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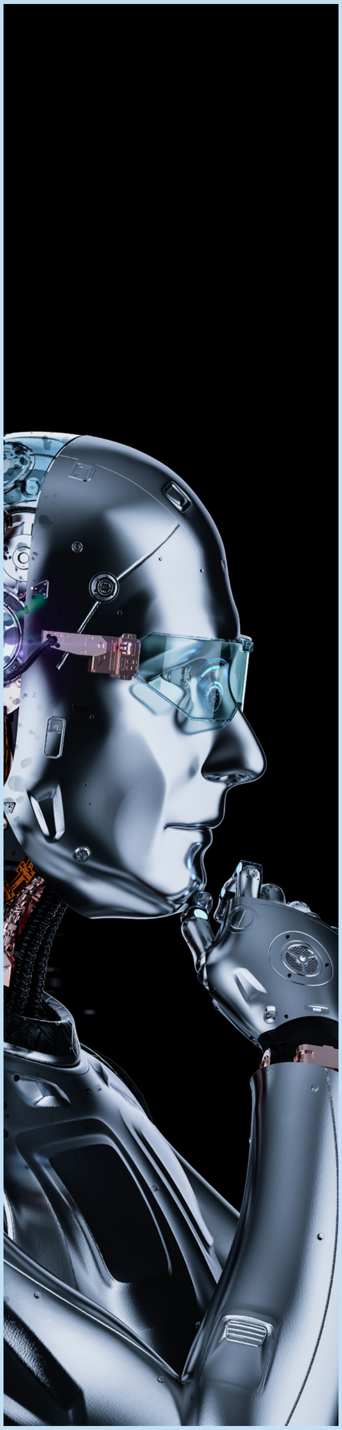

EMBODIED AI: THE NEW PRODUCTIVITY FORCE AMPLIFYING ENTERPRISE OUTCOMES IN CHINA AND BEYOND — MOVING BEYOND THE PROMISE

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Over the last decade, robotics has undergone a profound transformation — evolving from rigid, pre-programmed automation into intelligent, embodied agents capable of perceiving, reasoning, deciding, and acting within the physical world. These systems are now visible across warehouses, factories, hospitals, hotels, and agricultural fields. Most recently, China's humanoid robots captured global attention with acrobatic kung fu performances at the nationally televised Spring Festival Gala — a powerful signal that robotics has entered the public imagination.

This paradigm shift marks the dawn of a cognitive industrial era. It is the result of a powerful convergence: advances in high-torque-density actuators and precision sensors, multimodal foundation models, high-performance on-device GPUs, synthetic data generation; and sophisticated simulation environments. Together, these innovations have paved the way for Embodied AI.

Embodied AI refers to AI-powered hardware systems capable of perceiving multimodal inputs (vision, sound, touch), interpreting context, making autonomous decisions, and executing physical actions in real-world environments. These systems continuously learn and improve over time. Importantly, Embodied AI extends far beyond humanoid robots (and other robotic form factors such as quadrupeds). It includes drones, autonomous vehicles (AVs), industrial simulators, and intelligent sensors embedded in smart environments. Infosys has supported clients leveraging image analytic techniques, complex AI and computer vision helping make tangible impact.

As part of the Infosys AI Value framework, we can translate intelligence into real-world, measurable business outcomes—moving beyond insight to impact. Through our strategic collaborations with leading robotics providers, we are witnessing a global race to fuse physical machinery with high-level intelligence. From China's aggressive push on industry standards and humanoid deployment to the global rise of imitation learning and reinforcement learning powered by state-of-the-art (SOTA) large models, Embodied AI is fundamentally redefining the "4Ds" of robotics: dull, dirty, dangerous, and dexterous jobs.

This article summarizes the current state of Embodied AI and outlines the pragmatic path toward enterprise-scale deployment.

Evolutionary Stages of Embodied Intelligence

From an industry perspective, embodied AI has evolved through distinct technological paradigms — progressing from rigid systems to increasingly adaptive and generalizable intelligence.

Early Foundations: Rule-Based Programming

The first generation of industrial robots relied on explicit, hard-coded instructions designed for repetitive tasks in controlled environments. These systems excelled in precision but struggled with variability. This model remains dominant in high-volume manufacturing, such as automotive assembly lines, where robots from companies like FANUC and ABB perform welding and painting with exceptional reliability.

Perception and Navigation: SLAM and Environmental Awareness

The integration of Simultaneous Localization and Mapping (SLAM) allowed robots to construct real-time maps and navigate dynamic environments. This breakthrough powered consumer products like robot vacuum cleaners and industrial applications such as autonomous guided vehicles (AGVs) for logistics and inspection.

Imitation Learning: Learning from Demonstration

Machine learning introduced imitation-based approaches, enabling robots to replicate human actions from demonstrations rather than relying solely on coded rules. This has gained traction in dexterity-intensive industries such as electronics manufacturing, where robots learn intricate assembly tasks via teleoperation or guided training.

Reinforcement Learning: Optimization Through Trial and Error

Reinforcement learning (RL) further advanced adaptability, allowing robots to refine behaviors through feedback and iterative experimentation. RL has proven effective in dynamic environments such as autonomous driving, adaptive welding, and self-optimizing assembly processes — addressing variability that earlier systems could not manage efficiently.

Foundation Models and Vision-Language-Action Architectures

The current frontier lies in large-scale foundation models, including world models and Vision-Language-Action (VLA) architectures. These systems integrate multimodal inputs — vision, language, and action — into unified frameworks capable of generalizing across tasks. They interpret natural language instructions, reason about environments, and execute actions with limited task-specific training.

While still in early adoption, VLA models represent state-of-the-art embodied intelligence, with pilots emerging across services, hospitality, and manufacturing. Companies such as UBTECH are incorporating such models into humanoid platforms like the Walker S series to enhance flexibility in industrial environments.

This trajectory reflects a broader shift toward scalable cognitive capabilities that blur the boundaries between perception, planning, and execution.

Beyond Technology: Ecosystem Integration and Accelerated Adoption

Successful deployment of Embodied AI requires ecosystem orchestration — integrating mechanical engineering, embodied intelligence models, domain data, manufacturing processes, and enterprise systems.

Recent advances in compact model architectures — including open-source initiatives — have dramatically lowered barriers to entry. Models with parameter sizes as small as 7 billion can now operate on-device, enabling localized autonomy in factory environments and edge settings.

Unlike earlier AI systems that required massive centralized data and persistent cloud connectivity, these next-generation solutions function effectively in constrained environments and adapt to highly contextual manufacturing conditions.

Industrial adoption is accelerating across sectors:

- Flexible Automation Lines — Robotic arms dynamically adapt to mixed product variants without reprogramming.
- Adaptive Quality Inspection — Vision-language systems detect defects and recommend corrective actions in real time.
- Collaborative Robotics (Cobots) — Robots work safely alongside humans, understanding verbal instructions and operational constraints.
- Mobile Logistics — Autonomous systems reposition inventory and materials with minimal oversight.

Service Robots – Use cases in hospitality and medical care.

These innovations improve efficiency, elevate safety, reduce downtime, and reallocate human labor toward higher-value supervision and cross-functional roles.

The Global Embodied AI Landscape

Global Innovation Dynamics

Globally (excluding China), major technology ecosystems are advancing embodied AI through differentiated strategies. Japan emphasizes core hardware excellence and service-oriented applications, particularly in eldercare. The United States focuses on industrial productivity and frontier AI innovation. Key players include Tesla, Figure AI, Agility Robotics, and Boston Dynamics in the U.S., alongside Honda, Kawasaki, and Toyota in Japan.

The AI backbone powering global deployments includes advanced multimodal models and platforms such as Gemini Robotics and Nvidia Cosmos. Leading research institutions, including Stanford's Human-Centered AI Institute (HAI), continue to push foundational research in embodied cognition.

By 2026, Asia-Pacific commands approximately 74% of global robot installations, with operational industrial robot stock exceeding 4.6 million units worldwide — signaling a widening deployment gap.

China's Robotics Momentum

China has emerged as a dominant force in embodied intelligence, supported by coordinated policy, capital investment, industrial demand, demographic pressures, and supply chain depth. Leveraging synergies built through the EV ecosystem — particularly in sensors and batteries — China has achieved rapid iteration cycles.

Embodied AI is positioned as a lever to strengthen the "real economy" by integrating digital intelligence with manufacturing. The objective is structural: boost productivity, address labor shortages from demographic shifts, and support eldercare.

According to McKinsey, the general-purpose robotics market could reach USD 370 billion by 2040, with roughly half of that value potentially concentrated in China.

Research institutions and enterprises are advancing novel embodied architectures and training paradigms. Tsinghua University's iRe-VLA model integrates VLA architectures with reinforcement learning to unlock more advanced robotic reasoning. Alibaba's open-sourced RynnBrain, built on Qwen3-VL, enhances spatiotemporal understanding and physics-aware task execution.

China's robot density reached 470 units per 10,000 employees in 2023, more than doubling since 2019. Humanoid robotics is also scaling, led by companies such as Agibot, Unitree, UBTECH, and Fourier Intelligence.

Beyond enterprise momentum, China has introduced a National Standard System for Humanoid Robots and Embodied AI — a comprehensive regulatory framework covering the industrial value chain and lifecycle governance.

Regional ecosystems further reinforce this momentum:

- Guangdong as the global hardware production powerhouse
- Shanghai as an advanced R&D and integration hub
- Hangzhou emerging as a humanoid innovation center

To address embodied data constraints, China has established 27 nationwide data collection sites to industrialize training pipelines.

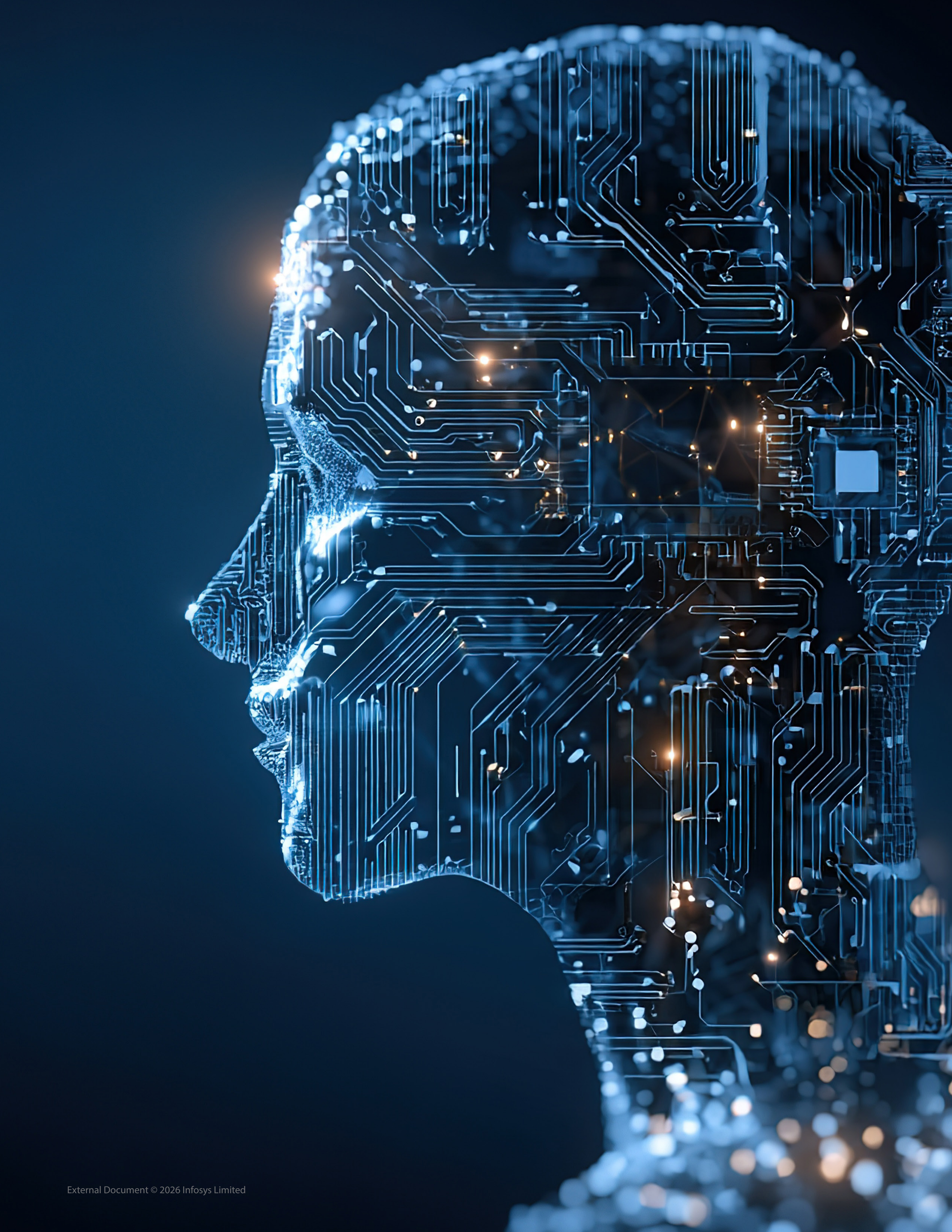
The Dark Factory: Embodied AI Enabled Blueprint for Autonomous Manufacturing

The "Dark Factory" represents the apex of industrial automation — hyper-autonomous facilities integrating IoT, Robotics, simulation, and AI-driven digital control systems.

Leading examples in China such as Chang'An Automobile and CATL demonstrate that these environments are more than lights-out operations; they function as continuous-learning ecosystems. By integrating humanoid robots and SOTA models into production, these factories create near-zero-defect closed-loop systems where each production cycle improves future performance.

From a capital allocation perspective, Dark Factories require high upfront investment but deliver value through yield optimization, scrap reduction, faster time-to-market, and resilience.

However, adoption remains gradual. Integrating legacy ERP systems with advanced robotic intelligence is complex, and long-tail edge cases challenge model robustness. As such, the Dark Factory serves not as a binary objective but as a strategic North Star — implemented progressively within defined vertical scenarios.



Navigating the Next: A Pragmatic Enterprise Path

Despite rapid advances, Embodied AI remains immature at scale. Challenges include:

- Integration complexity across enterprise systems
- Data scarcity in high-fidelity physical environments
- Edge compute and battery limitations
- Manipulation precision and degrees-of-freedom constraints in humanoids
- Robot fleet orchestration
- Responsible deployment (safety, transparency, accountability, workforce impact)

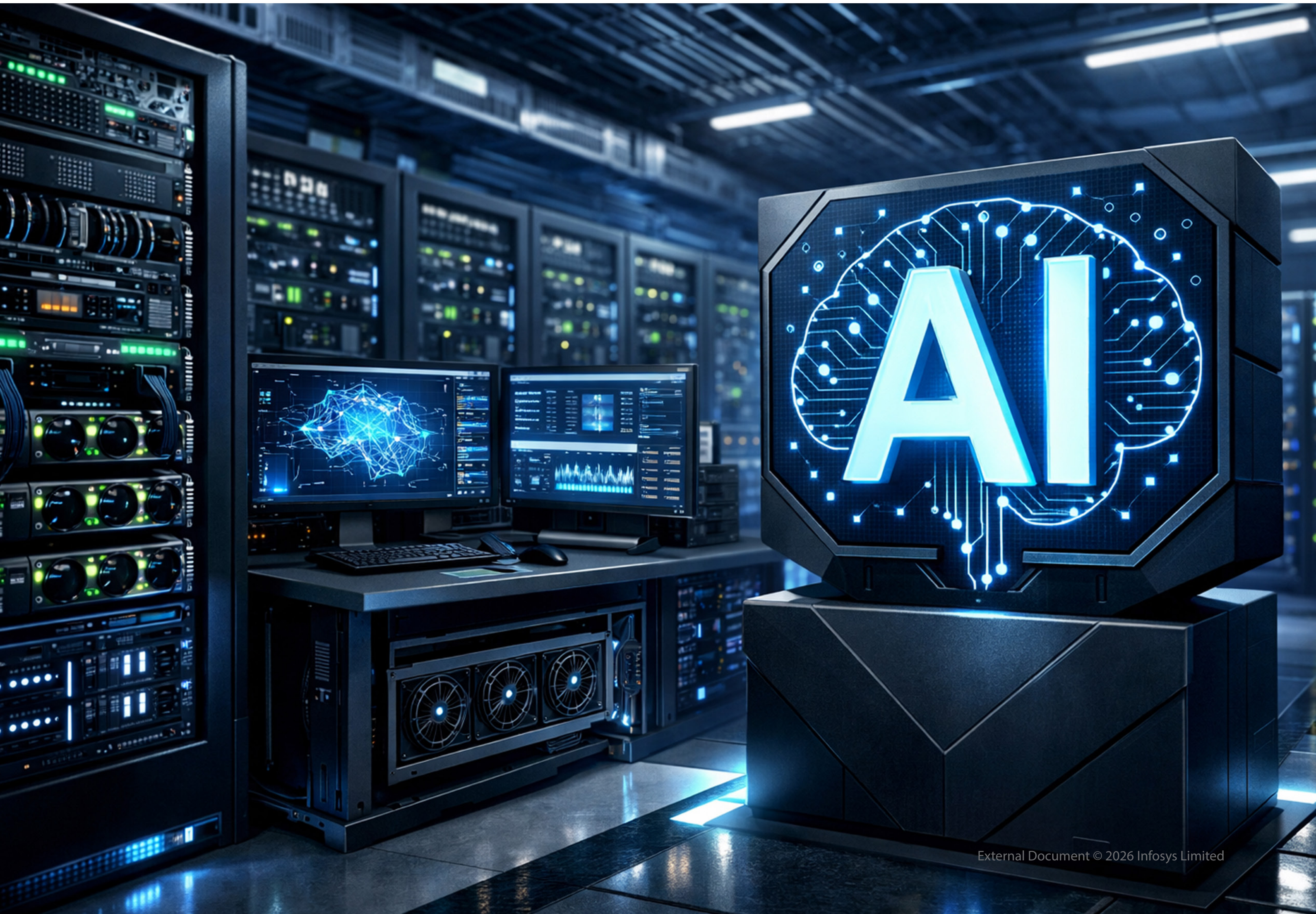
Training robots for real-world industry scenarios remains resource-intensive. Enterprises must balance technological acceleration with long-term reliability and ROI justification.

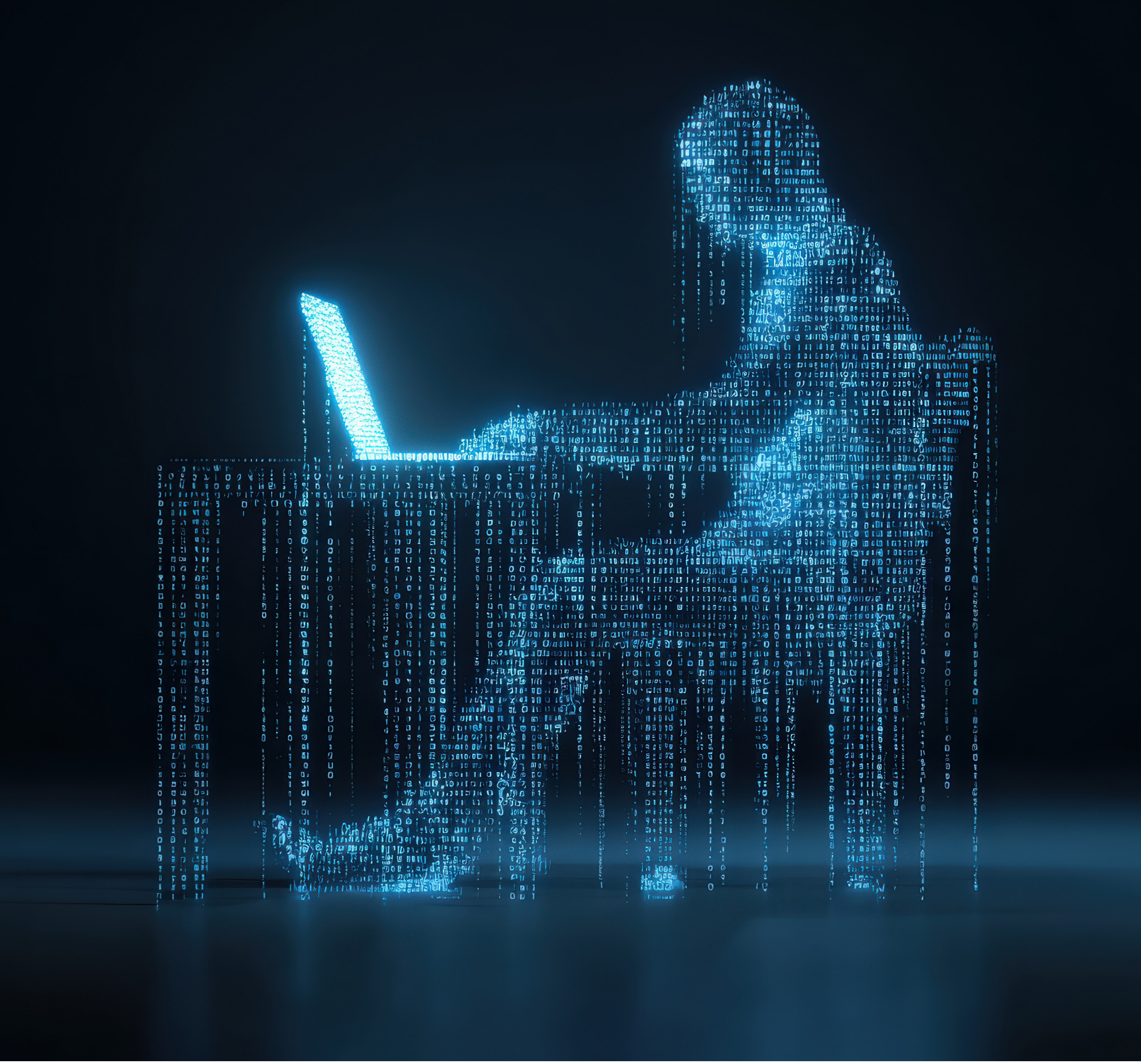
The most viable near-term strategy lies in focused, industry-specific deployments with measurable value and controlled risk. Many robotics companies are deliberately prioritizing vertical scenarios to build technical depth and operational maturity before expanding into broader domains.

For enterprises, the pragmatic pathway includes:

- Embedding Embodied AI into broader AI and automation strategy
- Designing extensible enterprise AI architectures that incorporate robotic agents
- Investing in data infrastructure and simulation capabilities
- Building strong ecosystem partnerships
- Operating within a Responsible AI governance framework

Infosys builds on its existing differentiated offerings of solutions, frameworks and platforms in Robotics and Autonomous systems, combining them with deep industry context and partnerships with AI disruptors to help clients navigate these pathways.





Conclusion: From Digital Intelligence to Physical Impact

After a decade of rapid advancement in the digital AI realm, the pivot toward physical-world intelligence is now underway. Embodied AI represents the next productivity frontier — one capable of transforming enterprise outcomes and redefining industrial competitiveness. Enterprises can unlock this value by harnessing the power of Infosys industry-leading generative and agentic AI suite, Infosys Topaz™ . Infosys AI first value framework helps organizations combine Embodied AI , and edge intelligence to reimagine products, operations, and experiences where digital and physical converge.

We are at an inflection point: the transition from promise to measurable impact. With pragmatic deployment, ecosystem integration, and responsible governance, Embodied AI can become a true productivity force.

Author

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Rajnish is Global Vice President at Infosys and Country Head of Infosys China. He is also a Member of Board of Directors of Infosys China. He is currently based in Shanghai.

He is responsible for overall Business and Operations for Infosys in China, including Sales, Marketing and Service Delivery across multiple centers in China . With a passion for AI, Cloud & Automation led digital service offerings, he leads a team of professionals at Infosys that define and implement strategies for local and global multinational clients, to help them navigate their digital transformation journey. He is also responsible for managing and scaling Infosys capabilities in the Greater China region. He is a team player, leads a diverse cross functional team and is a strong advocate of Diversity and Inclusion at workplace. He is a frequent keynote speaker, has authored articles in leading publications, received multiple recognitions and featured in media.

During his 24+ years with Infosys, he has worked alongside clients in multiple industry sectors, across the globe including in US, Europe, and Asia Pacific geographies. Rajnish has a Bachelor's degree in Computer Engineering from National Institute of Technology, Kurukshetra, India.

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