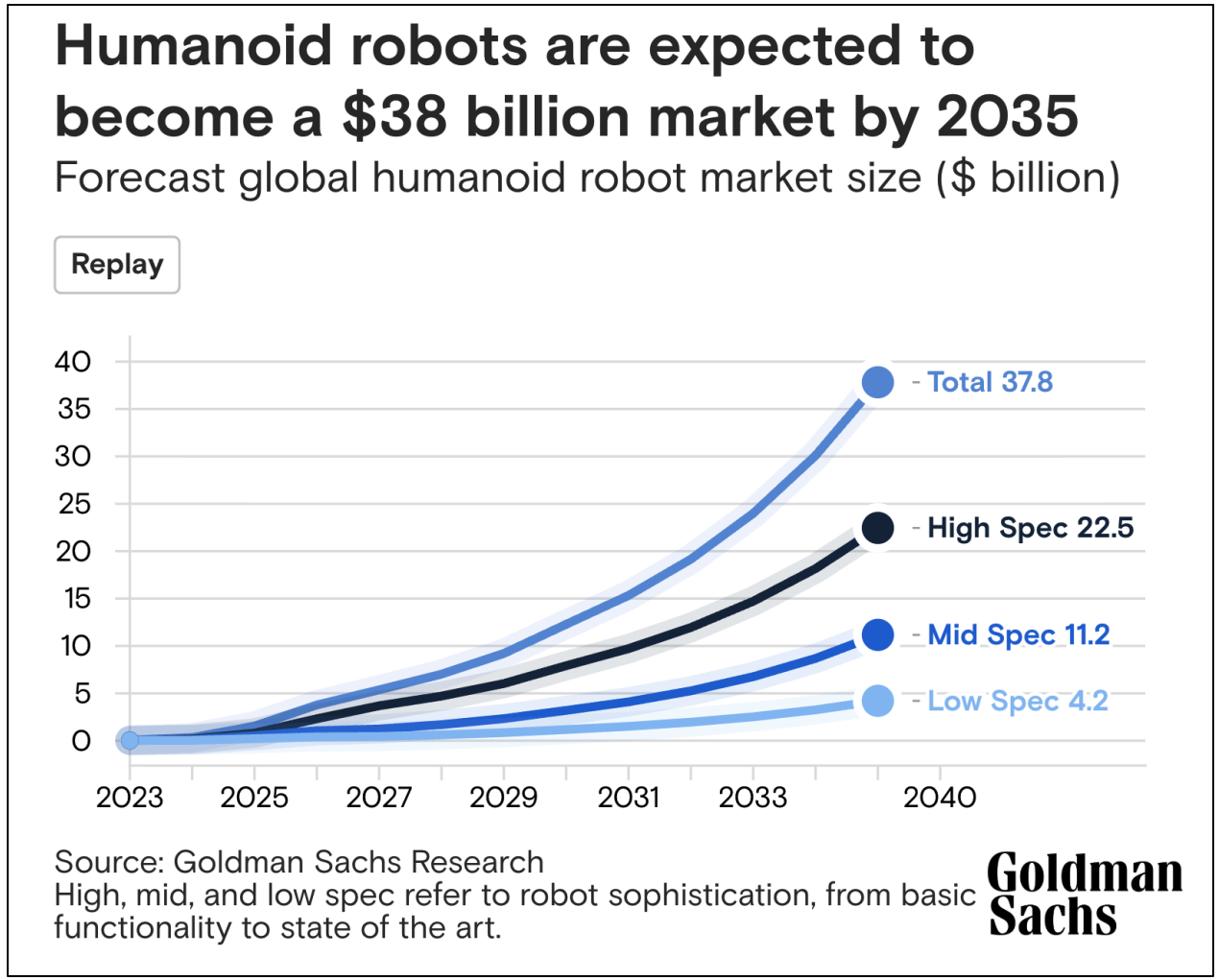
1.3 Trends of Humanoids – Market Share



- *Goldman Sachs* projects the total addressable market (TAM) for humanoid robots will rise to US $38 billion by 2035 (up more than sixfold from an initial estimate of US $6 billion)
- Expected cumulative shipments by 2035: ≈ 1.4 million units globally
- More affordable: Production cost per robot is anticipated to decline by ~40%, from $50K–$250K to $30K–$150K, speeding commercial adoption

https://www.goldmansachs.com/insights/articles/the-global-market-for-robots-could-reach-38-billion-by-2035

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1.3 Trends of Humanoids – Market Share (cont.)

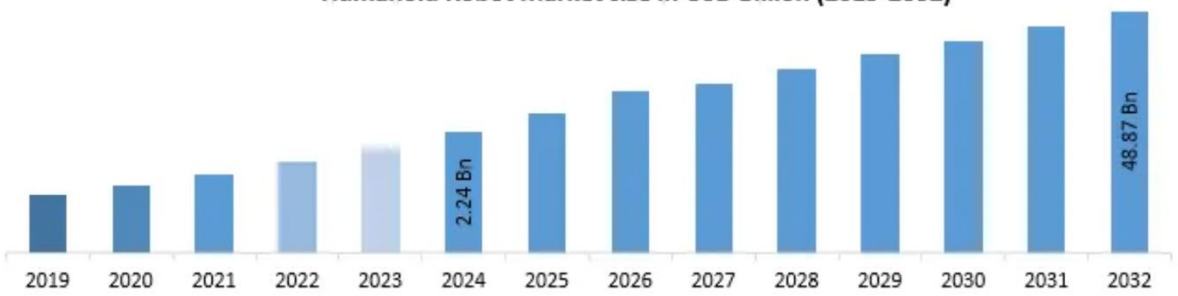
Asia Pacific market accounted largest share in the Humanoid Robot Market in 2024.

47% CAGR

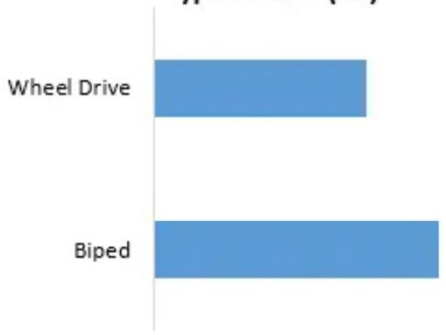
Humanoid Robot Market to grow at a CAGR of 47% during 2025-2032

Humanoid Robot Market

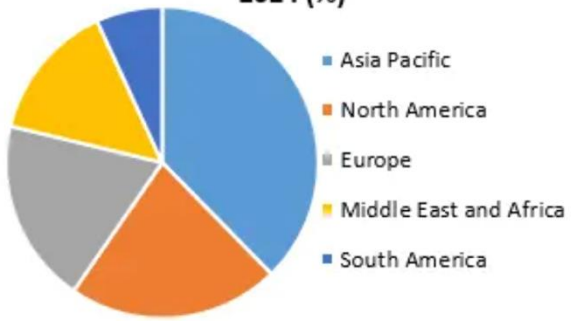
Humanoid Robot Market size in USD Billion (2019-2032)



Humanoid Robot Market, by Motion Type in 2024 (Bn)



Humanoid Robot Market, by Region In 2024 (%)



Manufacturers

Boston Dynamics, SoftBank Robotics, Hanson Robotics, UBTECH, PAL

Research Institution	Component Providers
Carnegie Mellon University The Robotics Institute, Illinois Tech, IITM Research Initiatives	Shadow Robot, Precision Automation, NVIDIA, Bosch, intel
AI Developers	**Software Developers**
Sanctuary AI, OpenAI, Google DeepMind	Furhat Robotics, Aldebaran
End User	**Integrators**
SmartClass, Toyota, Universal Robots, Disney+ hotstar, Japan Airlines	PAL, Kawasaki Robotics
	Service and Support Providers
	RLS, Robotiq, Robokind
	Marketplace and Distributors
	Aldebaran, amazon robotics, RobotShop

https://www.maximizemarketresearch.com/market-report/global-humanoid-robot-market/10567/

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1.4 Trends of Humanoids - Summary

- Initial **market dominance** lies in "*Industrial sectors*". Consumer-focused applications are expected to expand only in the latter half of the decade

- **Current barriers**: Battery life (~2-3hr), Limited combination of physical and cognitive ability, Safety standard, High complexity, and Reliability.
  Mass adoption: not soon, expected in 5-10 years.

- **The overall ecosystem positions** **China as a manufacturing center** (supported by governmental funding and component supply chains), with **US/Europe leading on AI software innovation**, shaping global market share distribution toward 2035.

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2.1 What is Humanoid ?

A **humanoid** is a machine built to *look like*, *move like*, and *interact like a human*, enabling it to operate in spaces and perform tasks originally designed for people.

- **Physical structure**: Typically features a torso, head, two arms, and two legs (or at least an upper body with human-like features).
- **Mobility**: Can walk or move in ways similar to humans (bipedal locomotion, arm movements, grasping).
- **Sensing and interaction**: Equipped with sensors to perceive the environment and interact naturally with humans.
- **Human-centered design**: Intended to work in human environments, use human tools, and communicate naturally with people.

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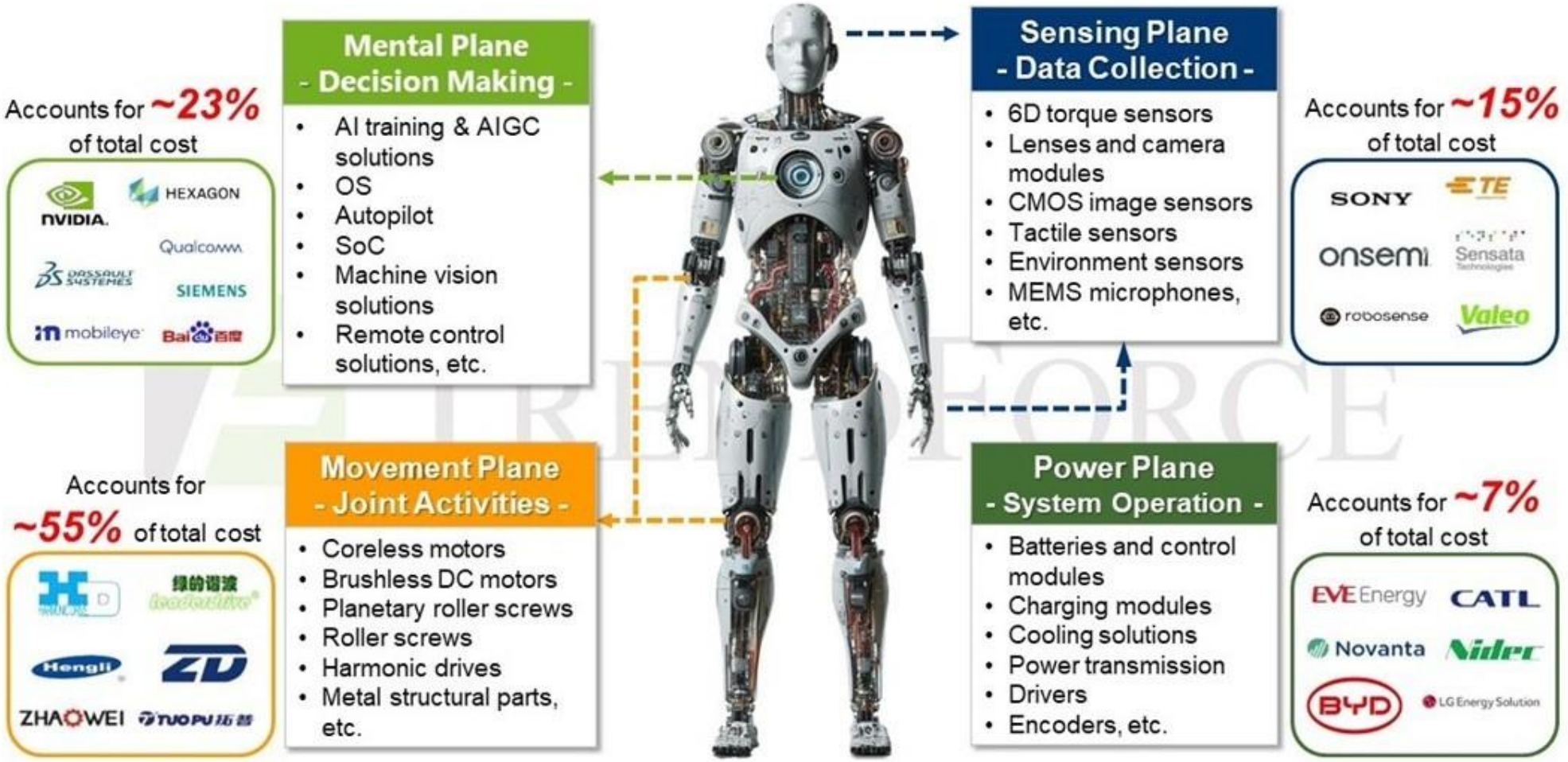
2.2 Key Components

Humanoid Robots – Key Components and Potential Suppliers Worldwide

TRENDFORCE



https://www.trendforce.com/presscenter/news/20250224-12481.html

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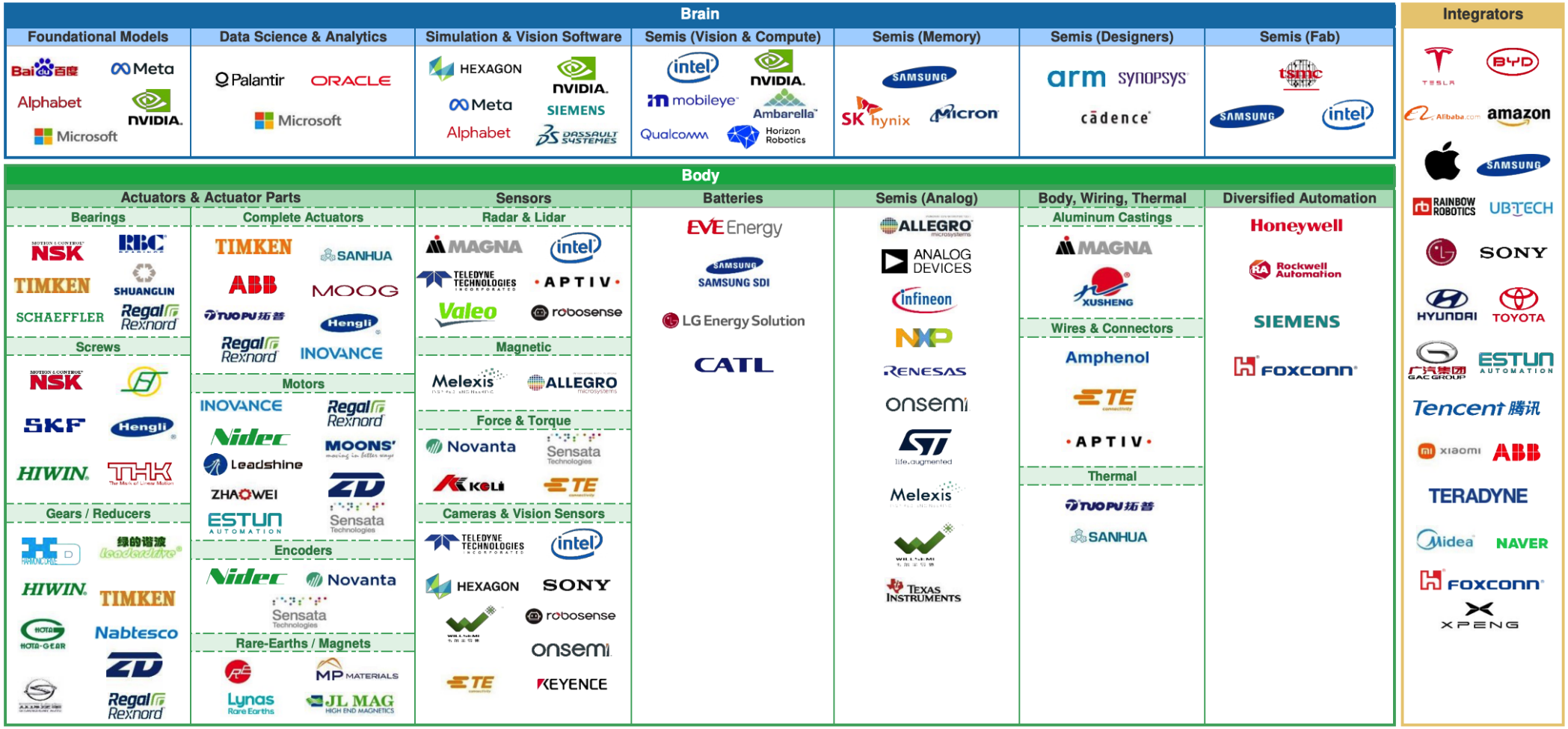
2.3 Humanoid Ecosystem

Exhibit 8: Introducing the Humanoid 100- Morgan Stanley's List of Global Humanoid Enablers



Note: Public companies only. Not all inclusive.

Source: Morgan Stanley Research

https://advisor.morganstanley.com/john.howard/documents/field/j/jo/john-howard/The_Humanoid_100_-_Mapping_the_Humanoid_Robot_Value_Chain.pdf, Morgan Stanley, Humanoid, Access Feb 2025

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2.4 Key Product Specifications

Key Product Specifications of Humanoid Robots: US vs. China

TRENDFORCE

American Manufacturers

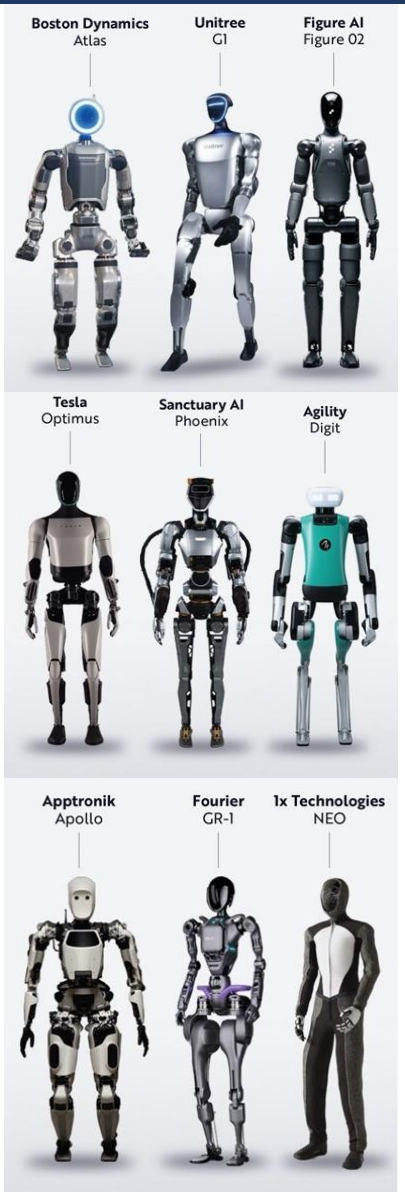
Higher load capacity and longer battery life, optimized for warehousing and logistics applications

Developer	Product	Full-Body Freedom	Hand Freedom	Load	Duration
TESLA	Optimus Gen 3	>70	22	≈20kg	≈6hr
Boston Dynamics	Atlas	>38	>7	N/A	N/A
APPTRONIK	Apollo	>35	10	25kg	4hr
AGILITY ROBOTICS	Digit	28	(≥4)	16kg	N/A
FIGURE	Figure 02	>50	16	20kg	5hr

Chinese Manufacturers

Enhance full-body and hand mobility, enabling versatile deployment across various scenarios

Developer	Product	Full-Body Freedom	Hand Freedom	Load	Duration
Fourier Intelligence	GR-1 Pro	44	12	N/A	N/A
Fourier Intelligence	GR-2	53	12	3kg (Single-arm)	2hr
小鹏汽车	PX5	>40	11	3kg (Single-arm)	≥2hr
UBTECH	Walker S	41	12	N/A	2.5hr
Unitree Robotics	Unitree G1 EDU	≤43	7	N/A	2hr



https://www.trendforce.com/presscenter/news/20250224-12481.html
https://www.theedgesingapore.com/views/tech/humanoid-robots-are-here

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3.1 When “To Use / Not to Use” Humanoids ?

Use humanoids where being “human-like” matters
(interaction, environments designed for people, branding).

Avoid humanoids where efficiency matters more than human form
(industry, logistics, heavy work)

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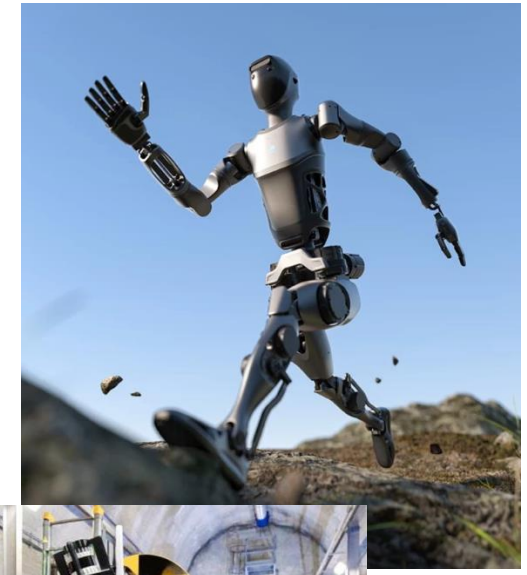
3.2 “Wheels” OR “Legs”

Wheeled Robots

Legged-Wheel Robots



Legged Robots

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3.3 Why Using Humanoids Instead of Other Types of Robots ?

Dimension	Humanoid	Other Robots (wheeled, arms, drones, etc.)
Adaptability	High – can use human tools, move in human spaces	Usually low – designed for specific tasks
Human interaction	Natural, intuitive	Requires training or indirect interfaces
Infrastructure	No major change needed	May need redesign (e.g., AGVs need special paths)
Cost & Complexity	High	Lower
Efficiency	Moderate (generalist)	High (specialist)
Emotional/PR impact	Very high	Low–moderate

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With consideration of economically feasibility

Humanoids can be economically feasible in:

- ✓ Niche roles where human-like interaction is valuable
- ✓ Environments that are already human-centric and unstructured
- ✓ High-labor-cost or labor-shortage sectors (e.g., Japan, Europe)
  But in many areas, non-humanoid robots (wheeled, industrial arms, etc.) still offer better ROI due to lower complexity and cost.

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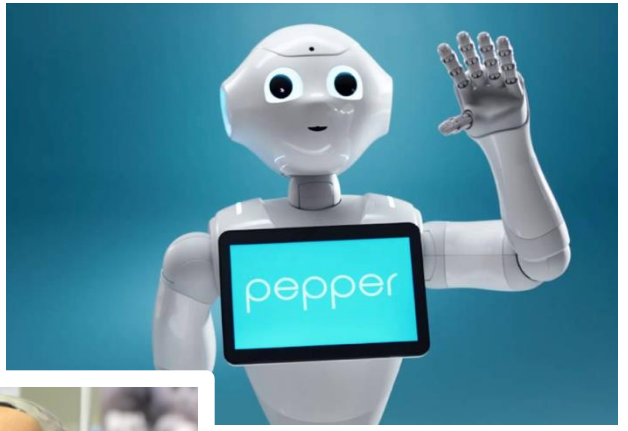
4.2 Idea & Use Cases

1. Customer Service in Retail / Hospitality

- **Tasks**: Greeting customers, answering basic inquiries, guiding to product locations, simple check-in/check-out.
- **Examples**:
  - SoftBank's **Pepper** in stores and malls.
  - Hanson Robotics' **Sophia** as a brand ambassador.
- **Feasibility**: Can be cost-effective in flagship or high-traffic locations where brand experience matters more than ROI per task.



2. Reception / Front Desk Automation

- **Tasks**: Visitor registration, queue management, wayfinding, ID verification.
- **Examples**: Humanoid robots used in hotels (e.g., **Henn-na Hotel** in Japan).
- **Feasibility**: Helps reduce long-term labor costs in high-wage countries and operates 24/7.

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4.2 Idea & Use Cases (cont.)

3. Elderly Care / Social Companionship

- **Tasks**: Conversation, reminders for medication, physical and cognitive activity prompts, fall detection.
- **Examples**:
  - **PARO** (not humanoid but relevant),
  - **Temi** and similar companion robots.
- **Feasibility**: High potential in aging societies (Japan, South Korea, EU) where caregiver shortages are critical.

5. Laboratory / Healthcare Assistance (Limited Use Cases)

- **Tasks**: Transporting samples, delivering medicines, fetching supplies in hospital or lab settings.
- **Examples**: Custom humanoid platforms in smart hospitals.
- **Feasibility**: Mostly used in pilot projects or high-tech hospitals; not yet widely adopted due to cost and regulation.

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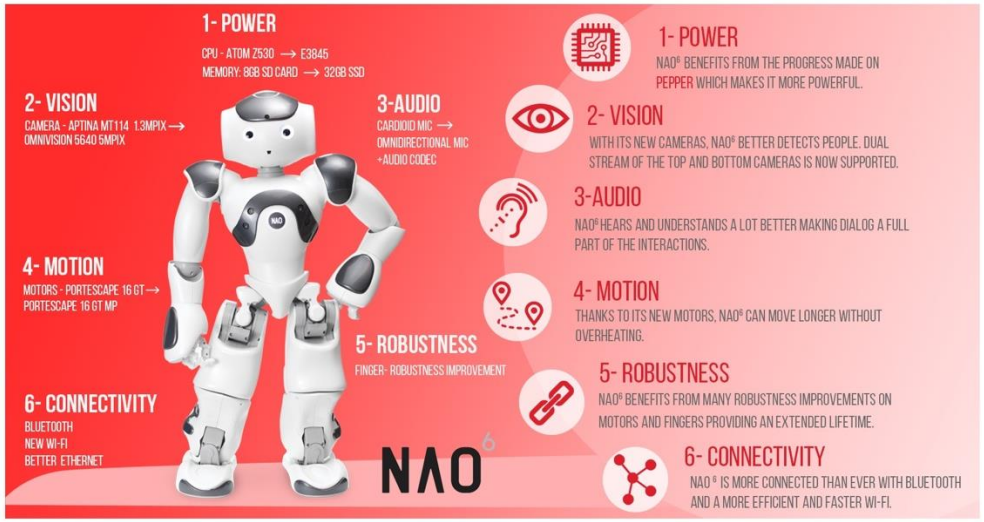
4.2 Idea & Use Cases (cont.)

4. Education and STEM Engagement

- **Tasks**: Teaching assistant, interactive tutor, storytelling, coding education.
- **Examples**:
  - **NAO** robots used in classrooms for autistic children or language learning.
- **Feasibility**: Viable in premium education or special needs schools. Useful as an engagement tool more than a full teaching replacement.



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4.2 Idea & Use Cases (cont.)

6. Manufacturing Support (Where Human Form Helps)

- **Tasks**: Tool delivery, manual switch pressing, tasks in human-centric workspaces.
- **Examples**:
  - **Tesla's Optimus** and **Figure AI's humanoid** are aiming here.
- **Feasibility**: Only becomes economical **if the robot can multitask** in dynamic environments and use existing infrastructure (vs. reprogramming or rebuilding).

7. Logistics – Warehouse & Factory Inspection

- **Tasks**: Navigating human-designed environments to inspect, fetch items, report anomalies.
- **Examples**: Humanoids climbing stairs, lifting boxes in Amazon-style warehouses.
- **Feasibility**: Still developing; currently, mobile wheeled robots (like AMRs) are more cost-effective.

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4.3 Tasks Humanoids Can Do but Are Not Economically Feasible .. Yet

Require too much dexterity, safety, power, or cost to be feasible today.

- General-purpose housework (vacuuming, dishwashing, laundry folding)
- Complex caregiving (feeding, bathing)
- Construction labor
- Cooking in dynamic kitchens
- Security enforcement

Factor	Comment
Cost vs. Labor Saving	Most humanoids are $50K–$200K+, which takes years to recover unless ROI is clear.
Environment Adaptation	Humans work in messy, unstructured environments; robots still struggle.
Safety and Regulation	Especially critical in healthcare, education, and hospitality.
Maintenance & Downtime	Robots need regular software/hardware updates and repairs.

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5.1 Applications Where Humanoids + MAR Tech Can Be Feasible

Humanoid + MAR Tech (Marketing Technology) makes sense when:

- You want **differentiated customer experience**
- You're in **high-margin industries** (luxury, health, education, tourism)
- The robot is **multi-functional**: entertainment + lead generation + data collection
- It's part of a **larger marketing campaign** with measurable KPIs

Challenge	Impact
High Initial Cost	$50K–$200K+ per unit — only viable if ROI from engagement/lead generation is high.
Maintenance & Downtime	Requires technical staff or service plan.
Novelty Wears Off	Without regular updates, engagement may drop after novelty fades.
Privacy & Compliance	Data collection via humanoids must comply with laws (GDPR, PDPA, etc.).
Space & Power Needs	Humanoids often require flat surfaces, stable WiFi, and charging stations.

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1. Experiential Marketing / Brand Activation

- **Use Case**: Humanoids act as *brand ambassadors* in stores, events, or expos to attract attention, deliver messages, and offer interactive experiences.
- **Tech Stack**:
  - Facial recognition → demographic segmentation
  - Emotion detection → personalized messages
  - Voice interaction + NLP → brand storytelling
- **Economic Justification**:
  - Works well in **high-traffic retail** or **flagship events** where customer engagement has high ROI.
  - Adds novelty and PR value.
- **Example**: A cosmetics brand deploying a humanoid to scan skin and recommend products using AI.

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5.2 Humanoid and MAR Tech Ideas (cont.)

2. Data Collection & Real-Time Customer Insights

- **Use Case**: Humanoids interacting with customers can collect:
  - Foot traffic metrics
  - Engagement duration
  - Product interest and feedback
- **MAR Tech Integration**:
  - CRM systems (e.g., Salesforce)
  - Analytics dashboards
  - A/B testing for interaction models
- **Feasibility**: Medium — depends on volume of data and scale of deployment.

3. Interactive Surveys and Lead Generation

- **Use Case**: At trade shows or airports, humanoids can:
  - Engage passersby with questions
  - Collect contact info (name, email)
  - Promote product trials or demos
- **Feasibility**: Effective for industries like insurance, banking, and healthcare where **leads are valuable** and conversion is trackable.

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5.2 Humanoid and MAR Tech Ideas (cont.)

4. Retail Personalization

- **Use Case**: In physical retail, a humanoid can:
  - Greet customers by name
  - Recommend products based on previous visits (via loyalty program integration)
  - Offer promotions or personalized coupons
- **MAR Tech Components**:
  - Loyalty platforms
  - POS integration
  - Customer segmentation engines
- **Feasibility**: Higher in luxury or boutique retail where the **customer lifetime value** is high enough to justify the cost.

5. Digital Signage & Voice-Controlled Displays

- **Use Case**: Humanoid robots acting as smart kiosks or signage that respond to voice or gesture.
- **Enhancement with MAR Tech**:
  - Targeted ads based on user profile
  - Real-time content adjustment
- **Feasibility**: More viable than passive signage in environments like shopping malls, tech stores, or tourist hubs.

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THANK YOU

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